



An Overview of the European Low-Cost Carrier (LCC) Market: Identifying Sources of Competitive Advantage

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Abstract

Title: An Overview of the European Low-Cost Carrier (LCC) Market: Identifying Sources of Competitive Advantage

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This paper explores the low-cost carrier (LCC) reality in Europe by interrogating the main sources of competitive advantage and considering what major players should do to increase market share in the aftermath of the COVID-19 pandemic. By applying a standardized score methodology, this study took into account 25 variables to measure dimensions of competitive advantage and relative competitive positioning using published data sources from companies. The study further analyzed correlations between different indicators and confirmed strategies LCCs employ to maintain competitive positioning. Ryanair was considered the “lowest-cost carrier”, having the best competitive position in Europe, while WizzAir also displayed some promising indicators. easyJet exhibits indications that it is deviating from a pure low-cost model and employing strategies leaning towards a more hybrid business mode

Sumário

Título: Uma perspetiva sobre o mercado europeu de companhias de baixo-custo: identificação das fontes de vantagem competitiva

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Palavras-chave: Vantagem competitiva, posição competitiva, companhias aéreas, *low-cost*, Ryanair, WizzAir, easyJet, performance, arquitetura de produto e organizacional

Este artigo explora a realidade das companhias de baixo custo (LCC) na Europa, ao descobrir quais são as principais fontes de vantagem competitiva e ao considerar o que os principais *players* devem fazer para aumentar a quota de mercado no pós-pandemia da COVID-19. Ao aplicar uma metodologia de pontuação padronizada, este estudo levou em conta 25 variáveis para medir as dimensões da vantagem competitiva e o posicionamento competitivo, utilizando fontes de dados publicadas pelas empresas. O estudo ainda analisou as correlações entre os diferentes indicadores e confirmou as principais estratégias que as LCCs empregam para manter o seu posicionamento competitivo. A Ryanair foi considerada a "companhia de mais baixo custo" com a melhor posição competitiva na Europa, enquanto a WizzAir também apresentou alguns indicadores promissores. A easyJet apresenta indicações de que está a desviar-se de um modelo de *low-cost* puro e a adotar estratégias que se inclinam para um modelo de negócio mais híbrido.

Contents

Abstract	1
Sumário	2
Contents	3
Acknowledgements	5
Introduction	6
Literature Review	7
LCCs uprising and establishment in the European market	8
Product Architecture	12
Connectivity	12
Convenience	13
Comfort	14
Organizational Architecture	15
Fleet	15
Staff	15
Distribution, Marketing, and IT Services	16
Competitive environment	17
Methodology	18
Choice of means of comparison	18
Choice of competitors to compare	21
Choice of period	22
Benchmark index calculation	22
Research	25
Consolidated income statements	25
Index analysis	25
Competitive position and internal evolution	26
Profitability	26
Revenue index	27
Connectivity index	28
Convenience index	29

Comfort index	30
Distribution index	31
Aircraft index	32
Labour index	33
Preliminary summary	34
Correlations between indices	35
Average fare and flight numbers	35
Airport accessibility and airport capacity	36
On-time performance and several indicators	37
Load factor and marketing costs	38
Fleet homogeneity and employees per aircraft	38
Fleet age and fuel costs	39
Final remarks, recommendations, and limitations	40
Appendices	43
References	59

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Introduction

On December 17th, 1903, the Wright brothers achieved what people thought was impossible -- an activity that would take “the combined efforts of the world’s best mathematicians for 1-10 million years” to achieve, according to a New York Times article published the same year. Their discovery ushered in one of humanity’s most relevant breakthroughs. From transportation of people and goods around the world, to tactical warfare advantages and new opportunities to study other scientific phenomena, the ability to fly completely transformed the world. By 1945, the world already had carriers that would turn out to be major players today, like Qantas, KLM, Aeroflot, Iberia, and American Airlines. According to a book published by the [Air Transport Association of America \(1946\)](#), in that year alone in the United States, a total of 3,500,102,057 passenger miles were flown, as well as 65,095,548 tons of mail. The average number of seats was rising due to larger planes, while prices were going down, according to a report by [The Geography of Transport Systems \(2016\)](#). In the 1960s and 1970s, new jet aircraft emerged that were more efficient and dependable, easier to use, flew a longer range and were able to carry larger numbers of passengers and cargo. Flying was present in all aspects of life, but despite the downwards trend of prices and increasing availability, it was still a luxury only accessible to the wealthy ([Air Transport Association of America \(1946\)](#)). Flying was positioned as a luxurious experience, and not simply as the service of transportation.

Over the years, the industry has developed, responding to regulations, innovations in jet technology, new airports being constructed and changing needs of customers. These and other factors presented more possibilities to differentiate product offerings. Carriers once limited by technological and technical capabilities of equipment and infrastructure, could now offer different services while targeting new customers. Deregulation of the airline industry in the US in 1978 further paved the way for a liberalization and led to a more competitive environment. States were prohibited from regulating prices, routes, or services of a carrier. It was around this time that Southwest Airlines, despite being founded in 1967, started shifting its business model towards becoming the first modern-day LCC. The company mostly operated in the US and prioritized cost cutting, even if it meant decreasing the quality of service, to achieve the lowest fares possible. This *inter alia* entailed operating a limited number of aircraft to trim costs of pilot training and maintenance, operating out of secondary airports in point-to-point routing, (where planes flew directly between destinations instead of the hub-and-spoke model, where carriers focus on flying

in and out of major airports), limiting the amount of luggage allowed free-of-charge and having only economy class, among other innovative measures. Today, Southwest is the largest LCC in the world and has the greatest number of Boeing 737s (762 aircraft as of 2021), the most popular airplane in the world, according to [Wikipedia \(2022\)](#) and Southwest's yearly reports.

Southwest's business model drew attention in Europe and several carriers were established with the objective of mirroring Southwest. Moreover, the European Union also massively deregulated the carrier sector in 1992, paving way for burgeoning European LCCs. In 1984, Ryanair was founded in Dublin. It initially operated small turbo-propelled airplanes out of southern Ireland to London Gatwick. Later, other routes were established between Dublin and several destinations in the United Kingdom. The company struggled to make a profit in 1988 and 1989. In 1990 Michael O'Leary joined the company as CFO and completely transformed Ryanair's business model, heavily inspired by Southwest's success. Backed by the EU's deregulation in 1992, Ryanair opened routes to Stockholm, Paris, Oslo, and Brussels and supported expansion with a massive 2-billion-dollar purchase of 45 Boeing 737-800s. The company grew rapidly employing Southwest's methods, while also adding new ways of cost cutting. The advent of the Worldwide Web witnessed a shift in ticket purchasing methods. In 2000, the first year of the Ryanair website, bookings were negligible, but in a year's time, 3 out of 4 tickets were bought online. This decreased the need to have people at counters in airports and decreased staff costs. Moreover, Ryanair also cut costs and increased revenues by installing non-reclining seats, no on-board magazines, and less legroom, increasing the airplane's capacity.

Ryanair began to offer even lower fares and appealed to a whole new target audience in Europe – the price sensitive customer. The following years witnessed periods of strong and rapid growth for Ryanair, backed by yearly launches of new routes and bases. In 2006, Ryanair grew the number of passengers flown by more than 20% compared to the previous fiscal year. Ryanair's expansion also relied on taking over several potential competitors, like Buzz in 2003 and Lauda in 2018. Two attempts to take over Aer Lingus also occurred, but both were unsuccessful. Ryanair's rapid growth has also sparked considerable criticism regarding working conditions, safety procedures, invoicing, and hygiene.

Today, Ryanair is the largest LCC in Europe and second only to Southwest, worldwide. It operates 519 airplanes, most of which Boeing 737s, and serves 35 countries through 84 bases in

Europe, North Africa, and the Middle East, according to an article by [Wikipedia \(2022\)](#) and Ryanair's yearly reports.

Naturally, such a profitable business model attracted more players – not only subsidiaries created by larger full-service network carriers, but also companies established specifically to compete in the space. easyJet was one of these that best took advantage of the European business environment. Established in the United Kingdom in 1995 by the Greek businessman Stelios Haji-Ioannou, it was based on also the Southwest business model. The company was headquartered at Luton Airport and started operations with two leased Boeing 737 between Luton and Glasgow and Edinburgh. It carried 40.000 passengers in its first year of operations. In 1996, it bought its first aircraft and launched its first international route, between Luton and Amsterdam Schiphol, which drew a lot of attention from the Dutch flag carrier KLM, whose predatory pricing sparked an investigation by the European Union.

Like Ryanair, easyJet also took off, exploiting the industry niche associated with greater efficiency and lower fares. This permitted the airline to scale rapidly with investments in new aircraft and new bases established throughout Europe, increasing its reach to hitherto untapped destinations. In the first decade of the millennium, easyJet launched routes to countries like Spain, Italy, France, and Germany, opening several routes in each country. easyJet also focused on acquisitions to boost growth – in 1998, Swiss TEA Basle was bought by easyJet, which became the first base outside of the United Kingdom and in 2002, Go Fly was purchased, giving easyJet three more bases in East Midlands, Bristol and Stansted, as well as almost doubling the amount of aircraft in its fleet.

Despite criticism for not adhering to European regulations regarding cancellations and delays, and discrimination towards people with disabilities, today easyJet operates 1051 routes out of 30 bases in Europe and North Africa, and counts on 322 Airbus aircraft to support its operations. Like its low-cost competitors, easyJet also operates only one family of aircraft, despite also flying A319s and A320s, after having decided to phase out all the Boeing 737 in 2002 ([Wikipedia \(2022\)](#) and easyJet's yearly reports).

The most recent of the LCCs operating in the European theatre is Hungarian-founded WizzAir. Established in 2003 by Indigo Partners, an American private equity firm specialized in transport operations, WizzAir aimed to offer the same services as easyJet and Ryanair in a region

that was still somewhat unexplored by the LCCs at the time – eastern Europe. Its first flight took off from Katowice to Budapest and set the course for what would become one of the biggest LCCs in Europe.

As the latest LCC, WizzAir was able to exploit intelligence already available about low-cost operations in Europe, employing these insights in countries like Slovakia, Hungary, Poland and Romania. After its initial success, WizzAir launched operations to the more competitive western markets, and further east, to countries where LCCs were unheard of, like Georgia and Kazakhstan, the UAE, Saudi Arabia, Russia, and even Sri Lanka. That expansion consolidated WizzAir as the LCC present in most countries in the world, many of which are exclusively served by WizzAir for low-cost travel.

The carrier later established subsidiaries in the UAE, Malta, Ukraine, Bulgaria, and the UK to foster its expansion ambitions in the European market and beyond. It now flies 175 Airbus aircraft with outstanding orders of 373 new aircraft and offers around 1.000 routes in 51 countries. It is the main non-flag carrier in countries like Poland, Romania, and Hungary, according to [Wikipedia \(2022\)](#) and WizzAir's yearly reports.

Despite lower cost allocations of LCCs towards maintenance, LCCs in Europe have never experienced a major accident. Some incidents include bird strikes, political-motivated diversions or weather-related groundings, as these companies have to adhere to strict European safety regulations. All the carriers operate similarly and whenever they fly the same routes, competition is fierce, often easily identifiable by the even lower prices in comparison to routes with fewer operators. Despite there being several other LCCs in Europe, like Vueling, Transavia, Eurowings and Norwegian Air Shuttle, this study aims to compare several indicators associated with the three main European LCCs to establish the major sources of competitive advantage among them. We chronologically compare performance within companies, while also using that data to make recommendations to improve competitive positioning in the aftermath of the COVID-19 pandemic.

Literature Review

LCCs uprising and establishment in the European market

As [Porter \(1985\)](#) proposed, strategy in general, and carrier strategy in particular, may be divided into two categories. There is *cost leadership*, where companies compete to cut costs, eliminate inefficiencies, and offer goods or services at attractive prices; and *product differentiation*, where firms position themselves to meet customer expectations, thereby trying to create uniqueness in their selling propositions. This bifurcation of business philosophies began with Southwest Airlines in 1973, after it started employing actions that most modern LCCs use today. Decreasing the average price for a fare meant common carriers started losing market share ([Klisauskaite \(2022\)](#)).

This business model is characterized by a general philosophy of cost cutting to lower prices, sacrificing satisfaction related to certain specific customer preferences and standardizing processes, minimizing their complexity, making use of the strongest core competencies and outsourcing non-relevant and non-strategic tasks ([Gross and Schroder \(2007\)](#)). The most widely used methods of improving efficiency include:

- Leasing aircraft instead of purchasing;
- Placing large orders for aircraft to get bulk discounts, as Ryanair did earlier this century by obtaining a 26% discount in a deal made with Boeing for the purchase of 70 737-800 in 2005;
- Operating the same model of aircraft, to save costs in pilot and cabin crew training, as well as creating economies of scale for maintenance;
- Point-to-point operations out of smaller airports, avoiding higher fees and heavier competition at larger airports. Smaller airports also allow smaller scale logistics in cleaning, boarding, and taxiing related tasks, preventing the likelihood of delays;
- Adhering to minimum cabin crew required per type of plane;
- Selling additional products, like food and drinks, separately;
- Prioritizing distribution through online channels and automation of processes;
- Outsourcing of non-relevant and non-strategic tasks.

[Stoyanov \(2015\)](#) further identified recognisable characteristics such as:

- Scheduling of flights for non-traffic intensive hours;

- Non availability of transit connection services;
- Use of airstairs and shuttles instead of jet bridges;
- Prioritizing short distance flights, under 1500km;
- Less legroom to fit more seats and increase efficiency.

In Europe, growth of this business model was sparked by the rise of Ryanair and easyJet, which are, to this day, the largest LCCs in Europe. Despite their being established in the 90s, it was not until the early 2000s that their market share began to grow significantly. In terms of capacity, LCCs went from offering 4% of seats available in 2001 to 23% in 2006, according to [Rebollo et. al. \(2009\)](#). In what market share is concerned, the figures went from 1,6% in 1998 to 30,3% in 2018, evincing just how successful the business model turned out to be, according to a report from [Statista \(2022\)](#). From January until September 2022, a report from [Eurocontrol \(2022\)](#) highlighted the fact that out of the 15 carriers that operated most flights based in Europe, 8 were considered to be low-cost, with Ryanair topping the list with 2,584 average daily flights, followed by easyJet with 1,367. Other carriers in the list include Turkish Airways, Air France, KLM and British Airways. Ryanair and easyJet together account for 15.4% of flights operating within Europe.

After rapid growth of LCCs created two clearly different business models, this divide has somewhat begun to dissolve. Despite there still being clear and identifiable differences, both [Alamdari and Fagan \(2005\)](#) and [Stoyanov \(2015\)](#) found a tendency for pure play LCCs to adopt certain strategies of FSNCs (full-service network carriers), such as offering additional products and services, or greater leg room. Moreover, [Klophaus et. al. \(2012\)](#) noted that FSNCs are battling for cost sensitive and short-haul passengers, a reason why LCCs are evolving their businesses into more of a hybrid model.

[Mason and Morrison \(2008\)](#) introduced the concept of product and organizational architecture to the carrier industry. They identified several key components of the complex carrier markets and proposed a framework for comparing different companies. There are three major factors defining product architecture, notably connectivity, convenience, and comfort. Regarding organizational architecture, salient matters include IT services, fleet quality, staff, and airport infrastructure. [Moir and Lohmann \(2018\)](#) included five more variables including customer satisfaction, fuel efficiency, and stage length, as determinants of competitive advantage.

Product Architecture

Connectivity

To frame the importance of connectivity, one must first understand how routes are established. [Alderighi et al. \(2004\)](#) highlight the two dominant models: hub-and-spoke, where carriers focus on establishing a number of routes to and out of a central airport, and point-to-point, where carriers increase the number of flights but decrease the need for customer layovers, focusing primarily in secondary airports. Both models have turned out to be profitable. [Zeigler et al. \(2017\)](#) describe connectivity as being dependent on several factors such as types of carriers operating at an airport and the scale and geographic scope of carrier networks. The authors suggest that hub-and-spoke is mainly adopted by flag carriers and FSNCs who establish themselves in a central base, from there delivering a wide range of flights. Examples include Lufthansa in Frankfurt, British Airways at London Heathrow, or TAP at Lisbon Portela. Point-to-point models are more recent and typically adopted by LCCs, like Ryanair, easyJet and WizzAir, among others. LCCs have become dominant players in the short-haul European market with some hitherto point-to-point routes becoming so popular that they have transformed some airports into hubs. Examples include Milan Malpensa and London Gatwick. [Malighetti et al \(2008\)](#) goes even further stating that approximately 66% of the fastest indirect connections are operated by carriers other than an FSNC. However, some authors hold that LCCs failed to have a significant impact on smaller airport connectivity. [Suau-Sanchez and Burghouwt \(2012\)](#) found that although medium-sized airports had a positive impact for the creation of LCCs, smaller regional airports not only failed to increase passenger traffic but, in some cases, passenger numbers even decreased, a conclusion also shared by [Lian and Rønnevik \(2011\)](#).

Despite difficulty measuring differences in perceptions and needs of customers ([Nassiri and Rezaei \(2012\)](#)), most flyers tend to opt for direct routes to destinations, even if it means paying a premium for the ticket. Nevertheless, brand loyalty does also play a role, driven by frequent flier plans and carrier status benefits. There are a number of ways scholars measure connectivity: factors include the demand-based accessibility index by [Redondi et al. \(2013\)](#), where loss of accessibility from small airports closer is mitigated by the greater connectivity of point-of-origin airports; there are also the Netscan model by [Suau-Sanchez and Burghouwt \(2012\)](#); and the Danesi model ([Danesi \(2006\)](#)). On the supply side, metrics used to analyse connectivity are: the closeness centrality [Sapre and Parekh \(2011\)](#), betweenness centrality [Malighetti et al. \(2008\)](#), weighted

betweenness [Rodríguez-Déniz \(2012\)](#), and average quickest travel time [Niese and Grimme \(2013\)](#), which this study is going to make use from.

Connectivity encompasses the degree to which a passenger is able to get from point A to point B – thus, the notion also includes ground connections and ease of accessibility of airports. A city’s airport connectivity has also been positively correlated with economic and social benefits, as per [Florida et al. \(2015\)](#), and it is intuitive, *ceteris paribus*, that carriers operating out of more convenient airports will gain more customers.

Convenience

Convenience has been thoroughly studied as a variable that determines purchasing decisions. The first study was [Kelley \(1958\)](#) who recognized its impact on consumer behaviour. Convenience as a predictive variable was also posited by [Mason and Morrison \(2008\)](#) who included measurable sub-variables such as airport location, punctuality, and baggage service. [Moir and Lohmann \(2018\)](#) further added speed of resolving customer complaints as an element for measuring a carrier in terms of convenience. A report from the [International Air Transport Association \(2022\)](#) framed convenience as a top priority for travellers in the aftermath of COVID-19. Proximity to an airport was a main demand when choosing where to fly (75% of people mentioned airport location). This carried greater importance than ticket price (with only 39% of people citing cost). The same report found that customers are also keen on the implementation of more convenient extra-flight processes such as biometrics to speed passage through security, luggage pick-up services, or luggage monitoring. Coincidentally, several convenience indicators have seen decreased levels of service - [Ahlgren \(2022\)](#) reported that mishandled baggage spiked 24% in the post-pandemic world. For every 1000 passengers, in 2021 on average 4.35 pieces of luggage were mishandled. [Brady \(2022\)](#) also stated that flight delays across Europe have risen and are likely to continue in the short-term, when compared to pre-pandemic levels.

[Yimga \(2017\)](#) was able to study the effect of on time performance on the customer behaviour in the carrier market and concluded that customers are willing to pay a premium for a smaller likelihood of flight delays. The study further ascertained how costly each minute of delay is for carriers, at \$1,38, \$1,07 and \$0,91 for long-, mid- and short-haul flights.

Comfort

The concept of comfort has no easy definition – it encompasses levels of stress, safety, air temperature, and amenities. [Li and Tang \(2020\)](#) define travel comfort as the degree of physiological and psychological ease associated with the journey. [Kremser et. al. \(2012\)](#) also laid their views on comfort, having described it as more complex than the inexistence of comfort, as it is also connected to relaxation and luxury, and not just biometric factors. [Mason and Morrison \(2008\)](#) identified passengers per flight and economy seat width and pitch as quantifiable travel comfort variables. [Moir and Lohmann \(2018\)](#) added the load factor and enplaned customers per staff as relevant for determining a carrier's comfort index while [Davis and Nag \(2020\)](#) mention available legroom with [Blok et. al. \(2007\)](#) having stated that this is the most important factor. [Vink et. al. \(2012\)](#) studied how to improve comfort of air travel and concluded that in addition to leg room, hygiene, space for luggage, flight information, noise, and cabin crew were also relevant factors for the comfort calculus. They reported customers' degree of awareness of comfort factors, analyzing more than 10,000 online reports and 153 client surveys.

[Vredenburg et. al. \(2015\)](#) conducted a study on the most relevant factors contributing to anger, and found out that seat width and pitch are strong contributors to passenger dissatisfaction after looking at data from the four major carriers in the US. Today's roomier seat is tighter than the tightest seat in 1990 in the sample, studied which, combined with the increase of the average weight of Americans, has strongly contributed to discomfort and dissatisfaction. [Pierce et. al. \(1999\)](#) conducted one of the first specific studies on the characteristics of seats and found out that legroom was the main source of passenger discomfort. [Kremser et. al. \(2012\)](#) also confirmed the importance of seat width and pitch and estimated that the optimal measures for seat pitch are between 34 and 42 inches. [Balcombe et. al. \(2009\)](#) explored the willingness to pay extra for extra levels of comfort and found out that that premium is for extra legroom and extra seat width can reach 22 and 29€, respectively, while also stating that a customer can be willing to pay in total up to 120€ for better comfort conditions overall. [Brundrett \(2001\)](#) suggests that tighter seating can prevent the recommended exercise on long-haul flights, can be an obstacle to smooth evacuation procedures and has effects on blood circulation, with a number of enquired having reported pain related to posture.

Organizational Architecture

Fleet

A carrier's fleet of aircraft relates to the firm's vision and intended service offering. Some aircraft are long-haul equipment, while others are designed for medium or short-haul flights. The homogeneity of planes, hours of utilization, and daily departures are all important according to [Mason and Morrison \(2008\)](#). [Moir and Lohmann \(2018\)](#) added further factors related to fuel efficiency. [Purkayatsha and Sharma \(2016\)](#) identified maintenance costs as being key for competitiveness, which is positively correlated with a fleet's average age, as per [Dixon \(2006\)](#). Fleet age also brings an additional indirect source of competitive advantage according to [Baumeister \(2015\)](#) – there is an increasingly high awareness of environmental impacts and the need for sustainable practices, and a younger fleet requires less fuel. The same study also found a correlation between fleet age and international alliances – carriers in alliances have, on average, older aircraft. [Lee et. al. \(2009\)](#) affirmed that the most relevant factors affecting carbon intensity in air transportation include, *inter alia*, the rate of fleet renewal and average size of an aircraft. [Bruggen and Klose \(2010\)](#) and [Zou et. al. \(2015\)](#) explore how fleet homogeneity contributes to creating economies of scale for maintenance and operations, thereby decreasing costs.

Staff

The carrier industry offers a broad range of occupations. In the air, flight and cabin crew work on board the aircraft. On the ground, there are many personnel in offices and other airport environments. There are also specialized drivers for different equipment and airports. At some airports, engineers are also critical for roles that include assembly, maintenance, and testing. Despite more automated processes, there is still need for human intervention, notably in baggage handling and loading ([McGregor \(2002\)](#)), as well as for customer support. However, automation has taken over many functions completely or almost completely. Ticketing for example, occurs almost exclusively online, and even customer support has shifted to the online environment with chatbots, etc., making many dedicated staff previously employed by carriers redundant, according to [Multafi \(2020\)](#).

[Mason and Morrison \(2008\)](#) identified various staff metrics including passengers per employee, employees per aircraft, personnel cost per available seat kilometer (ASK), the ratio

between flight and cabin crew per total employees and ASK per employee. These indicators were used to calculate a carrier's staff index under the Product Architecture and Organization framework. [Moir and Lohmann \(2018\)](#) used the same approach but pointed out the margin of error in the index based on the fact that it's hard to ascertain how extensively carriers outsource various functions. The commercial carrier industry is highly competitive and [Babbar & Koufteros \(2008\)](#) noted that employees with customer contact skills are key differentiators for passenger satisfaction due to the quality of service provided. Training of staff means stronger corporate results based on employee productivity, service quality, customer satisfaction, and profitability. These have been thoroughly explored, both in the carrier industry and other sectors. [Aguinis & Kraiger \(2009\)](#), [Batt \(1999\)](#) and [Curtis et. al. \(2012\)](#) are part of a large cohort of scholars demonstrating the importance of in-flight service. Consequently, many carriers, like Lufthansa, Singapore Airlines, among others, actively conduct competency-based training programs ([Kim & Park, 2014](#)) to ensure that flight attendants have the knowledge and skills for delivering requisite standards of cabin service.

Distribution, Marketing, and IT Services

Digitalization has become a relevant variable in all industries and with this comes the need for cyber security. [Kaglwalla and Churi \(2019\)](#) stated that the greatest issue with aviation cyber security is lack of resources and dedicated attention to rising challenges. According to [Lloyd \(2020\)](#), in 2019, 55% of British businesses reported cyber-attacks, while in 2018 that number was just 40%. The same report mentions compromising attacks with thefts of data on easyJet, Cathay Pacific, and British Airways. TAP also suffered a data breach on September 2022 according to [SH Legal \(2022\)](#). All these can negatively impact a firm's reputation and ultimately, client retention. It is estimated that that around a billion euros were lost in the carrier sector due to cyber-attacks.

In 2016, a Boeing 757 sitting on a tarmac was cyber-attacked by security researchers who were able to control several of the plane's critical functions, as reported by [Tripwire \(2017\)](#). It is no secret that plane manufacturers are working to make digitalized aviation systems cyber secure. Despite this, the B757 attack succeeded. Moreover, hackers conduct approximately 1000 cyber-attacks per month, according to [Valero \(2016\)](#). There has not been any recorded death or injury related to cyber-attacks but several recorded delays and financial loss for carriers have occurred ([SH Legal \(2022\)](#)).

[Akhter and Bashir \(2008\)](#) studied the web design and customer support services relating to online purchases. [Sheth and Ambika \(2020\)](#) also carried out an investigation of the relevance of repositioning customer support services from strategic cost centers to strategic profit centers, and defined CSS as one of the only direct interconnecting links between the firm and customers. They recommended implementing revenue creation possibilities in points of contact with clients. [Kumar et. al. \(2017\)](#) stated that post-sales customer support is significant for retaining consumers.

Drucker (1954) stated that the purpose of business is to create and retain customers. Marketing and distribution are critical for both these goals. [Van Triest et. al. \(2008\)](#) found a clear correlation between customer targeted marketing expenses and customer retention. As society makes the transition to the digital sphere, it is crucial for carriers to provide their products in a simple and digitalized manner. [Mason and Morrison \(2008\)](#) identified internet distribution of tickets as a relevant variable for determining marketing spend and for achieving competitive advantage.

Competitive environment

Insofar as fares are concerned, [Malighetti et. al. \(2014\)](#) concluded that monopolistic routes do not necessarily provide a competitive edge in medium to long-haul flights, because prices are determined by demand and tend not to be affected by competition. Moreover, given that layover flights can also be considered indirect competition, there is almost never a true monopoly. However, carrier dominance in an airport or terminal, E.g., Emirates in Dubai or Ryanair in Lisbon's Terminal 2, can turn out to be a barrier to new entrants. Moreover, there is a significant difference in prices in ultra-short-haul flights, up to 300km. However, if one of the competitors is a LCC, there is a visible impact on the decrease of the average fare offered by all players, according to a case study on Southwest Airlines by [Morrison \(2001\)](#). [Dresner et. al. \(1996\)](#) go even further, stating that the presence of low-cost carriers not only brings the prices down in the routes served, but also in competing route markets, claim that was later also confirmed by [Morrison \(2001\)](#).

[Koenigsberg et. al. \(2008\)](#) obtained new inputs concerning customers' willingness to pay prior to a ticket being bought, as well as what strategies should be employed by carriers to maximize profit. In situations where there are more competitors, carriers are encouraged to offer last-minute deals in accordance with game theory. [Mason and Morrison \(2008\)](#) also identified the average size of a city as a relevant variable in defining a carrier's competitive position.

Methodology

According to Mitchell and Coles (2003), “strategic competitive advantage means that your products and services can be provided in ways that deliver more sales, higher profitability and greater cash flow than would occur for any competitor if competitors supplied the same customer instead.”

Choice of means of comparison

The first mention of the POA assessment model goes back to [Gulati \(1996\)](#), where the structure of a business model is divided into two segments: the product architecture, that takes into consideration intrinsic features of the good or service -- the components which are later going to define product positioning in the eyes of the consumer, and consequently, the best pricing strategy, which in itself is going to help drive revenue. There is, then, the organizational architecture that approaches all of the other processes where the company assigns resources -- the inputs, which are going to be sources of cost for the company. By combining both these architectures, it is possible to establish a framework comparing different company business models in a particular industry.

[Mason and Morrison \(2008\)](#) first built an overall schema that can generally be applied to businesses. “Figure 1” displays a simplified version.

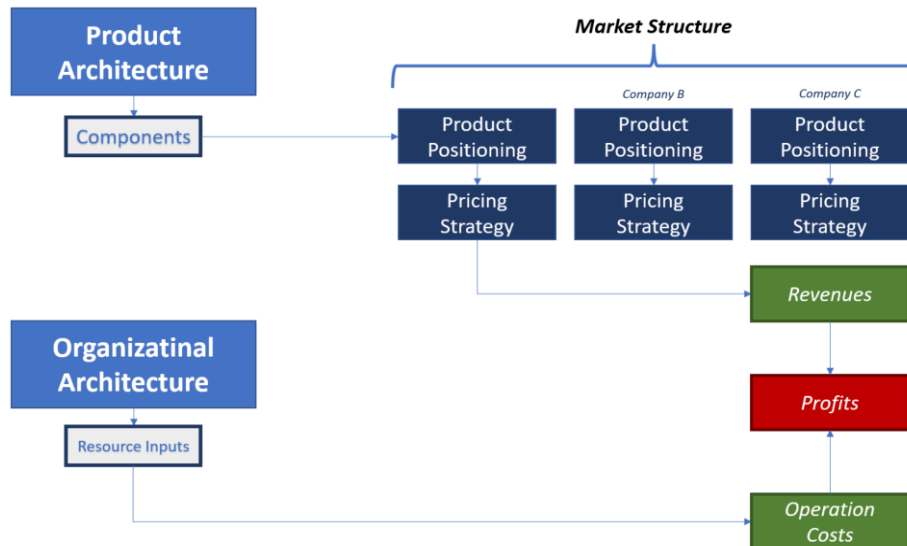


Figure 1 - Simplified version of the POA assessment mode

To achieve the goal of the study, this framework was applied to the carrier industry. This means of comparing carriers has been previously used, firstly by [Mason and Morrison \(2008\)](#) and later revisited by [Moir and Lohmann \(2018\)](#) with some differences.

The first step was to organize several indices according to the POA model. The groups formed in a first stage were:

Profitability index

- Revenue/Operating Costs -- shows how many euros are generated per euro spent on operational processes

Cost index

- Operating Costs/ASK -- shows the OPEX and its efficiency on the carrier's supply capacity

Revenue index

- Revenue per available passenger kilometer, in EUR (Revenue/ASK) -- shows the overall capacity of generating cash flows per seat kilometer
- Average fare (Revenue/Passengers) -- shows how each passenger contributes to revenue creation
- Operating revenue per sector (EBITDA/flights) -- shows how each flight contributes to the EBITDA

Notice that these indicators are a sound reflection of a carrier's value creation structure. Profitability is the overall summary of the success of a company. The unit costs represent, in aggregate, the decisions of the company regarding resource allocation, and the revenue index overall shows how efficient the company is at generating cash flows.

The following process was used to identify components of the product architecture, and the inputs of the organizational architecture. In both cases, indices and sub variables were chosen according to proven relevance for firm competitiveness, as well as other relevant benchmark data. Under each index, several sub-variables were used to define those same indices as follows:

Product architecture

Connectivity index

- Departures per airport per day (yearly departures/365) – aims to display the level of availability of each carrier;

- Routes offered -- showcases the overall geographical availability and capacity to serve specific demand.
- Average number of available destinations per airport served (Routes/Airports served) – shows the possibility for a passenger to fly to a certain airport as a transit point for reaching some other final destination.

Convenience index

- Average weekly frequency per route (Number of flights/routes) -- shows the ability to serve passengers needs regarding their number and preferred times of arrival;
- Average distance in time from closest cities (Distance from city center to airport/number of cities) -- displays the ease of access from major cities to airport facilities;
- % of flights on time (flights with delays under 15 minutes/total flights) – shows the overall ability to serve the passengers with accurate departure estimates.

Comfort index

- Average load factor (enplaned passengers/total available seats) -- shows the ability to accurately predict demand and delivering revenue-generating flights efficiently;
- Seat width -- shows level of comfort provided;
- Seat pitch -- shows level of comfort provided.

Organisational Architecture

Distribution index

- Marketing expenses per passenger (marketing expenses/tickets sold) -- shows the overall contribution of marketing expenses to customer acquisition;

Aircraft index

- Aircraft daily utilization (daily time in the air/24) -- shows the level of efficiency of aircraft usage;
- Fleet homogeneity (number of most popular plane in fleet/total fleet) -- shows the ability to create scale economies in maintenance and training;
- Daily flights per aircraft (total flights/365/planes) -- shows the ability to effectively deliver full services;

- Average fleet age (total age of planes/planes) -- shows the ability to save maintenance and operation costs, as well as level of comfort;
- Fuel cost per ASK (fuel cost/ASK) -- shows the ability to save costs and to reach client expectations regarding CO2 emissions;
- CO2 emissions per passenger kilometer (CO2 emissions/RPK) -- shows the ability to create advantage through meeting customer expectations;

Labour index

- Enplaned customers per cabin crew (passengers/cabin crew members) -- displays the ability to decrease costs through higher staff productivity;
- Employee per aircraft (total employee/aircraft) -- displays the ability to decrease costs through higher staff productivity, including staff that doesn't necessarily board the plane;
- Staff costs per ASK (personnel costs/ASK) -- shows efficiency of human resource usage;
- ASK per employee (ASK/total employees) -- shows the individual contribution of a worker; in the supply of ASKs;
- Flight and cabin crew % of total employees (flight and cabin crew members/total members) -- shows the overall efficiency of administrative staff in the off-aircraft tasks at hand.

Organizing the sub variables is a naturally complex task, as one can argue that some variables belong to other indices – such as the percentage of monopolistic routes in the convenience index, or the average fleet age in the comfort index. But it is natural that variables have slight overlaps with other areas of the business. The analytical framework, index choice and their sub variables were selected according to the best fit possible, relying on the work of [Mason and Morrison \(2008\)](#) and [Moir and Lohmann \(2018\)](#).

Choice of competitors to compare

Based on own research, Ryanair, easyJet and WizzAir were the companies that flew the most passengers in Europe in 2021 with business models that fit into the LCC category. Moreover, these carriers operate several routes at the same time, which constitute the most direct form of competition, like Kraków to London, or Lisbon to London, where the three carriers operate simultaneously. Where this does not occur, most routes have direct competition from at least one other LCC, and this is especially true for easyJet and Ryanair. The same phenomenon occurs for

WizzAir but due to its strategic area of operation, the number of routes where WizzAir has no competition from other LCCs or even no competition at all, is higher.

Choice of period

In 2019, a novel coronavirus was found in Wuhan, China and rapidly spread throughout the world. That was a never-before seen impact on aviation -- lockdowns and travel bans decreased traffic by around 60% compared to 2019, according to a report by ICAO (2020). Several carriers had to be bailed out by governments, such as American Airlines, United Airlines, Lufthansa and TAP. As such, the financial statements and corporate data from the years 2020 and 2021 are outliers and not entirely reflective of companies' fiscal realities, but rather presents a unique and especially impactful extreme event for carriers. Because of this, data to compute benchmark indices will be from the years 2017, 2018 and 2019, with data from more recent years being used where it makes sense to do so.

Benchmark index calculation

The dataset was built using information from yearly and quarterly reports, as well as other statistics websites. Some information is unavailable from these sources, and all the efforts have been made to estimate what those values really are according to inferences and assumptions to estimate said figures as accurately as possible. The table can be found in the appendices under "Table 3".

In such a complex industry, and any other for that matter, not all variables associated with conducting a business have the same impact. Hence, it is important to assign weights to each one, for the framework to correctly accrue levels of importance and to estimate competitive advantage. The weights were calculated by running a correlation analysis of all the sub variables with the profitability index. With this, we were able to calculate how, on average, each index contributes to profitability, and thus, to greater competitive advantage. The weights calculated go from -1 to 1 – the further away from 0 the index's weight is, the more impact it has on profitability. The table can be found in the appendices as "Table 4"

Some indices will be positively correlated with competitive advantage, like all those related to the efficiency of operations, while others will naturally be inversely correlated, like distance between airports and cities, or staff costs per ASK. To standardize interpretation of the scores of each index, where lower values mean lower performance and higher values represent higher

performance, calculations need to be made differently according to the sign of the correlation weights. If the weight is positive, then the calculation was guided by the best performer of the group according to the data gathered in “Table 3” using the formula:

$$\text{Company's score in a variable} = \text{Company's value} / \text{Best value}$$

In this case, in the variable “EBIT per flight”, for example, WizzAir in 2018 will score 0,7670, as its value is 1,741.89€ and the best performer, which is Ryanair in 2017, achieved a value of 2,270.97€. This means that WizzAir’s numbers were 76.70% of those of the best performer. The top performer will then achieve the highest score on said variable, of 1.00, and the rest will have scores that reflect their performances relative to the best performer.

$$\text{WizzAir 2018 EBIT per flight score} = \text{WizzAir 2018's EBIT per flight} / \text{Ryanair 2017's EBIT per flight}$$

(=)

$$0.7670 = 1741.89 / 2270.97$$

In cases where the lowest value is expected to be the most desirable, the calculations were carried out according to the formula:

$$\text{Company's score in a variable} = (\text{Worst value} - \text{Company's value}) / (\text{Worst value} - \text{Best value})$$

In this situation, applicable to variables like “Daily flights per aircraft”, WizzAir 2018 would score 0.3601, based on the aforementioned formula, considering Ryanair 2017 as the best performer and easyJet 2017 as the worst.

$$\text{WizzAir's score in a "Daily flights per aircraft"} = (\text{easyJet 2017's daily flights per aircraft} - \text{WizzAir 2018's daily flights per aircraft}) / (\text{easyJet 2017's daily flights per aircraft} - \text{Ryanair 2017's daily flights per aircraft})$$

(=)

$$0.3601 = (5.08 - 4.96) / (5.08 - 4.63)$$

Due to the inclusion of the worst value in the numerator, the worst performer will have a score of 0.

All these calculations lead to the sub variable values in “Table 5” of the appendices, for each pair carrier/year, and with these results in mind, the calculation of each index was made according to the formula:

$$\Sigma((score_a * weight_a) + (score_b * weight_b) + \dots)$$

The weighted scores were then standardized, to establish a more correct means of comparison, according to the best performer. This means that the total final score can be achieved through:

$$Weighted\ score / Best\ performer * 10$$

With this, the index values and total scores are registered in “Table 6” of the appendices.

Research

Consolidated income statements

Examining the companies' consolidated income statements was relevant for better understanding the realities of these firms and differences between them. The annual reports of the analyzed companies provided the data present in "Table 1" of the appendices. That data gives us a notion of the overall cost structure of companies in this sector.

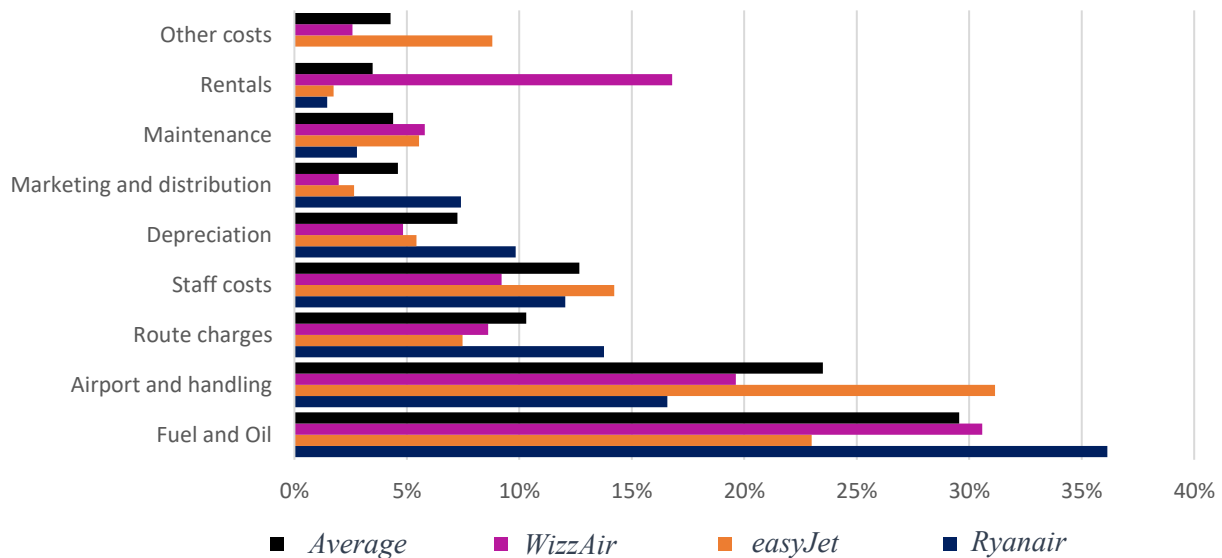


Chart 1 - Aggregated cost structures from the three LCCs from 2017 to 2019

Some differences in cost allocation are easily identifiable, like the Ryanair's stronger weight allocated to fuel (in contrast with easyJet's 23%), WizzAir's extreme cost allocation to aircraft leases, or easyJet's above-the-average costs of airport and handling. There seems to be, however, a somewhat standard cost allocation among LCCs, with fuel and airport costs being the heaviest, with an average of roughly 29% and 23.5% respectively. "Table 2" of the appendices provides a more insightful look at these numbers.

Index Analysis

The indices themselves cover a wide range of processes and sectors within a carrier's reality, and it reflects a strong degree of accuracy pertaining to the competitive reality of the carriers relative to each other. The data used to conduct this study is interesting to analyse from two different perspectives:

- 1 – Competitive position and evolution of carriers relative to each other; and
- 2 – Analysing correlations between different indices and variables

Competitive position and internal evolution

Profitability

After running the necessary calculations in tables 2, 3 and 4, it is correct to assert that, on average and over the years, Ryanair has established itself as the most competitively capable LCC in the European skies. The first indicator of this is a simple analysis of the profitability index, built by one single sub variable -- “Revenue/Operating costs”. Ryanair managed to achieve a return of 1.30 euros for every euro invested in operational processes for two fiscal years in a row, before struggling to keep the same level in 2019 and dropping the same figure to 1.15, partially due to an increase in oil derivatives prices in 2019. Ryanair achieved in all three years analyzed, higher profitability indices than its major competitors, which indicates a stronger ability to generate cash flows.

easyJet and WizzAir followed a downward trend and returned similar values for this sub-variable. Despite showing a strong 1.24 in 2017, this figure declined in the later years to 1.11 in 2018 and 1.07 in 2019, whereas WizzAir, despite achieving a lower score in 2017, managed to only slightly decrease its margins, having scored 1.18 and 1.15 in the coming two years.

Cost index

The cost index, made up of only one sub variable, also sheds some light on the competitive advantage Ryanair exhibits. It also highlights one of the main reasons why WizzAir was considered the fastest growing carrier in 2019, according to a news article by [Koraba \(2019\)](#). Ryanair has managed to efficiently control its costs per available seat kilometer to a minimum 3.22 cents in 2018 after having dropped slightly from 3.25 in 2017 and before increasing to 3.59 in 2019, due to higher fuel prices, which make up between 35-37% of Ryanair’s operating costs. These figures are substantially better than easyJet’s 5.52, 6.05 and 6.00 cents per ASK which contributes to an overall higher average fare. However, and maybe somewhat unexpectedly due to its young age, WizzAir showed the best overall values of costs per ASK in all three years of analysis, having recorded 3.15 in 2017 (the best value of the analysis), 3.19 in 2018 and 3.35 in 2019. Considering that this sub-

variable has a strong negative correlation with the profitability index, it is naturally an area where companies will look to improve if they seek to steal market share from the competition.

Revenue index

The revenue index is also relevant for determining competitive advantage -- two of its three sub variables are strongly correlated with profitability and will later have a strong impact on the final scores. It seems curious that revenue per ASK is negatively correlated with profitability, but in addition to its subsequent correlation with higher costs (a company with more revenue will necessarily have to incur extra costs), correlation here is not only weak, but also almost non-existent. Nevertheless, both Ryanair and easyJet have achieved similar results, despite Ryanair dropping its revenue per ASK to slightly over 4 cents, while easyJet maintained this figure between the 6 and 6.5 cents. In this category, WizzAir stands out having kept its revenue per ASK relatively smaller than its competitors, between 3.75 and 3.85 for the analyzed timespan.

As far as average fares are concerned, Ryanair and WizzAir stand out as the sub variable is negatively correlated with profitability and these companies offered the lowest average fares in all of Europe. Ryanair achieved the lowest fare in 2019, of a mere 37€ per ticket, confirming a downward trend in this sub variable, despite a substantial increase in cost per ASK. WizzAir on the other hand, kept its fares also within the same range as Ryanair, having varied between 38.2 and 39.5 from 2017 and 2019. easyJet, however, features some surprisingly high fares when compared to its main competitors. Its average fares are around 42 to 45% higher when compared to Ryanair and WizzAir, at 57.8€ in 2017 and climbing up to 61.01€ in 2019, after registering a record high 61.48€ in 2018. Considering the typical target of LCCs and how price sensitive the average target consumer is, easyJet has a demonstrable competitive disadvantage. One of the possible reasons may be its strong presence with important bases in cities with overall higher price indices and disposable income, like Geneva, Basel, and Paris Charles de Gaulle.

EBIT per flight is also one of the sub variables of the index, and one of the most strongly correlated sub variables in the whole model. Ryanair has posted some significant numbers in 2017 and 2018, surpassing the 2000€ of operational results in both years, despite having dropped this figure by more than 45% in 2019. WizzAir has been able to have stable numbers throughout the three years, with a curious result in 2017 and 2018 -- this sub variable in both years only differed by 86 cents, and later dropped to 1577€ in 2019. easyJet once again has the least favourable

numbers, having never been able to reach an EBIT per flight of over 1000€. This indicator is important for not only ascertaining the money generating capabilities of companies, but also, and maybe more importantly, the extent to which carriers are able to establish efficient processes.

Connectivity index

The connectivity index is also meaningful and measures to some extent the ability to take passengers where they want, when they want. The departures per airport per day sub variable aims to describe how present a carrier is at airports in which they operate. It has, however, turned out to be weakly correlated with profitability, mainly due to the differences in strategies deployed by the airlines. Ryanair and easyJet have both offered between 8.9 and 10.5 daily flights per airport. easyJet has been able always to offer slightly more daily flights than Ryanair, which would lead the reader to assume that a greater number of daily flights per airport would constitute a source of costs. WizzAir only operated 3 daily flights per airport on average in 2017, and that number has risen to 3.57 in 2019, but is still far from its competition. This means that despite having a solid network, WizzAir limits access to certain routes by operating fewer flights than the competition. Because load factors are high, and because WizzAir is still relatively recent, it would be reasonable to assume that WizzAir is still developing its fleet by obtaining extra capacity to serve the demand on routes where often times they only operate. Despite the correlation being weak, which indicates that an increase in flights would also lead to higher costs, raising flight numbers will most likely increase profitability through economies of scale, especially for a growing company like WizzAir.

When it comes to routes offered, no company scores better than Ryanair, even when compared to other LCCs and full-service network carriers. In 2019, it offered a staggering 2,764 different routes, having provided around 300 more routes than 2018 and 600 more compared to 2017. Despite the three companies having displayed yearly growth for this metric, no competitor comes close to Ryanair's numbers. easyJet managed to surpass the 1,000 routes in 2019 after having grown approximately 12% per year, and WizzAir had 650 confirming its same overall growth trend since 2017. With a correlation of 0.42, this sub variable is a natural source of competitive advantage because the likelihood of a company being able to serve a customer's specific needs increases with the number of routes, and so does the number of monopolistic routes. If the airline offers more routes than its competition, some routes will naturally be monopolies. An interesting preliminary conclusion may also be that clients are adaptable regarding flight times, and

are more interested simply in from A to B, supported by both correlations of these two last indices with profitability.

Another important variable is the supply provided by the airports from which these carriers operate. With a moderate negative correlation, one might anticipate that low-cost flyers will prefer to search for smaller airports, where LCCs typically operate, with lower costs and lower fares. There is a clear distinction between strategies of the three players concerning this sub variable. Where easyJet bets on busier and more connected airports with an average of 127 destinations served by each airport, WizzAir focuses more on smaller airports further away from cities and serving smaller population centers, with an average of 59 available destinations in the airports served. In between we find Ryanair, the carrier with the most extensive network, where flying to smaller or more remote airports is not always possible (E.g., Lisbon, Budapest and Bucharest, among others). In this case, Ryanair has positioned itself for a more mixed approach, having served airports that offer between 83 and 88 routes.

Convenience index

The convenience index, although remarkably similar to the connectivity index, encompasses all the variables that relate to making a trip as smooth as possible. Its sub variables are strongly correlated, with the exception of the average distance from airports to city centers. The first sub variable in the index relates to average weekly flights per route. There are substantial differences in the values recorded. On one hand, Ryanair and WizzAir both managed to register more or less the same values, varying from 5.5 to 6.2 weekly flights per route. Yearly growth is almost equal, with both carriers growing to around 6.15 from 2017 to 2018, before dropping again to an average of 5.55. In contrast, easyJet operated an average of 11.5 flights per week per route. These numbers combined with the negative correlation could mean that easyJet is overflying some routes, incurring costs where demand has already been met. Not only did easyJet reallocate aircraft to other routes in 2021, but also a quick look at load factors suggests that easyJet struggled to keep the same numbers, further supporting the hypothesis of there being more supply than demand.

Average distance from cities, despite being weakly correlated, sheds some insight upon the overall strategy of the carriers. WizzAir operates mainly from airports within a 22-minute drive from the city center, which indicates that, consonant with one of the many characteristics of LCCs, WizzAir chooses to operate out of smaller airports, serving smaller cities, which are typically closer

to city centers. Ryanair, because of its network, sometimes has no other option than to operate out of main airports, typically further away. Ryanair's bases were 28 minutes away on average in 2019 from city centers, which are slightly but insignificantly closer than easyJet's bases which are around half an hour. The weak negative correlation was to be expected, as one might assume that airport distances are almost irrelevant, but if they were of consequence, further airports would be considered harder to access.

With respect to on-time performance, the high correlation of almost 0.5 with profitability confirms that it is one of the most important KPIs that carriers should always look to improve. Ryanair put up the best numbers, never dropping below 85% of flights on time in the analyzed horizon, even reaching a high of 92% in 2019. easyJet and WizzAir have both struggled to match Ryanair's numbers, with the former being able to achieve between 75 and 76% of flights on time, while the latter secured around 78.5% in 2017 and 2018 before dropping to 71% in 2019.

Comfort index

Comfort is also a key variable in such a homogenous market. On one hand, lower costs often come at the expense of other amenities, like better seats. However, offering higher comfort conditions can sometimes be the key for customer choice between two seemingly equal services. The first variable is load factors, which are not exclusively related to comfort, but also efficiency. This explains the high correlation. Once again, Ryanair managed to post the best figures, having been able to sell 96 out of every 100 seats available in 2019, after witnessing a slow yet steady rise from 94 and 95% in 2017 and 2018 respectively. easyJet has struggled to keep the same numbers over the years, having dropped its load factors from 92.6% in 2017 to 91.5% in 2019. This may suggest that, combined with the high number of flights per route and the increasing average fares, easyJet might be overestimating demand. WizzAir is the least efficient company, but has recently shown progress, having gone from 90% in 2017 to 92.8% in 2019, surpassing easyJet.

Seat conditions were also relevant to the analysis because they represent the trade-off between cost effectiveness and providing comfort. The differences in correlation are somewhat unexpected. According to seat width data, Ryanair offers the least amount of space, at 43.2 cm, whereas easyJet is able to offer 44 cm seats. WizzAir, despite operating the same model of aircraft as easyJet, offers more space, even if just half a centimetre more. The negative correlation implies that carriers with wider aisles offer a better trade-off, for example through faster boarding and

deplaning processes. The opposite correlation concerns seat pitch, the distance from the back of a seat to the back of the seat in front. It seems that a bigger pitch is something customers value and are willing to pay a premium for this feature. It is expected, however, that this correlation is limited by the amount of available data. Had it not been so, and this would directly contradict the fundamental characteristic of efficiency in LCCs.

Distribution index

The distribution index aims to assess how hard carriers try to reach their targets, and how this ultimately affects results. Due to lack of any further available data, this index was built using only one sub variable -- marketing expenses per passenger flown. The correlation between marketing expenses and profitability is around 0.3. This is, in part, due to fierce competition in some routes, where companies advertise their lower fares, but also the lack of competition in others (the opening of new routes, for example). Yet again, Ryanair excels in this KPI, having spent 2.68€ per passenger flown, which kept increasing to 3.86€ in 2019, an increase of roughly 30%. easyJet has recorded significantly lower numbers, despite having shown growth. Its highest number was 1.91€ in 2019, which is still significantly higher than WizzAir. WizzAir, somewhat surprisingly, has even cut costs in marketing, recording 1.13€ in 2017 and then slightly dropping to 1.09€ in 2019, which helps explain lower profitability.

Aircraft index

The aircraft index measures performance and overall characteristics of a carriers most important assets, the equipment flown. It should come as no surprise that the sub variables display a medium to strong correlation with profitability, mainly via fleet homogeneity, flights per aircraft, and utilization. The first of the aforementioned sub variables measures the amount of time an airplane is not parked, per day. This is negatively correlated with profitability. While Ryanair's aircraft are used around 9 hours a day (which is a number that has been decreasing), easyJet manages to keep their aircraft in use for longer at an average of 10h per day. Despite a downward trend, WizzAir's aircraft spent a record high 12.68h airborne, before dropping to 12h in 2019. The negative correlation might be explained by Ryanair's stronger ability not to overuse airplanes and to distribute flight times across a greater number of aircraft. On average, higher aircraft utilization means more flights per aircraft (which will later be confirmed), meaning that there will be more

boarding and deplaning time. That can influence on time performance, which in itself is a source of competitive advantage.

Aircraft homogeneity turned out to be one of the most important sub variables in estimating competitive advantage in the LCC sector, which is coherent with one of the main characteristics of such carriers. With a strong correlation of 0.56, Ryanair has managed to record the best possible result by operating only Boeing 737s in its entire fleet. Because of the recent acquisition of Lauda Air, a carrier operating Airbus aircraft, this homogeneity has slightly decreased, but it is still by far the best value of the three companies as of 2019. easyJet has been undergoing a massive change in fleet composition, shifting from smaller A319s to the larger and more fuel efficient A320neos. Scrapping or selling older A319s and the acquisition of new A320s is clearly visible with their growing fleet homogeneity – in 2017 numbers were below 50%, and in 2019 it achieved 60%. WizzAir's fleet is considerably more homogenous than easyJet's recording a decrease in numbers. This decrease is characteristic from an initial phase of fleet replacement. Fleet homogeneity is meaningful because LCCs routes are compatible with operating only one type of aircraft. However, frequent renewal of the fleet is also important, because as technology progresses, more fuel-efficient aircraft appear, a factor crucial for carriers as fuel costs represent about 35-37% of all operating costs. The age of aircraft also influences profitability, although to a small extent. WizzAir recorded the lowest average age, set at 4.8 years, predictably because of its young age and more aggressive investment in aircraft, whereas easyJet still operates the oldest fleet, at a 7.4 year average age. Ryanair's fleet is slightly younger, having moved aged from 6.5 to 7 years.

Daily flights per aircraft also presented itself as a significant sub variable. Despite small differences between the three carriers, easyJet has been the most intensive user of aircraft, followed by WizzAir and Ryanair with similar but slightly lower numbers. Once again, it seems that easyJet may be slightly over-operating its aircraft, as the correlation is considerably negative.

Fuel, as previously mentioned, is the most relevant cost center and it should come as no surprise that there was a negative correlation. WizzAir had the best bargaining power, despite being the smallest and most recent of the three carriers, recording a cost of 1.11 cents per ASK. Ryanair recorded slightly more expenses, with fuel costs being 1.29 cents per ASK. Finally, easyJet, registered a considerably high value in 2019 of 1.43 cents. It is clear that fuel prices have risen sharply in 2019 (confirmed by the three annual reports), but also this has strongly impacted

profitability, which declined for all carriers coming into 2019. Fuel efficiency is not only financially important, but also has relevance for marketing. CO2 emissions per passenger kilometer, along with carbon offsetting programmes and other similar initiatives, play an important role for Corporate Social Responsibility and lower emissions are generally more attractive to customers. But this sub variable was the least correlated in the whole model. Nevertheless, it is worth mentioning that all carriers have showed remarkable progress in cutting emissions, with WizzAir recording the best numbers, followed by Ryanair and lastly easyJet.

Labour index

Staff efficiency is a key variable in every industry and the carrier industry is no exception, confirmed by the significant correlations of the sub variables in the index. Enplaned customers per cabin crew represents how many passengers each cabin crew member dealt with throughout the year. As expected, more efficient employees are better for the company, and Ryanair has managed to excel at this variable registering 9,212 passengers per crew member. Ryanair has let many employees go and managed to improve this number to 15,627 in 2019. In the case of easyJet, 10,500 customers per cabin crew were the numbers for 2017 and 2018, before hiring more staff and dropping this to roughly 7,400. Due to growth in personnel, WizzAir went from 15,473 to 12,357, from 2018 to 2019. In both cases, numbers are expected to grow back, as a greater intake of cabin crew means an imminent increase in new routes and more flights, meaning more passengers.

The employee per aircraft index also reflects overall staff efficiency, taking administrative staff into account, and is a key variable in predicting profitability. With a correlation of almost 0.7, Ryanair has managed to operate aircraft using the combined work of around 35 people, after increasing from numbers from an even more efficient 32. WizzAir has also shown a slight upward trend, having increased numbers to 40.5 people in 2019. easyJet has struggled to compete in this category, despite having been able to need only 40 people per aircraft, better than WizzAir in 2019. Its efficiency has since dropped significantly in the following year, increasing to 47 in 2019.

Wages, directly correlated with motivation and productivity, also play a significant role in defining competitive positioning. WizzAir is the company that pays employees the least, having spent 0.33 cents per ASK in 2019. One of the reasons for this is its geographical area of operations. With important bases in Poland, Romania, Hungary and Sofia, it is normal that most employees

are paid according to the cost of living of each country, which is considerably less than, say, Switzerland or the UK, two of the main hubs for the competition. Ryanair has spent more on staff with figures around 0.5 cents per ASK. easyJet has been the most generous to employees, having increased its staff costs until 2019, to almost 0.9 cents per ASK.

Other efficiency measures include ASKs per employee and percentage of cabin crew and flight crew in the total company. The former does not seem to have a strong correlation but is demonstrative of a carrier’s strategic decisions. The metric explains Ryanair downsizing personnel in 2018 and the greater inefficiencies of easyJet. WizzAir consistently has managed to offer the most seat kilometers per operational staff. Percentages of flight and cabin crew are highly correlated with profitability, because they reflect the efficiency of administrative and on-board personnel, the latter who are typically better paid and more costly. Ryanair at 86% is roughly the same as WizzAir and slightly better than easyJet’s 83% in 2019.

Preliminary summary

The analyses above demonstrate Ryanair’s better overall positioning in the LCC competitive carrier market. For the years discussed, Ryanair dominated all the indices, apart from costs, where WizzAir had an edge. For the revenue, convenience, and labour indices, WizzAir has been able to put up some fierce competition but falls short by a margin on all other areas. It still managed to categorically beat easyJet in all but two areas -- comfort and distribution – where the latter struggled to compete both with WizzAir but mainly Ryanair.

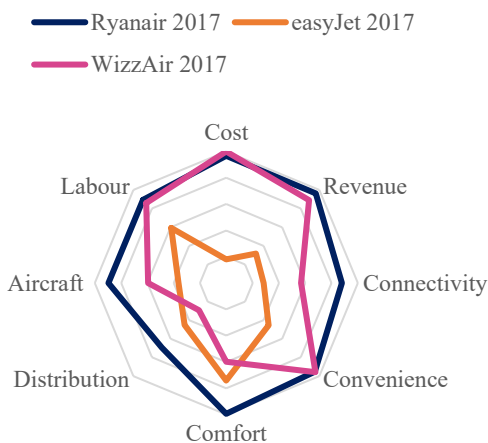


Chart 2 - Competitive position in 2017 (10 being the best score in the three years of analysis)

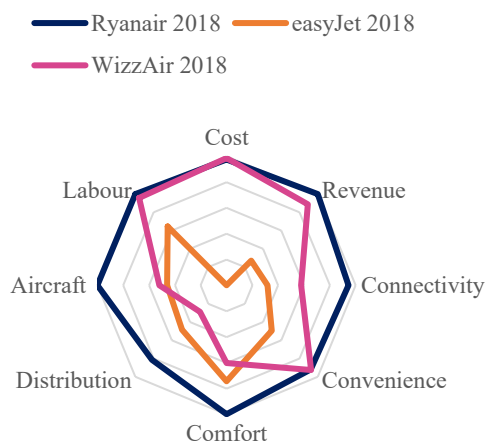


Chart 3 - Competitive position in 2018 (10 being the best score in the three years of analysis)

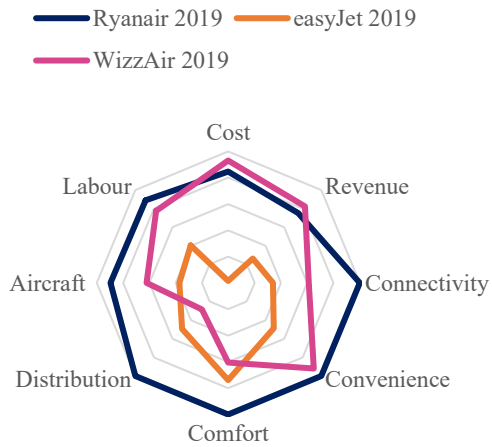


Chart 4 - Competitive position in 2017 (10 being the best score in the three years of analysis)

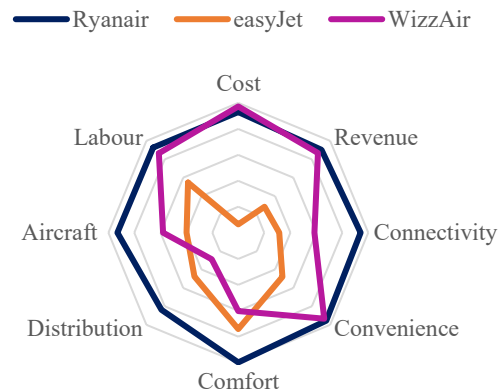


Chart 5 - Average competitive position throughout the three years of analysis (10 being the best score achieved in a year)

Correlations between indices

After running a correlation matrix between all the indices (“Table 7” of the appendices), there are certain correlations that immediately catch the reader’s attention, with several values above 0.8 (and below -0.8). From these, certain conclusions about the LCC market can be drawn.

Average fare and flight numbers

One of the first striking correlations identifiable is between average fares and two variables related to flight numbers - average number of available destinations per base, and average weekly frequency per route, with correlations of 0.91 and 0.98 respectively, see charts 6 and 7. This suggests that busier airports, where there are more connections available, typically have more demand and carriers have to pay more fees for slots. It also conforms with LCC management theory. For weekly frequencies, the correlation is even higher, suggesting that carriers tend to decrease flight frequency and operate new routes instead, as their ability to do so decreases, prices increase.

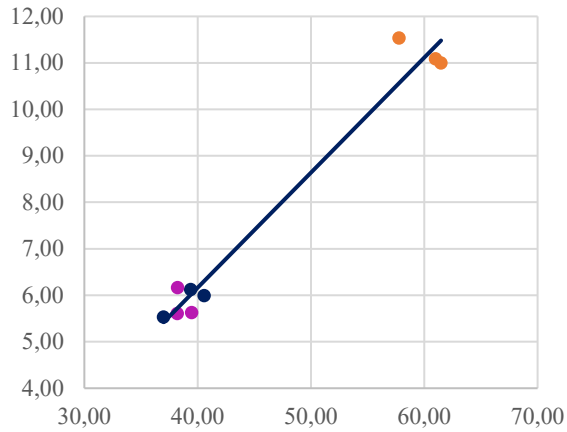


Chart 6 – $x = \text{Average fare (€)}$; $y = \text{Average weekly frequency per route}$

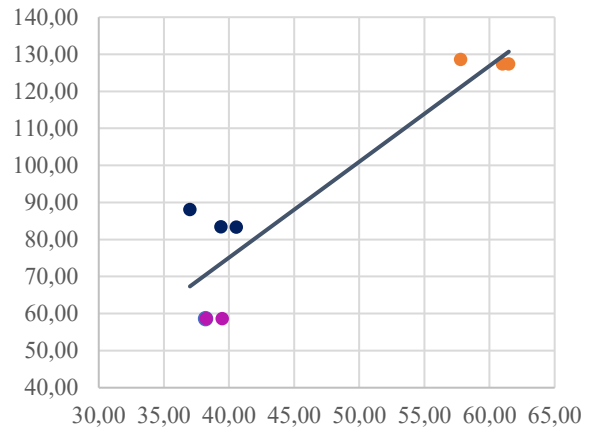


Chart 7 – $x = \text{Average fare (€)}$; $y = \text{Average number of available destinations per base}$

Airport accessibility and airport capacity

Another interesting correlation is that between airport distance to city centers and departures per base per day. One might expect that LCCs operate only out of smaller and secondary airports, which are further away from the city centers. While this is somewhat true (Ryanair has a base in Paris Beauvais, which is approximately 70km from Paris), it is not necessarily the case. LCCs often aim to serve smaller cities, whose airports are closer to cities due to fewer traffic issues and lower costs. The difference can be seen on chart 7 – easyJet operates more routes than its competitors out of bigger airports – like Paris Charles de Gaulle, and chooses often not to serve smaller cities. Ryanair employs a mixed strategy due to some limitations in airport supply combined with its extensive network. And WizzAir operates out of a large number of airports where the urban population does not exceed 500,000 inhabitants.

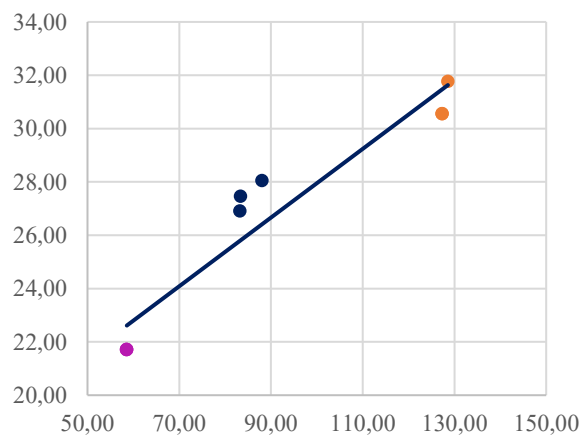


Chart 8 – $x = \text{Average number of available destinations per base}$; $y = \text{Average distance from closest cities (minutes)}$

On-time performance and several indicators

There are a number of indicators that strongly negatively correlate with on-time performance, one of them being seat characteristics. With a correlation of -0.83, it seems that the wider the seats, the less space there is for luggage storage, which has an impact on the ability to depart on time. Moreover, it is also possible to identify a strong positive correlation with seat pitch - longer pitch is associated with fewer seats on the plane so there is lower capacity for ticket sales. This decreases plane boarding times and presumably helps on-time performance.

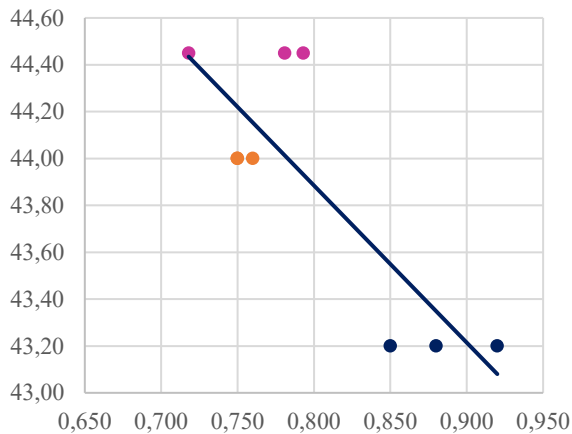


Chart 9 – x = Average percentage of flights on time; y = Average seat width (cm)

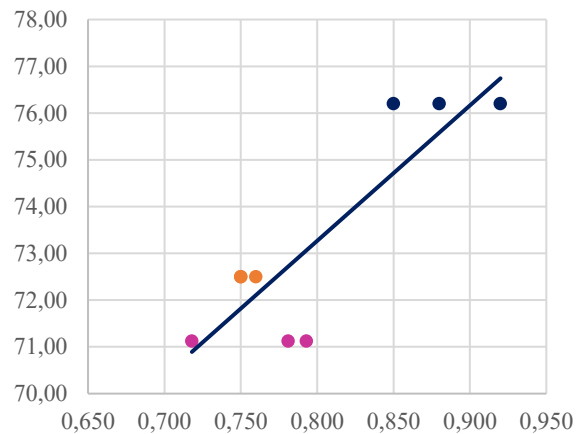


Chart 10 – x = Average percentage of flights on time; y = Average seat pitch (cm)

Another interesting correlation exists with employees per aircraft. The numbers suggest that with fewer employees, there is greater likelihood of on time departures. Naturally, on-time departures depend on a considerable number of factors, but the data indicates that having more than the minimum requested personnel on board may hamper boarding and thus, making aircraft depart later possibly because they greet passengers and block aisles, among other factors.

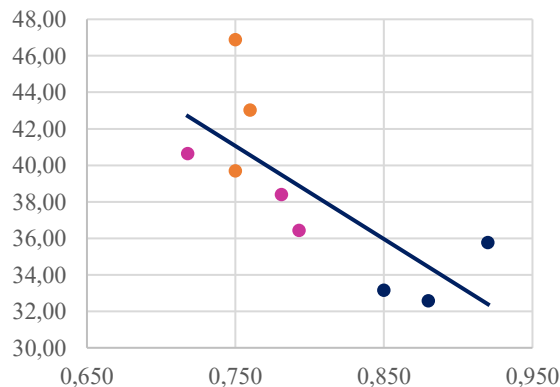


Chart 11 – x = Average percentage of flights on time; y = Employees per aircraft

Load factor and marketing costs

The importance of marketing as a way to shape consumer behaviour is well-established, and the airline sector is no exception. In such a price competitive market, it is important to ensure people know what prices to expect, etc. With a correlation of 0.89, this study further confirms the effect marketing on customer acquisition.

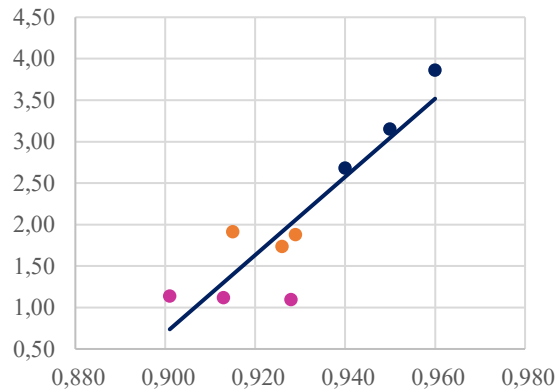


Chart 12 – x = Average load factor; y = Marketing costs per passenger (€)

Fleet homogeneity and employees per aircraft

Data seems to suggest that higher fleet homogeneity requires fewer employees to take care of an aircraft. Reasons may include the creation economies of scale through a higher number of flights per cabin crew, diminished need for pilots to train for different aircraft, and easier fleet management by administrative staff.

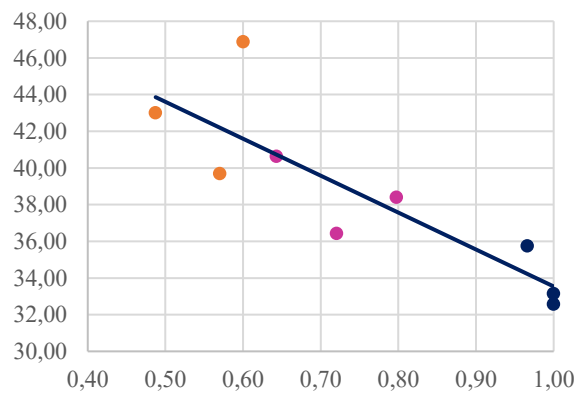


Chart 13 – x = Fleet homogeneity; y = Employee per aircraft (€)

Fleet age and fuel costs

Constant investment in fleet renewal has been proven to be crucial not only for customer satisfaction through better in-flight conditions, but also from reductions in fuel costs. This study confirms the foregoing. A strong positive correlation of 0.91 has been verified, with older fleets being less fuel efficient, confirming yet again the importance of younger fleets.

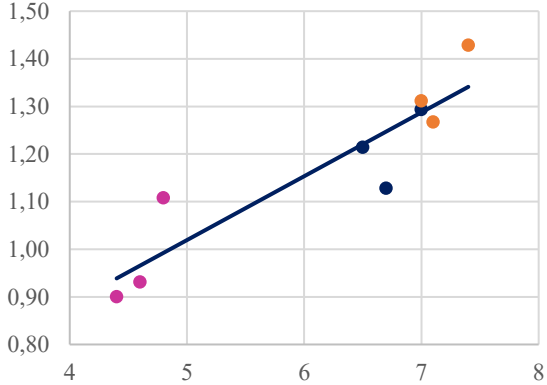


Chart 14 – x = Fleet age; y = Fuel costs per ASK (€ cents)

Final remarks, recommendations, and limitations

In complex and dynamic industry sectors like the airlines, it is often difficult to make comparisons between different companies with distinct philosophies and to generalize characteristics. Even within the low-cost sector, there are many differences in the *modus operandi* of individual companies, which is confirmed by this paper. Nevertheless, it is possible to identify and predict the main sources of competitive advantage, and with this proffer recommendations for LCC airlines.

Firstly, the correlation matrices support the idea that the main sources of competitive advantage in the LCC market include on-time performance, fleet homogeneity, employee per aircraft and ratio of operational staff (pilots and cabin crew) to total employees and average fares. Competitive advantage accrues from decreasing costs, providing better conditions for the customer, or both.

As far as carriers are concerned, Ryanair can be considered by some margin to be the most successful LCC operating in Europe. The score system awarded Ryanair the best score of 7 out of 8 indices and the airline scored in all three years more than 9 points. Ryanair demonstrated an especially strong score for aircraft, distribution, comfort and connectivity indices, categories where other carriers most struggled to compete. Some recommendations for Ryanair to further improve its competitive position after the COVID-19 pandemic include:

- 1- Starting and expediting the fleet renovation process;
- 2- Reviewing of conditions pertaining to fuel supply contracts;
- 3- Improving the company's ratio of operational staff (pilots and cabin crew) to total employees;
- 4- Continuing the downwards trend of average fares charged.

WizzAir demonstrated promising results, as one of the fastest growing carriers in Europe. It showed superlative scores in 10 out of the 25 sub variables that this study employed. The Hungarian company demonstrated almost equal scores to Ryanair with regard in cost, labour, revenue, and convenience indices, and achieved the best overall score of 7.65 in 2018. The recommendations for WizzAir to bounce back from the COVID-19 pandemic and continue its growth trajectory include:

- 1- Increasing marketing investment;

- 2- Developing mechanisms to better predict demand and increase load factors;
- 3- Increasing fleet homogeneity;
- 4- Engaging in productivity reviews of administrative staff to reduce the employee per aircraft and increase the flight and cabin crew over total employees.

Of the three companies in this case study, easyJet deviates the most from a pure play LCC business model. However, this seems to be part of a long-term strategy shift from an LCC to a more hybrid model. For example, easyJet has moved its operations from January 1st, 2023 from Lisbon's terminal 2, dedicated to LCCs, to terminal 1, suited for full service network providers. Nonetheless, easyJet still continues to identify itself as low-cost, despite some clear competitive disadvantages over Ryanair and WizzAir. Recommendations include:

- 1- Reviewing the company's spending as to decrease CASK, mainly fuel costs;
- 2- Optimizing boarding and deplaning processes to improve on-time performance;
- 3- Effecting fleet renovation to create economies of scale for the administration and management of aircraft through higher homogeneity, and also to decrease fuel costs;
- 4- Rethinking the pricing model with regards to ticket prices;
- 5- Analyzing administrative HR needs to decrease avoidable staff costs.

The study followed a quantitative and data-driven approach, mostly based on the three airlines' annual and quarterly reports. Some carriers, like Vueling, Transavia, and Norwegian Air Shuttle are part of larger holding companies that release quarterly reports consolidating numbers for all companies in the group. This fact, combined with the overall unavailability of representatives at said companies, made it impossible to include further LCCs in the study to broaden its scope, despite an initial draft including them. A few interesting indicators were also unavailable in the company yearly reports. For example, the literature review includes the competitive environment and also broaches cyber security as important variables used in other studies. But these indicators could not be found nor calculated to an acceptable degree of certainty, despite manual calculations for other variables being possible. Moreover, a general lack of responsiveness and follow-through from professionals in the sector was experienced. Multiple attempts were made to contact airline executives and experts from all around the aviation world, most of them to no avail, even after several follow ups. Some individuals promised to have conversations or to supply data and then stopped responding. These overall limitations made the

data sample smaller than expected. Nevertheless, it was possible to develop meaningful and substantive insights that can form the basis for future research on the LCC sector.

Appendices

	Ryanair 2017	Ryanair 2018	Ryanair 2019	easyJet 2017	easyJet 2018	easyJet 2019	WizzAir 2017	WizzAir 2018	WizzAir 2019
<i>Scheduled revenues</i>	4,868.2	5,134.0	5,261.1	5,659.1	5,297.9	5,712.8	909.3	1,132.2	1,366.1
<i>Ancillary revenues</i>	1,779.6	2,017.0	2,436.3	101.6	1,367.4	1,569.3	652.7	806.8	953.0
<i>Fuel and Oil</i>	1,913.4	1,902.8	2,427.3	1,212.2	1,338.0	1,614.9	375.2	479.8	667.9
<i>Airport and handling</i>	864.8	938.6	1061.5	1,672.2	1,863.5	2,104.2	271.1	323.7	382.5
<i>Route charges</i>	655.7	738.5	984.0	434.9	452.0	466.5	118.9	142.0	167.8
<i>Staff costs</i>	633.0	701.8	745.2	736.2	860.0	979.7	112.6	147.6	198.6
<i>Depreciation</i>	497.5	561.0	640.5	206.6	224.9	552.0	57.5	90.6	92.7
<i>Marketing and distribution</i>	322.3	410.4	547.3	139.3	161.6	179.1	27.0	33.1	37.8
<i>Maintenance</i>	141.0	148.3	190.9	305.9	353.7	344.4	74.7	98.6	115.1
<i>Rentals</i>	86.1	82.3	83.9	125.6	183.1	5.7	233.9	276.3	326.0
<i>Other costs</i>	0.0	0.0	0.0	444.0	663.4	487.0	43.6	54.2	30.9
Operating Profit	1534.0	1667.3	1016.8	484.0	565.1	548.6	247.5	293.1	299.8

Table 1 - Consolidated income statements (in millions of euros)

	Ryanair	easyJet	WizzAir	Total
<i>Scheduled revenues</i>	15,263.3 71%	16,669.7 85%	3,407.6 59%	35,342.2 75%
<i>Ancillary revenues</i>	6,232.9 29%	3,038.3 15%	2,412.5 41%	11,684.2 25%
<i>Fuel and Oil</i>	6,243.5 36%	4,165.2 23%	1,522.9 31%	11,932.1 30%
<i>Airport and handling</i>	2,864.9 17%	5,639.9 31%	977.2 20%	9,482.5 23%
<i>Route charges</i>	2,378.2 14%	1,353.4 7%	428.8 9%	4,160.6 10%
<i>Staff costs</i>	2,080.0 12%	2,575.9 14%	458.8 9%	5,115.0 13%
<i>Depreciation</i>	1,699.0 10%	983.5 5%	240.8 5%	2,923.4 7%
<i>Marketing and distribution</i>	1,280.0 7%	479.9 3%	97.9 2%	1,857.9 5%
<i>Maintenance</i>	480.2 3%	1,004.0 6%	288.4 6%	1,772.7 4%
<i>Rentals</i>	252.3 1%	314.3 2%	836.2 17%	1,402.9 3%
<i>Other costs</i>	0.0 0%	1,594.4 9%	128.7 3%	1,723.2 4%
Operating Profit	4,218.1	1,597.6	840.4	6,656.1

Table 2 - Aggregated income statements from 2017 to 2019 (in millions of euro), along with the respective revenue and cost structure

	Ryanair 2017	Ryanair 2018	Ryanair 2019	easyJet 2017	easyJet 2018	easyJet 2019	WizzAir 2017	WizzAir 2018	WizzAir 2019
Profitability Index									
<i>Revenue/Operating Costs</i>	1.30	1.30	1.15	1.24	1.11	1.07	1.19	1.18	1.15
Cost Index									
<i>CASK (Euro cents)</i>	3.25	3.22	3.59	5.52	6.05	6.00	3.15	3.19	3.35
Revenue Index									
<i>RASK (Euro cents)</i>	6.79	4.20	4.14	6.02	6.53	6.44	3.75	3.76	3.85
<i>Average fare (Euro)</i>	40.58	39.40	37.00	57.80	61.48	61.01	38.21	38.25	39.48
<i>EBIT per flight (Euro)</i>	2,270.97	2,222.35	1,200.47	892.09	953.59	900.25	1,741.03	1,741.89	1,577.74
Connectivity Index									
<i>Departures per airport served per day</i>	8.94	9.20	9.88	10.26	9.83	10.44	3.01	3.27	3.57
<i>Routes offered</i>	2,170	2,430	2,746	862	979	1,051	486	525	650
<i>Average number of available destinations per base</i>	83.26	83.40	88.07	128.58	127.32	127.32	58.57	58.57	58.57
Convenience Index									
<i>Average weekly frequency per route</i>	5.99	6.12	5.53	11.53	11.00	11.09	5.61	6.16	5.62
<i>Average distance from closest cities (minutes)</i>	26.90	27.46	28.05	31.77	30.55	30.55	21.71	21.71	21.71
<i>Flights on time (%)</i>	0.880	0.850	0.920	0.760	0.750	0.750	0.781	0.793	0.718
Comfort Index									
<i>Average load factor (%)</i>	0.940	0.950	0.960	0.926	0.929	0.915	0.901	0.913	0.928
<i>Seat width (cm)</i>	43.2	43.2	43.2	44	44	44	44.45	44.45	44.45
<i>Seat pitch (cm)</i>	76.2	76.2	76.2	72.5	72.5	72.5	71.12	71.12	71.12
Distribution Index									
<i>Marketing expenses per passenger (Euro)</i>	2.68	3.15	3.86	1.74	1.88	1.91	1.13	1.12	1.09
Aircraft Index									
<i>Aircraft daily utilization (hours)</i>	9.33	9.13	9.02	10.9	11.1	10.9	12.48	12.68	12.02
<i>Fleet homogeneity (%)</i>	1.0000	1.0000	0.9660	0.4875	0.5700	0.6000	0.7975	0.7204	0.6429
<i>Daily flights per aircraft</i>	4.63	4.51	4.59	5.08	4.87	5.02	4.91	4.96	4.65
<i>Average fleet age (years)</i>	6.5	6.7	7.0	7.1	7	7.4	4.4	4.6	4.8
<i>Fuel cost per ASK (Euro cents)</i>	1.95	1.13	1.29	1.27	1.31	1.43	0.90	0.93	1.11
<i>CO2 emissions per passenger km (grams)</i>	76.00	66.31	66.00	78.62	78.46	77.07	61.50	59.95	58.50
Labour Index									
<i>Enplaned customers per cabin crew</i>	9212	15769	15624	10627	10412	7392	15054	15473	12357
<i>Employee per aircraft</i>	32.57	33.14	35.75	43.01	39.68	46.88	38.39	36.42	40.63
<i>Staff costs per ASK (Euro cents)</i>	0.6465	0.4340	0.5293	0.7647	0.8350	0.8664	0.2708	0.2868	0.3300
<i>ASK per employee (x1000)</i>	7,516.43	11,668.59	11,040.20	7,982.67	7,175.62	7,478.80	13,745.79	15,216.12	13,249.22
<i>Flight and cabin crew over total employees (%)</i>	0.9014	0.8979	0.8635	0.9032	0.8559	0.8377	0.8180	0.9191	0.8640

Table 3 - Data from the three major European low-cost-carriers

Correlation**Profitability Index***Revenue/Operating Costs* -**Cost Index***CASK (Euro cents)* -0.5278**Revenue Index***RASK (Euro cents)* -0.0443*Average fare (Euro)* -0.4432*EBIT per flight* 0.7333**Connectivity Index***Departures per airport served per day* 0.0431*Routes offered* 0.4268*Average number of available destinations per base* -0.2638**Convenience Index***Average weekly frequency per route* -0.3750*Average distance from closest cities (minutes)* -0.0661*Flights on time (%)* 0.4894**Comfort Index***Average load factor (%)* 0.3525*Seat width (cm)* -0.4987*Seat pitch (cm)* 0.5321**Distribution Index***Marketing expenses per passenger (Euro)* 0.3074**Aircraft Index***Aircraft daily utilization (hours)* -0.4295*Fleet homogeneity (%)* 0.5644*Daily flights per aircraft* -0.3243*Average fleet age (years)* -0.0269*Fuel cost per ASK (Euro cents)* -0.3142*CO2 emissions per passenger km (grams)* -0.0167**Labour Index***Enplaned customers per cabin crew* 0.2625*Employee per aircraft* -0.6963*Staff costs per ASK (Euro cents)* -0.2538*ASK per employee (x1000)* 0.0537*Flight and cabin crew over total employees (%)* 0.6139

Table 4 - Correlation table of every sub variable against the profitability index

	<i>Ryanair</i> 2017	<i>Ryanair</i> 2018	<i>Ryanair</i> 2019	<i>easyJet</i> 2017	<i>easyJet</i> 2018	<i>easyJet</i> 2019	<i>WizzAir</i> 2017	<i>WizzAir</i> 2018	<i>WizzAir</i> 2019
Profitability Index									
<i>Revenue/Operating Costs</i>	-	-	-	-	-	-	-	-	-
Cost Index									
<i>CASK (Euro cents)</i>	0.9671	0.9749	0.8470	0.1803	0.0000	0.0145	1.0000	0.9862	0.9310
Revenue Index									
<i>RASK (Euro cents)</i>	0.0000	0.8502	0.8707	0.2545	0.0840	0.1157	1.0000	0.9948	0.9670
<i>Average fare (Euro)</i>	0.8538	0.9020	1.0000	0.1505	0.0000	0.0191	0.9507	0.9489	0.8986
<i>EBIT per flight (Euro)</i>	1.0000	0.9786	0.5286	0.3928	0.4199	0.3964	0.7666	0.7670	0.6947
Connectivity Index									
<i>Departures per airport served per day</i>	0.8563	0.8809	0.9464	0.9829	0.9418	1.0000	0.2883	0.3131	0.3415
<i>Routes offered</i>	0.7902	0.8849	1.0000	0.3139	0.3565	0.3827	0.1770	0.1912	0.2367
<i>Average number of available destinations per base</i>	0.6473	0.6453	0.5786	0.0000	0.0179	0.0179	1.0000	1.0000	1.0000
Convenience Index									
<i>Average weekly frequency per route</i>	0.9241	0.9020	1.0000	0.0000	0.0891	0.0742	0.9873	0.8949	0.9848
<i>Average distance from closest cities (minutes)</i>	0.4838	0.4287	0.3702	0.0000	0.1211	0.1211	1.0000	1.0000	1.0000
<i>Flights on time (%)</i>	0.9565	0.9239	1.0000	0.8261	0.8152	0.8152	0.8489	0.8620	0.7804
Comfort Index									
<i>Average load factor (%)</i>	0.9792	0.9896	1.0000	0.9646	0.9677	0.9531	0.9385	0.9510	0.9667
<i>Seat width (cm)</i>	1.0000	1.0000	1.0000	0.3600	0.3600	0.3600	0.0000	0.0000	0.0000
<i>Seat pitch (cm)</i>	1.0000	1.0000	1.0000	0.9514	0.9514	0.9514	0.9333	0.9333	0.9333
Distribution Index									
<i>Marketing expenses per passenger (Euro)</i>	0.6943	0.8161	1.0000	0.4498	0.4858	0.4954	0.2939	0.2897	0.2830
Aircraft Index									
<i>Aircraft daily utilization (hours)</i>	0.9153	0.9699	1.0000	0.4863	0.4317	0.4863	0.0546	0.0000	0.1803
<i>Fleet homogeneity (%)</i>	1.0000	1.0000	0.9660	0.4875	0.5700	0.6000	0.7975	0.7204	0.6429
<i>Daily flights per aircraft</i>	0.8005	1.0000	0.8586	0.0000	0.3679	0.1083	0.2882	0.2148	0.7619
<i>Average fleet age (years)</i>	0.3000	0.2333	0.1333	0.1000	0.1333	0.0000	1.0000	0.9333	0.8667
<i>Fuel cost per ASK (Euro cents)</i>	0.4048	0.5684	0.2547	0.3052	0.2214	0.0000	1.0000	0.9413	0.6063
<i>CO2 emissions per passenger km (grams)</i>	0.1302	0.6117	0.6272	0.0000	0.0080	0.0770	0.8509	0.9279	1.0000
Labour Index									
<i>Enplaned customers per cabin crew</i>	0.5842	1.0000	0.9908	0.6739	0.6603	0.4688	0.9546	0.9812	0.7836
<i>Employee per aircraft</i>	1.0000	0.9596	0.7773	0.2704	0.5029	0.0000	0.5930	0.7308	0.4370
<i>Staff costs per ASK (Euro cents)</i>	0.3691	0.7260	0.5660	0.1706	0.0526	0.0000	1.0000	0.9732	0.9006
<i>ASK per employee (x1000)</i>	0.4940	0.7669	0.7256	0.5246	0.4716	0.4915	0.9034	1.0000	0.8707
<i>Flight and cabin crew over total employees (%)</i>	0.9808	0.9769	0.9395	0.9827	0.9312	0.9115	0.8900	1.0000	0.9400

Table 5 - Calculated sub variables

	Ryanair	Ryanair	Ryanair	easyJet	easyJet	easyJet	WizzAir	WizzAir	WizzAir
	2017	2018	2019	2017	2018	2019	2017	2018	2019
<i>Cost Index Standardized Score</i>	9.67	9.75	8.47	1.80	0.00	0.15	10.00	9.86	9.31
<i>Cost Index Score</i>	0.510	0.515	0.447	0.095	0.000	0.008	0.528	0.520	0.491
<i>Revenue Index Standardized Score</i>	9.62	10.00	7.53	3.17	2.70	2.63	8.90	8.89	8.23
<i>Revenue Index Score</i>	1.112	1.155	0.869	0.366	0.312	0.304	1.028	1.027	0.951
<i>Connectivity Index Standardized Score</i>	8.79	9.45	10.00	2.84	3.18	3.40	5.67	5.79	6.12
<i>Connectivity Index Score</i>	0.545	0.586	0.620	0.176	0.197	0.211	0.352	0.359	0.380
<i>Convenience Index Standardized Score</i>	9.53	9.21	10.00	4.55	4.95	4.89	9.58	9.27	9.20
<i>Convenience Index Score</i>	0.847	0.819	0.889	0.404	0.440	0.435	0.852	0.824	0.817
<i>Comfort Index Standardized Score</i>	9.95	9.97	10.00	7.42	7.42	7.39	5.98	6.01	6.05
<i>Comfort Index Score</i>	1.376	1.380	1.383	1.026	1.027	1.022	0.827	0.832	0.837
<i>Distribution Index Standardized Score</i>	6.94	8.16	10.00	4.50	4.86	4.95	2.94	2.90	2.83
<i>Distribution Index Score</i>	0.213	0.251	0.307	0.138	0.149	0.152	0.090	0.089	0.087
<i>Aircraft Index Standardized Score</i>	8.96	10.00	8.95	3.64	4.60	3.72	5.94	5.21	6.21
<i>Aircraft Index Score</i>	1.435	1.600	1.433	0.583	0.737	0.595	0.951	0.834	0.994
<i>Labour Index Standardized Score</i>	8.95	10.00	8.89	5.92	6.46	4.04	8.61	9.57	7.76
<i>Labour Index Score</i>	1.572	1.756	1.561	1.040	1.134	0.709	1.512	1.681	1.362
<i>Total Score</i>	7.61	8.06	7.51	3.83	4.00	3.44	6.14	6.17	5.92
<i>Standardized score</i>	9.44	10.00	9.32	4.75	4.96	4.26	7.62	7.65	7.34

Table 6 - Calculated final indices

	<i>Revenue/Operating Costs</i>	<i>CASK (Euro cents)</i>	<i>RASK (Euro cents)</i>	<i>Average fare (Euro)</i>	<i>EBIT per flight</i>	<i>Departures per airport served per day</i>
<i>Revenue/Operating Costs</i>	1					
<i>CASK (Euro cents)</i>	-0.527765603	1				
<i>RASK (Euro cents)</i>	-0.044298409	0.712361201	1			
<i>Average fare (Euro)</i>	-0.44320041	0.986280550	0.758931734	1		
<i>EBIT per flight</i>	0.733347448	-0.837643302	-0.333918806	-0.75425805	1	
<i>Departures per airport served per day</i>	0.043083107	0.622747643	0.714409188	0.590158092	-0.387241247	1
<i>Routes offered</i>	0.426757034	-0.245142188	0.088614913	-0.298027832	0.317699306	0.582466603
<i>Average number of available destinations per base</i>	-0.263769644	0.932574529	0.79711184	0.917570202	-0.709482031	0.851597643
<i>Average weekly frequency per route</i>	-0.375000906	0.973384634	0.718867349	0.984990417	-0.76983549	0.595435308
<i>Average distance from closest cities (minutes)</i>	-0.066106296	0.794079268	0.763066127	0.770314425	-0.56559654	0.958907235
<i>Flights on time (%)</i>	0.489356016	-0.476694246	-0.085001569	-0.531252566	0.442879437	0.30794129
<i>Average load factor (%)</i>	0.352497114	-0.168815188	0.045554892	-0.234119074	0.171938143	0.560288355
<i>Seat width (cm)</i>	-0.498681974	0.117032525	-0.286855106	0.144371794	-0.295181273	-0.696481552
<i>Seat pitch (cm)</i>	0.532113778	-0.212171669	0.210692947	-0.239198884	0.368840265	0.623948916
<i>Marketing expenses per passenger (Euro)</i>	0.307363916	-0.102332137	0.124493565	-0.176614002	0.138092107	0.671774025
<i>Aircraft daily utilization (hours)</i>	-0.429497151	0.020490354	-0.323202513	0.055499118	-0.184780867	-0.761143234
<i>Fleet homogeneity (%)</i>	0.564370624	-0.729991399	-0.282304684	-0.74111059	0.763476971	0.008221657
<i>Daily flights per aircraft</i>	-0.42431426	0.608106092	0.283475279	0.627793909	-0.623866322	-0.044679555
<i>Average fleet age (years)</i>	-0.026936542	0.659658111	0.708997427	0.622576136	-0.435875021	0.996263008
<i>Fuel cost per ASK (Euro cents)</i>	-0.314273698	0.742631114	0.736877422	0.693545627	-0.590428843	0.889072742
<i>CO2 emissions per passenger km (grams)</i>	-0.016650755	0.788748891	0.953378613	0.814063387	-0.448943654	0.838529305
<i>Enplaned customers per cabin crew</i>	0.26246438	-0.701115879	-0.88882585	-0.752629627	0.403393427	-0.48410571
<i>Employee per aircraft</i>	-0.696269295	0.752423641	0.295072222	0.734591927	-0.81396719	0.136696113
<i>Staff costs per ASK (Euro cents)</i>	-0.2538104	0.88171539	0.914766562	0.876614931	-0.611693809	0.858628394
<i>ASK per employee (x1000)</i>	0.053652538	-0.744030797	-0.95269118	-0.758938997	0.420482661	-0.859462055
<i>Flight and cabin crew over total employees (%)</i>	0.613854008	-0.232790775	0.041068469	-0.185763528	0.354025035	0.098298711

	<i>Routes offered</i>	<i>Average number of available destinations per base</i>	<i>Average weekly frequency per route</i>	<i>Average distance from closest cities (minutes)</i>	<i>Flights on time (%)</i>
<i>Revenue/Operating Costs</i>					
<i>CASK (Euro cents)</i>					
<i>RASK (Euro cents)</i>					
<i>Average fare (Euro)</i>					
<i>EBIT per flight</i>					
<i>Departures per airport served per day</i>					
<i>Routes offered</i>	1				
<i>Average number of available destinations per base</i>	0.07531872	1			
<i>Average weekly frequency per route</i>	-0.302742076	0.923681178	1		
<i>Average distance from closest cities (minutes)</i>	0.340586929	0.958554507	0.788192013	1	
<i>Flights on time (%)</i>	0.878694045	-0.181035022	-0.506043046	0.075180744	1
<i>Average load factor (%)</i>	0.909017934	0.111685106	-0.231279329	0.355391877	0.710603387
<i>Seat width (cm)</i>	-0.971744921	-0.224365151	0.145833544	-0.480007581	-0.83221984
<i>Seat pitch (cm)</i>	0.982014689	0.128512693	-0.241008075	0.392990697	0.866148843
<i>Marketing expenses per passenger (Euro)</i>	0.97901587	0.208377653	-0.172586845	0.45843043	0.851257302
<i>Aircraft daily utilization (hours)</i>	-0.95798055	-0.312563322	0.059348525	-0.55860909	-0.757149293
<i>Fleet homogeneity (%)</i>	0.778252754	-0.491062358	-0.760224478	-0.253777683	0.872750109
<i>Daily flights per aircraft</i>	-0.746596171	0.420031139	0.684024717	0.205003209	-0.613163979
<i>Average fleet age (years)</i>	0.550057011	0.868617807	0.624064056	0.961768169	0.258030279
<i>Fuel cost per ASK (Euro cents)</i>	0.373181886	0.850780891	0.65719763	0.875105743	0.044918829
<i>CO2 emissions per passenger km (grams)</i>	0.159372602	0.913386792	0.806702755	0.904849185	-0.028348441
<i>Enplaned customers per cabin crew</i>	0.172181789	-0.670601776	-0.691418996	-0.561976802	0.377804928
<i>Employee per aircraft</i>	-0.592563362	0.546039477	0.730795478	0.337959446	-0.74755878
<i>Staff costs per ASK (Euro cents)</i>	0.14022865	0.958960904	0.852605347	0.925051919	-0.109219327
<i>ASK per employee (x1000)</i>	-0.259598175	-0.875759585	-0.722332792	-0.885442339	-0.010460081
<i>Flight and cabin crew over total employees (%)</i>	0.23103181	-0.069038257	-0.088169802	0.047494047	0.284623595

	<i>Average load factor (%)</i>	<i>Seat width (cm)</i>	<i>Seat pitch (cm)</i>	<i>Marketing expenses per passenger (Euro)</i>	<i>Aircraft daily utilization (hours)</i>	<i>Fleet homogeneity (%)</i>
<i>Revenue/Operating Costs</i>						
<i>CASK (Euro cents)</i>						
<i>RASK (Euro cents)</i>						
<i>Average fare (Euro)</i>						
<i>EBIT per flight</i>						
<i>Departures per airport served per day</i>						
<i>Routes offered</i>						
<i>Average number of available destinations per base</i>						
<i>Average weekly frequency per route</i>						
<i>Average distance from closest cities (minutes)</i>						
<i>Flights on time (%)</i>						
<i>Average load factor (%)</i>	1					
<i>Seat width (cm)</i>	-0.86433899	1				
<i>Seat pitch (cm)</i>	0.869600962	-0.995247453	1			
<i>Marketing expenses per passenger (Euro)</i>	0.896480694	-0.95136237	0.948567924	1		
<i>Aircraft daily utilization (hours)</i>	-0.88443684	0.986217789	-0.972619867	-0.951193456	1	
<i>Fleet homogeneity (%)</i>	0.574535162	-0.705323251	0.766532415	0.677997813	-0.615258573	1
<i>Daily flights per aircraft</i>	-0.769508371	0.647156626	-0.700271283	-0.636309550	0.626235081	-0.79736271
<i>Average fleet age (years)</i>	0.538172466	-0.657346272	0.582488657	0.645024919	-0.730434347	-0.039231531
<i>Fuel cost per ASK (Euro cents)</i>	0.418202129	-0.454872716	0.378499292	0.466507295	-0.559429371	-0.222006181
<i>CO2 emissions per passenger km (grams)</i>	0.121085856	-0.35561839	0.269732506	0.237830184	-0.404033088	-0.301766154
<i>Enplaned customers per cabin crew</i>	0.185459499	-0.009280354	0.078068058	0.155887665	0.061634873	0.471256135
<i>Employee per aircraft</i>	-0.520609114	0.550109084	-0.613669779	-0.478471436	0.43158753	-0.85403729
<i>Staff costs per ASK (Euro cents)</i>	0.146712151	-0.29859998	0.207735446	0.241516821	-0.375599471	-0.393725103
<i>ASK per employee (x1000)</i>	-0.239460485	0.433004961	-0.352335658	-0.321993096	0.49849753	0.223245485
<i>Flight and cabin crew over total employees (%)</i>	0.347697777	-0.287060615	0.29822518	0.160055440	-0.231515372	0.163097361

	<i>Daily flights per aircraft</i>	<i>Average fleet age (years)</i>	<i>Fuel cost per ASK (Euro cents)</i>	<i>CO2 emissions per passenger km (grams)</i>	<i>Enplaned customers per cabin crew</i>	<i>Employee per aircraft</i>
<i>Revenue/Operating Costs</i>						
<i>CASK (Euro cents)</i>						
<i>RASK (Euro cents)</i>						
<i>Average fare (Euro)</i>						
<i>EBIT per flight</i>						
<i>Departures per airport served per day</i>						
<i>Routes offered</i>						
<i>Average number of available destinations per base</i>						
<i>Average weekly frequency per route</i>						
<i>Average distance from closest cities (minutes)</i>						
<i>Flights on time (%)</i>						
<i>Average load factor (%)</i>						
<i>Seat width (cm)</i>						
<i>Seat pitch (cm)</i>						
<i>Marketing expenses per passenger (Euro)</i>						
<i>Aircraft daily utilization (hours)</i>						
<i>Fleet homogeneity (%)</i>						
<i>Daily flights per aircraft</i>	1					
<i>Average fleet age (years)</i>	-0.019371431	1				
<i>Fuel cost per ASK (Euro cents)</i>	0.042382151	0.916799402	1			
<i>CO2 emissions per passenger km (grams)</i>	0.328786661	0.830066614	0.782423424	1		
<i>Enplaned customers per cabin crew</i>	-0.379736729	-0.506984536	-0.68831077	-0.774745264	1	
<i>Employee per aircraft</i>	0.72958104	0.200124502	0.425599717	0.323823638	-0.569315929	1
<i>Staff costs per ASK (Euro cents)</i>	0.328854798	0.872772561	0.90435829	0.957795799	-0.806896593	0.475896442
<i>ASK per employee (x1000)</i>	-0.159124147	-0.855340927	-0.863165203	-0.968366377	0.815210172	-0.302801201
<i>Flight and cabin crew over total employees (%)</i>	-0.147645985	0.068849217	-0.108501716	0.041348215	0.134419047	-0.448751001

	<i>Staff costs per ASK (Euro cents)</i>	<i>ASK per employee (x1000)</i>	<i>Flight and cabin crew over total employees (%)</i>
<i>Revenue/Operating Costs</i>			
<i>CASK (Euro cents)</i>			
<i>RASK (Euro cents)</i>			
<i>Average fare (Euro)</i>			
<i>EBIT per flight</i>			
<i>Departures per airport served per day</i>			
<i>Routes offered</i>			
<i>Average number of available destinations per base</i>			
<i>Average weekly frequency per route</i>			
<i>Average distance from closest cities (minutes)</i>			
<i>Flights on time (%)</i>			
<i>Average load factor (%)</i>			
<i>Seat width (cm)</i>			
<i>Seat pitch (cm)</i>			
<i>Marketing expenses per passenger (Euro)</i>			
<i>Aircraft daily utilization (hours)</i>			
<i>Fleet homogeneity (%)</i>			
<i>Daily flights per aircraft</i>			
<i>Average fleet age (years)</i>			
<i>Fuel cost per ASK (Euro cents)</i>			
<i>CO2 emissions per passenger km (grams)</i>			
<i>Enplaned customers per cabin crew</i>			
<i>Employee per aircraft</i>			
<i>Staff costs per ASK (Euro cents)</i>		1	
<i>ASK per employee (x1000)</i>	-0.958442662		1
<i>Flight and cabin crew over total employees (%)</i>	-0.067156202	0.048000258	1

Table 7 – Correlation table between every sub variable

	<i>Ryanair 2017</i>			<i>Ryanair 2018</i>			<i>Ryanair 2019</i>			<i>Correlation</i>
Profitability Index										
<i>Revenue/Operating Costs</i>	1,30			1,30			1,15			-
	<i>Final scores</i>	<i>Relative scores</i>	<i>Data</i>	<i>Final scores</i>	<i>Relative scores</i>	<i>Data</i>	<i>Final scores</i>	<i>Relative scores</i>	<i>Data</i>	
<i>Cost Index Standardized Score</i>	9,67			9,75			8,47			
<i>Cost Index Score</i>	0,510			0,515			0,447			
<i>CASK (Euro cents)</i>	0,510	0,9671	3,25	0,515	0,9749	3,22	0,447	0,847	3,59	-0,5278
<i>Revenue Index Standardized Score</i>	9,62			10,00			7,53			
<i>Revenue Index Score</i>	1,112			1,155			0,869			
<i>RASK (Euro cents)</i>	0,000	0,000	6,79	0,038	0,850	4,20	0,039	0,871	4,14	-0,0443
<i>Average fare (Euro)</i>	0,378	0,854	40,58	0,400	0,902	39,40	0,443	1,000	37,00	-0,4432
<i>EBIT per flight</i>	0,733	1,000	2270,97	0,718	0,979	2222,35	0,388	0,529	1200,47	0,7333
<i>Connectivity Index Standardized Score</i>	8,79			9,45			10,00			
<i>Connectivity Index Score</i>	0,545			0,586			0,620			
<i>Departures per base per day</i>	0,037	0,856	8,94	0,038	0,881	9,20	0,041	0,946	9,88	0,0431
<i>Routes offered</i>	0,337	0,790	2170,00	0,378	0,885	2430,00	0,427	1,000	2746,00	0,4268
<i>Average number of available destinations per base</i>	0,171	0,647	83,26	0,170	0,645	83,40	0,153	0,579	88,07	-0,2638
<i>Convenience Index Standardized Score</i>	9,53			9,21			10,00			
<i>Convenience Index Score</i>	0,847			0,819			0,889			
<i>Average weekly frequency per route</i>	0,347	0,924	5,99	0,338	0,902	6,12	0,375	1,000	5,53	-0,3750
<i>Average distance from closest cities (minutes)</i>	0,032	0,484	26,90	0,028	0,429	27,46	0,024	0,370	28,05	-0,0661
<i>Flights on time (%)</i>	0,468	0,957	0,88	0,452	0,924	0,85	0,489	1,000	0,92	0,4894
<i>Confort Index Standardized Score</i>	9,95			9,97			10,00			
<i>Confort Index Score</i>	1,376			1,380			1,383			
<i>Average load factor (%)</i>	0,345	0,979	0,94	0,349	0,990	0,95	0,352	1,000	0,96	0,3525
<i>Seat width (cm)</i>	0,499	1,000	43,20	0,499	1,000	43,20	0,499	1,000	43,20	-0,4987

<i>Seat pitch (cm)</i>	0,532	1,000	76,20	0,532	1,000	76,20	0,532	1,000	76,20	0,5321
<i>Distribution Index Standardized Score</i>	6,94			8,16			10,00			
<i>Distribution Index Score</i>	0,213			0,251			0,307			
<i>Marketing expenses per passenger (Euro)</i>	0,213	0,694	2,68	0,251	0,816	3,15	0,307	1,000	3,86	0,3074
<i>Aircraft Index Standardized Score</i>	8,96			10,00			8,95			
<i>Aircraft Index Score</i>	1,435			1,600			1,433			
<i>Aircraft daily utilization (hours)</i>	0,393	0,915	9,33	0,417	0,970	9,13	0,429	1,000	9,02	-0,4295
<i>Fleet homogeneity (%)</i>	0,564	1,000	1,00	0,564	1,000	1,00	0,545	0,966	0,97	0,5644
<i>Daily flights per aircraft</i>	0,340	0,800	4,63	0,424	1,000	4,51	0,364	0,859	4,59	-0,4243
<i>Average fleet age (years)</i>	0,008	0,300	6,50	0,006	0,233	6,70	0,004	0,133	7,00	-0,0269
<i>Fuel cost per ASK (Euro cents)</i>	0,127	0,405	1,21	0,179	0,568	1,13	0,080	0,255	1,29	-0,3143
<i>CO2 emissions per passenger km (grams)</i>	0,002	0,130	76,00	0,010	0,612	66,31	0,010	0,627	66,00	-0,0167
<i>Labour Index Standardized Score</i>	8,95			10,00			8,89			
<i>Labour Index Score</i>	1,572			1,756			1,561			
<i>Enplaned customers per cabin crew</i>	0,153	0,584	9212,34	0,262	1,000	15769,09	0,260	0,991	15623,97	0,2625
<i>Employee per aircraft</i>	0,696	1,000	32,57	0,668	0,960	33,14	0,541	0,777	35,75	-0,6963
<i>Staff costs per ASK (Euro cents)</i>	0,094	0,369	0,65	0,184	0,726	0,43	0,144	0,566	0,53	-0,2538
<i>ASK per employee (x1000)</i>	0,027	0,494	7516,43	0,041	0,767	11668,59	0,039	0,726	11040,20	0,0537
<i>Flight and cabin crew over total employees (%)</i>	0,602	0,981	0,90	0,600	0,977	0,90	0,577	0,939	0,86	0,6139
<i>Total Score</i>	7,61			8,06			7,51			
<i>Standardized score</i>	9,44			10,00			9,32			

Table 8 - Ryanair aggregated data

	easyJet 2017			easyJet 2018			easyJet 2019			Correlation
Profitability Index										
<i>Revenue/Operating Costs</i>	1,24			1,11			1,07			-
	<i>Final scores</i>	<i>Relative scores</i>	<i>Data</i>	<i>Final scores</i>	<i>Relative scores</i>	<i>Data</i>	<i>Final scores</i>	<i>Relative scores</i>	<i>Data</i>	
Cost Index Standardized Score	1,80			0,00			0,15			
Cost Index Score	0,095			0,000			0,008			
<i>CASK (Euro cents)</i>	0,095	0,180	5,52	0,000	0,000	6,05	0,008	0,015	6,00	-0,5278
Revenue Index Standardized Score	3,17			2,70			2,63			
Revenue Index Score	0,366			0,312			0,304			
<i>RASK (Euro cents)</i>	0,011	0,255	6,02	0,004	0,084	6,53	0,005	0,116	6,44	-0,0443
<i>Average fare (Euro)</i>	0,067	0,150	57,80	0,000	0,000	61,48	0,008	0,019	61,01	-0,4432
<i>EBIT per flight</i>	0,288	0,393	892,09	0,308	0,420	953,59	0,291	0,396	900,25	0,7333
Connectivity Index Standardized Score	2,84			3,18			3,40			
Connectivity Index Score	0,176			0,197			0,211			
<i>Departures per base per day</i>	0,042	0,983	10,26	0,041	0,942	9,83	0,043	1,000	10,44	0,0431
<i>Routes offered</i>	0,134	0,314	862,00	0,152	0,357	979,00	0,163	0,383	1051,00	0,4268
<i>Average number of available destinations per base</i>	0,000	0,000	128,58	0,005	0,018	127,32	0,005	0,018	127,32	-0,2638
Convenience Index Standardized Score	4,55			4,95			4,89			
Convenience Index Score	0,404			0,440			0,435			
<i>Average weekly frequency per route</i>	0,000	0,000	11,53	0,033	0,089	11,00	0,028	0,074	11,09	-0,3750
<i>Average distance from closest cities (minutes)</i>	0,000	0,000	31,77	0,008	0,121	30,55	0,008	0,121	30,55	-0,0661
<i>Flights on time (%)</i>	0,404	0,826	0,76	0,399	0,815	0,75	0,399	0,815	0,75	0,4894
Confort Index Standardized Score	7,42			7,42			7,39			
Confort Index Score	1,026			1,027			1,022			
<i>Average load factor (%)</i>	0,340	0,965	0,93	0,341	0,968	0,93	0,336	0,953	0,92	0,3525
<i>Seat width (cm)</i>	0,180	0,360	44,00	0,180	0,360	44,00	0,180	0,360	44,00	-0,4987

<i>Seat pitch (cm)</i>	0,506	0,951	72,50	0,506	0,951	72,50	0,506	0,951	72,50	0,5321
Distribution Index Standardized Score	4,50			4,86			4,95			
Distribution Index Score	0,138			0,149			0,152			
<i>Marketing expenses per passenger (Euro)</i>	0,138	0,450	1,74	0,149	0,486	1,88	0,152	0,495	1,91	0,3074
Aircraft Index Standardized Score	3,64			4,60			3,72			
Aircraft Index Score	0,583			0,737			0,595			
<i>Aircraft daily utilization (hours)</i>	0,209	0,486	10,90	0,185	0,432	11,10	0,209	0,486	10,90	-0,4295
<i>Fleet homogeneity (%)</i>	0,275	0,487	0,49	0,322	0,570	0,57	0,339	0,600	0,60	0,5644
<i>Daily flights per aircraft</i>	0,000	0,000	5,08	0,156	0,368	4,87	0,046	0,108	5,02	-0,4243
<i>Average fleet age (years)</i>	0,003	0,100	7,10	0,004	0,133	7,00	0,000	0,000	7,40	-0,0269
<i>Fuel cost per ASK (Euro cents)</i>	0,096	0,305	1,27	0,070	0,221	1,31	0,000	0,000	1,43	-0,3143
<i>CO2 emissions per passenger km (grams)</i>	0,000	0,000	78,62	0,000	0,008	78,46	0,001	0,077	77,07	-0,0167
Labour Index Standardized Score	5,92			6,46			4,04			
Labour Index Score	1,040			1,134			0,709			
<i>Enplaned customers per cabin crew</i>	0,177	0,674	10626,74	0,173	0,660	10411,76	0,123	0,469	7392,31	0,2625
<i>Employee per aircraft</i>	0,188	0,270	43,01	0,350	0,503	39,68	0,000	0,000	46,88	-0,6963
<i>Staff costs per ASK (Euro cents)</i>	0,043	0,171	0,76	0,013	0,053	0,84	0,000	0,000	0,87	-0,2538
<i>ASK per employee (x1000)</i>	0,028	0,525	7982,67	0,025	0,472	7175,62	0,026	0,492	7478,80	0,0537
<i>Flight and cabin crew over total employees (%)</i>	0,603	0,983	0,90	0,572	0,931	0,86	0,560	0,911	0,84	0,6139
Total Score	3,83			4,00			3,44			
Standardized score	4,75			4,96			4,26			

Table 9 - easyJet aggregated data

	WizzAir 2017			WizzAir 2018			WizzAir 2019			Correlation
Profitability Index										
<i>Revenue/Operating Costs</i>	1,19			1,18			1,15			-
	<i>Final scores</i>	<i>Relative scores</i>	<i>Data</i>	<i>Final scores</i>	<i>Relative scores</i>	<i>Data</i>	<i>Final scores</i>	<i>Relative scores</i>	<i>Data</i>	
Cost Index Standardized Score	10,00			9,86			9,31			
Cost Index Score	0,528			0,520			0,491			
<i>CASK (Euro cents)</i>	0,528	1,000	3,15	0,520	0,986	3,19	0,491	0,931	3,35	-0,5278
Revenue Index Standardized Score	8,90			8,89			8,23			
Revenue Index Score	1,028			1,027			0,951			
<i>RASK (Euro cents)</i>	0,044	1,000	3,75	0,044	0,995	3,76	0,043	0,967	3,85	-0,0443
<i>Average fare (Euro)</i>	0,421	0,951	38,21	0,421	0,949	38,25	0,398	0,899	39,48	-0,4432
<i>EBIT per flight</i>	0,562	0,767	1741,03	0,562	0,767	1741,89	0,509	0,695	1577,74	0,7333
Connectivity Index Standardized Score	5,67			5,79			6,12			
Connectivity Index Score	0,352			0,359			0,380			
<i>Departures per base per day</i>	0,012	0,288	3,01	0,013	0,313	3,27	0,015	0,342	3,57	0,0431
<i>Routes offered</i>	0,076	0,177	486,00	0,082	0,191	525,00	0,101	0,237	650,00	0,4268
<i>Average number of available destinations per base</i>	0,264	1,000	58,57	0,264	1,000	58,57	0,264	1,000	58,57	-0,2638
Convenience Index Standardized Score	9,58			9,27			9,20			
Convenience Index Score	0,852			0,824			0,817			
<i>Average weekly frequency per route</i>	0,370	0,987	5,61	0,336	0,895	6,16	0,369	0,985	5,62	-0,3750
<i>Average distance from closest cities (minutes)</i>	0,066	1,000	21,71	0,066	1,000	21,71	0,066	1,000	21,71	-0,0661
<i>Flights on time (%)</i>	0,415	0,849	0,78	0,422	0,862	0,79	0,382	0,780	0,72	0,4894
Confort Index Standardized Score	5,98			6,01			6,05			
Confort Index Score	0,827			0,832			0,837			
<i>Average load factor (%)</i>	0,331	0,939	0,90	0,335	0,951	0,91	0,341	0,967	0,93	0,3525
<i>Seat width (cm)</i>	0,000	0,000	44,45	0,000	0,000	44,45	0,000	0,000	44,45	-0,4987

<i>Seat pitch (cm)</i>	0,497	0,933	71,12	0,497	0,933	71,12	0,497	0,933	71,12	0,5321
<i>Distribution Index Standardized Score</i>	2,94			2,90			2,83			
<i>Distribution Index Score</i>	0,090			0,089			0,087			
<i>Marketing expenses per passenger (Euro)</i>	0,090	0,294	1,13	0,089	0,290	1,12	0,087	0,283	1,09	0,3074
<i>Aircraft Index Standardized Score</i>	5,94			5,21			6,21			
<i>Aircraft Index Score</i>	0,951			0,834			0,994			
<i>Aircraft daily utilization (hours)</i>	0,023	0,055	12,48	0,000	0,000	12,68	0,077	0,180	12,02	-0,4295
<i>Fleet homogeneity (%)</i>	0,450	0,797	0,80	0,407	0,720	0,72	0,363	0,643	0,64	0,5644
<i>Daily flights per aircraft</i>	0,122	0,288	4,91	0,091	0,215	4,96	0,323	0,762	4,65	-0,4243
<i>Average fleet age (years)</i>	0,027	1,000	4,40	0,025	0,933	4,60	0,023	0,867	4,80	-0,0269
<i>Fuel cost per ASK (Euro cents)</i>	0,314	1,000	0,90	0,296	0,941	0,93	0,191	0,606	1,11	-0,3143
<i>CO2 emissions per passenger km (grams)</i>	0,014	0,851	61,50	0,015	0,928	59,95	0,017	1,000	58,50	-0,0167
<i>Labour Index Standardized Score</i>	8,61			9,57			7,76			
<i>Labour Index Score</i>	1,512			1,681			1,362			
<i>Enplaned customers per cabin crew</i>	0,251	0,955	15053,76	0,258	0,981	15473,08	0,206	0,784	12357,14	0,2625
<i>Employee per aircraft</i>	0,413	0,593	38,39	0,509	0,731	36,42	0,304	0,437	40,63	-0,6963
<i>Staff costs per ASK (Euro cents)</i>	0,254	1,000	0,27	0,247	0,973	0,29	0,229	0,901	0,33	-0,2538
<i>ASK per employee (x1000)</i>	0,048	0,903	13745,79	0,054	1,000	15216,12	0,047	0,871	13249,22	0,0537
<i>Flight and cabin crew over total employees (%)</i>	0,546	0,890	0,82	0,614	1,000	0,92	0,577	0,940	0,86	0,6139
<i>Total Score</i>	6,14			6,17			5,92			
<i>Standardized score</i>	7,62			7,65			7,34			

Table 10 - WizzAir aggregated data

References

- Aguinis, Herman, and Kurt Kraiger. "Benefits of Training and Development for Individuals and Teams, Organizations, and Society." *Annual Review of Psychology*, vol. 60, no. 1, 2009, pp. 451–474., <https://doi.org/10.1146/annurev.psych.60.110707.163505>.
- Ahlgren, Linnea. "The Worldwide Mishandled Baggage Rate Spiked By Almost A Quarter Last Year." *Simple Flying*, 26 May 2022, <https://simpleflying.com/worldwide-mishandled-baggage-rate-spike-2021/>. Accessed 30 Dec. 2022.
- Air Transportation*. 8th ed., Air Transport Association of America, 1946.
- Akhter, Shakeela, and Muhammad Bashir. "Importance of Web Site Design and Customer Support Services in Online Purchase." *Lulea University of Technology*, 2008.
- Alamdari, Fariba, and Simon Fagan. "Impact of the Adherence to the Original Low-Cost Model on the Profitability of Low-Cost Airlines." *Transport Reviews*, vol. 25, no. 3, 2005, pp. 377–392., <https://doi.org/10.1080/01441640500038748>.
- Alderighi, Marco, et al. "Network Competition—the Coexistence of Hub-and-Spoke and Point-to-Point Systems." *Journal of Air Transport Management*, vol. 11, no. 5, 2005, pp. 328–334., <https://doi.org/10.1016/j.jairtraman.2005.07.006>.
- "Aviation Is Facing a Rising Wave of Cyber-Attacks in the Wake of COVID." 8 Aug. 2022, <https://policymonitor.co.uk/wp-content/uploads/2021/11/Computer-Fraud-Security-Feb-2020.pdf>. Accessed 30 Dec. 2022.
- Babbar, Sunil, and Xenophon Koufteros. "The Human Element in Airline Service Quality: Contact Personnel and the Customer." *International Journal of Operations & Production Management*, vol. 28, no. 9, 2008, pp. 804–830., <https://doi.org/10.1108/01443570810895267>.

- Balcombe, Kelvin, et al. “Consumer Willingness to Pay for in-Flight Service and Comfort Levels: A Choice Experiment.” *Journal of Air Transport Management*, vol. 15, no. 5, 2009, pp. 221–226., <https://doi.org/10.1016/j.jairtraman.2008.12.005>.
- Batt, Rosemary. “Work Organization, Technology, and Performance in Customer Service and Sales.” *ILR Review*, vol. 52, no. 4, 1999, pp. 539–564., <https://doi.org/10.1177/001979399905200403>.
- Baumeister, Stefan. *Environmental Responsibility as a Factor in Gaining Competitive Advantage in the Aviation Industry*, vol. 1, no. 2, pp. 43–48.
- Bjelcic, Borislav, et al. *Handbook of Low Cost Airlines: Strategies, Business Processes and Market Environment*, Erich Schmidt, Berlin, 2007, pp. 31–50.
- Blok, M, and Peter Vink. “Comfortabel Vliegen: Comfort Van Het Vliegtuiginterieur Door De Ogen Van De Gebruiker.” [https://www.researchgate.net/publication/283996777_Comfortabel_vliegen_comfort_van_het_vliegtuiginterieur_door_de_ogen_van_de_gebruiker](https://www.researchgate.net/publication/283996777_Comfortabel_vliegen_comfort_van_het_vliegtuiginterieur_door_de ogen_van_de_gebruiker). Accessed 30 Dec. 2022.
- Brady, Sasha. “Europe Air Travel Problems to Continue: These Are the Destinations Facing Major Disruptions This Fall.”
- Brundrett, Geoffrey. “Comfort and Health in Commercial Aircraft: A Literature Review.” *Journal of the Royal Society for the Promotion of Health*, vol. 121, no. 1, 2001, pp. 29–37., <https://doi.org/10.1177/146642400112100108>.
- Brüggen, Alexander, and Levin Klose. “How Fleet Commonality Influences Low-Cost Airline Operating Performance: Empirical Evidence.” *Journal of Air Transport Management*, vol. 16, no. 6, 2010, pp. 299–303., <https://doi.org/10.1016/j.jairtraman.2010.02.006>.
- Cluley, Graham. “A Boeing 757 Was Hacked Remotely While It Sat on the Runway.” *Tripwire*, 16 Nov. 2017, <https://www.tripwire.com/state-of-security/boeing-757-hacked>. Accessed 30 Dec. 2022.

“Convenience Is Top Priority for Passengers.” *Airlines.iata*, 1 Nov. 2022, <https://www.airlines.iata.org/news/convenience-is-top-priority-for-passengers#:~:text=It%20enables%20airlines%20to%20present,Financial%20Settlement%20and%20Distribution%20Services>. Accessed 30 Dec. 2022.

Curtis, Tamilla, et al. “Satisfaction with Airline Service Quality: Familiarity Breeds Contempt.” *International Journal of Aviation Management*, vol. 1, no. 4, 2012, p. 242., <https://doi.org/10.1504/ijam.2012.050472>.

Danesi, Antonio. “Measuring Airline Hub Timetable Co-Ordination and Connectivity: Definition of a New Index and Application to a Sample of European Hubs.” *European Transport*, vol. 34, pp. 54–74.

Davis, James, and Barin Nag. “Customer-Oriented Competitive Advantage in the Airline Industry.” *Journal of Applied Business & Economics*, vol. 22, no. 3, pp. 102–115., <https://articlegateway.com/index.php/JABE/article/view/2859/2716>.

Dixon, Matthew C. *The Maintenance Costs of Aging Aircraft: Insights from Commercial Aviation*. RAND Project Air Force, 2006.

Dresner, Martin, et al. “The Impact of Low-Cost Carriers on Airport and Route Competition.” *Journal of Transport Economics and Policy*, vol. 30, no. 3, Sept. 1996, pp. 309–328.

EasyJet, *2017 Annual Report and Accounts*, https://corporate.easyjet.com/~/_media/Files/E/Easyjet/pdf/investors/results-center/2017/2017-annualreport-and-accounts-v1.pdf. Accessed 30 Dec. 2022.

EasyJet, *2018 Annual Report and Accounts*, https://corporate.easyjet.com/~/_media/Files/E/Easyjet/pdf/investors/results-center/2017/2017-annualreport-and-accounts-v1.pdf. Accessed 30 Dec. 2022.

EasyJet, *2019 Annual Report and Accounts*, https://corporate.easyjet.com/~/_media/Files/E/Easyjet/pdf/investors/results-center/2019/eas040-annual-report-2019-web.pdf. Accessed 30 Dec. 2022.

“EasyJet.” *Wikipedia*, Wikimedia Foundation, 23 Dec. 2022, <https://en.wikipedia.org/wiki/EasyJet>.

European Union, 2022, *Low Cost Carriers: Share of Total European Flights*, <https://www.eurocontrol.int/sites/default/files/2022-10/eurocontrol-data-snapshot-34.pdf>. Accessed 30 Dec. 2022.

Florida, Richard, et al. “Up in the Air: The Role of Airports for Regional Economic Development.” *The Annals of Regional Science*, vol. 54, no. 1, 2014, pp. 197–214., <https://doi.org/10.1007/s00168-014-0651-z>.

Gulati, Rosaline K. “The Coupling of Product Architecture and Organizational Structure Decisions.” *Massachusetts Institute of Technology*, 1996.

Kagalwalla, Navid, and Prathamesh P. Churi. “Cybersecurity in Aviation : An Intrinsic Review.” *2019 5th International Conference On Computing, Communication, Control And Automation (ICCUBEA)*, 2019, <https://doi.org/10.1109/iccubea47591.2019.9128483>.

Kelley, Eugene J. “The Importance of Convenience in Consumer Purchasing.” *Journal of Marketing*, vol. 23, no. 1, 1958, pp. 32–38., <https://doi.org/10.1177/002224295802300105>.

Kim, Youngmi, and Hyejung Park. “An Investigation of the Competencies Required of Airline Cabin Crew Members: The Case of a Korean Airline.” *Journal of Human Resources in Hospitality & Tourism*, vol. 13, no. 1, 2013, pp. 34–62., <https://doi.org/10.1080/15332845.2013.807393>.

Klisauskaite, Vyte. “The Story of the First Low-Cost Carrier in the United States.” *Aerotime Hub*, 16 Mar. 2022, <https://www.aerotime.aero/articles/30498-first-low-cost-carrier-in-the-united-states>. Accessed 30 Dec. 2022.

Klophaus, Richard, et al. “Low Cost Carriers Going Hybrid: Evidence from Europe.” *Journal of Air Transport Management*, vol. 23, 2012, pp. 54–58., <https://doi.org/10.1016/j.jairtraman.2012.01.015>.

- Knorr, Andreas, and Andreas Arndt. “Most Low-Cost Airlines Fail(Ed): Why Did Southwest Airlines Prosper?” *Competition versus Predation in Aviation Markets*, 2018, pp. 145–170., <https://doi.org/10.4324/9781351161404-8>.
- Koenigsberg, Oded, et al. “EasyJet® Pricing Strategy: Should Low-Fare Airlines Offer Last-Minute Deals?” *Quantitative Marketing and Economics*, vol. 6, no. 3, 2008, pp. 279–297., <https://doi.org/10.1007/s11129-007-9036-2>.
- Kremser, Florian, et al. “Aircraft Seating Comfort: The Influence of Seat Pitch on Passengers’ Well-Being.” *Work*, vol. 41, 2012, pp. 4936–4942., <https://doi.org/10.3233/wor-2012-0789-4936>.
- Kumar, Anil, et al. “Measuring and Improving Customer Retention at Authorised Automobile Workshops after Free Services.” *Journal of Retailing and Consumer Services*, vol. 39, 2017, pp. 93–102., <https://doi.org/10.1016/j.jretconser.2017.07.007>.
- Lee, David S., et al. “Aviation and Global Climate Change in the 21st Century.” *Atmospheric Environment*, vol. 43, no. 22-23, 2009, pp. 3520–3537., <https://doi.org/10.1016/j.atmosenv.2009.04.024>.
- Li, Xiaowei, et al. “Assessing Intercity Multimodal Choice Behavior in a Touristy City: A Factor Analysis.” *Journal of Transport Geography*, vol. 86, 2020, p. 102776., <https://doi.org/10.1016/j.jtrangeo.2020.102776>.
- Lian, Jon Inge, and Joachim Rønnevik. “Airport Competition – Regional Airports Losing Ground to Main Airports.” *Journal of Transport Geography*, vol. 19, no. 1, 2011, pp. 85–92., <https://doi.org/10.1016/j.jtrangeo.2009.12.004>.
- Lloyd, Guy. Elsevier, 2020, *The Business Benefits of Cyber Security for SMEs*, <https://policymonitor.co.uk/wp-content/uploads/2021/11/Computer-Fraud-Security-Feb-2020.pdf>. Accessed 30 Dec. 2022.

Malighetti, Paolo, et al. “Competitive vs. Monopolistic Routes: Are Fares so Different?” *Research in Transportation Economics*, vol. 45, 2014, pp. 3–8., <https://doi.org/10.1016/j.retrec.2014.07.001>.

Mason, Keith J., and William G. Morrison. “Towards a Means of Consistently Comparing Airline Business Models with an Application to the ‘Low Cost’ Airline Sector.” *Research in Transportation Economics*, vol. 24, no. 1, 2008, pp. 75–84., <https://doi.org/10.1016/j.retrec.2009.01.006>.

Moir, Loren, and Gui Lohmann. “A Quantitative Means of Comparing Competitive Advantage among Airlines with Heterogeneous Business Models: Analysis of U.S. Airlines.” *Journal of Air Transport Management*, vol. 69, 2018, pp. 72–82., <https://doi.org/10.1016/j.jairtraman.2018.01.003>.

Morrison, Steven. “Actual, Adjacent, and Potential Competition Estimating the Full Effect of Southwest Airlines.” *Journal of Transport Economics and Policy*, vol. 35, no. 2, 1 May 2001, pp. 239–256., <https://www.ingentaconnect.com/content/lse/jtep/2001/00000035/00000002/art00005#>. Accessed 31 Dec. 2022.

Mulfati, Justin. “Airlines Use Chatbots to Automate Customer Service as Requests Soar.” *Apex.aero*, 21 May 2020, <https://apex.aero/articles/airlines-chatbots-automate-customer-service-requests-soar/>. Accessed 30 Dec. 2022.

Nassiri, Habibollah, and Ali Rezaei. “Air Itinerary Choice in a Low-Frequency Market: A Decision Rule Approach.” *Journal of Air Transport Management*, vol. 18, no. 1, 2012, pp. 34–37., <https://doi.org/10.1016/j.jairtraman.2011.08.001>.

Niese, Hendrik, and Wolfgang Grime. *How to Measure Airport Connectivity? Average Quickest Travel Time as Indicator*. 29 June 2013, <https://core.ac.uk/download/pdf/16455112.pdf>.

Pierce, Mark, et al. “Air Quality on Commercial Aircraft.” *ASHRAE Journal*, 1999, pp. 26–34., <https://www.aivc.org/resource/air-quality-commercial-aircraft>.

Porter, Michael. “Chapter 3 and 4.” *Competitive Advantage: Creating and Sustaining Superior Performance*, 1st ed., The Free Press, New York, 1985, pp. 62–162.

Purkayastha, Anish, and Sunil Sharma. “Gaining Competitive Advantage through the Right Business Model: Analysis Based on Case Studies.” *Journal of Strategy and Management*, vol. 9, no. 2, 2016, pp. 138–155., <https://doi.org/10.1108/jsma-07-2014-0060>.

Redondi, Renato, et al. “European Connectivity: The Role Played by Small Airports.” *Journal of Transport Geography*, vol. 29, 2013, pp. 86–94., <https://doi.org/10.1016/j.jtrangeo.2013.01.010>.

Ryanair, 2017, *2017 ANNUAL REPORT*, <https://investor.ryanair.com/wp-content/uploads/2017/07/Ryanair-FY2017-Annual-Report.pdf>. Accessed 30 Dec. 2022.

Ryanair, 2018, *2018 ANNUAL REPORT*, <https://investor.ryanair.com/wp-content/uploads/2018/07/Ryanair-FY-2018-Annual-Report.pdf>. Accessed 30 Dec. 2022.

Ryanair, 2019, *2019 ANNUAL REPORT*, <https://investor.ryanair.com/wp-content/uploads/2019/07/Ryanair-2019-Annual-Report.pdf>. Accessed 30 Dec. 2022.

“Ryanair.” *Wikipedia*, Wikimedia Foundation, 27 Dec. 2022, <https://en.wikipedia.org/wiki/Ryanair>.

Sapre, Manasi, and Nita Parekh. “Analysis of Centrality Measures of Airport Network of India.” *Lecture Notes in Computer Science*, 2011, pp. 376–381., https://doi.org/10.1007/978-3-642-21786-9_61.

Sheth, Jagdish, et al. “Repositioning the Customer Support Services: The Next Frontier of Competitive Advantage.” *European Journal of Marketing*, vol. 54, no. 7, 2020, pp. 1787–1804., <https://doi.org/10.1108/ejm-02-2020-0086>.

Southwest Airlines, 2021, *2020 ANNUAL REPORT TO SHAREHOLDERS*, https://www.southwestairlinesinvestorrelations.com/~/_media/Files/S/Southwest-IR/LUV_2020_Annual%20Report_.pdf. Accessed 30 Dec. 2022.

Southwest Airlines, 2022, *2021 ANNUAL REPORT TO SHAREHOLDERS*,
https://www.southwestairlinesinvestorrelations.com/~media/Files/S/Southwest-IR/LUV_2021_Annual%20Report.pdf. Accessed 30 Dec. 2022.

“Southwest Airlines.” *Wikipedia*, Wikimedia Foundation, 29 Dec. 2022,
https://en.wikipedia.org/wiki/Southwest_Airlines.

Statista. “Market Share of Low-Cost Carriers in Europe from 1998 to 2018.”

<https://www.statista.com/statistics/1117218/low-cost-carrier-market-share-europe/>

Stojanov, Michal. “Characteristic Features of Low-Cost Airlines and Their Development in Europe.” *University of Economics of Varna*, Research Gate, 2015.

Suau-Sanchez, Pere, and Guillaume Burghouwt. “Connectivity Levels and the Competitive Position of Spanish Airports and Iberia’s Network Rationalization Strategy, 2001–2007.” *Journal of Air Transport Management*, vol. 18, no. 1, 2012, pp. 47–53.,
<https://doi.org/10.1016/j.jairtraman.2011.08.004>.

“Transport and Communication Costs Indexes, 1920-2015: The Geography of Transport Systems.” *The Geography of Transport Systems | The Spatial Organization of Transportation and Mobility*, 9 Jan. 2022, <https://transportgeography.org/contents/chapter1/what-is-transport-geography/transport-communication-costs-index/>.

Valero, Jorge. “Hackers Bombard Aviation Sector with over 1,000 Attacks per Month.” *Euractiv*,
<https://www.euractiv.com/section/justice-home-affairs/news/hackers-bombard-aviation-sector-with-more-than-1000-attacks-per-month/>.

Van Triest, Sander, et al. “The Impact of Customer-Specific Marketing Expenses on Customer Retention and Customer Profitability.” *Marketing Letters*, vol. 20, no. 2, 2008, pp. 125–138.,
<https://doi.org/10.1007/s11002-008-9061-2>.

Vera Rebollo, J. Fernando, and Josep A. Ivars Baidal. “Spread of Low-Cost Carriers: Tourism and Regional Policy Effects in Spain.” *Regional Studies*, vol. 43, no. 4, 2009, pp. 559–570., <https://doi.org/10.1080/00343400701874164>.

Vink, P., et al. “Possibilities to Improve the Aircraft Interior Comfort Experience.” *Applied Ergonomics*, vol. 43, no. 2, 2012, pp. 354–359., <https://doi.org/10.1016/j.apergo.2011.06.011>.

Vredenburg, Alexandra N., et al. “Air Rage.” *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, vol. 59, no. 1, 2015, pp. 400–404., <https://doi.org/10.1177/1541931215591084>.

“Wizz Air.” *Wikipedia*, Wikimedia Foundation, 29 Dec. 2022, https://en.wikipedia.org/wiki/Wizz_Air.

WizzAir, 2017, *Annual Report and Accounts 2017*, https://wizzair.com/static/docs/default-source/downloadable-documents/corporate-website-transfer-documents/annual-reports/wizz_air_holdings_plc_annual_report_and_accounts_2017_7d022e66.pdf. Accessed 30 Dec. 2022.

WizzAir, 2018, *Annual Report and Accounts 2018*, https://wizzair.com/static/docs/default-source/downloadable-documents/corporate-website-transfer-documents/annual-reports/wizz_air_holdings_plc_annual_report_and_accounts_2018_3a126a45.pdf. Accessed 30 Dec. 2022.

WizzAir, 2019, *Annual Report and Accounts 2019*, [https://wizzair.com/static/docs/default-source/downloadable-documents/corporate-website-transfer-documents/annual-reports/ar-f19-final-\(web-indexed\)_6afd66af.pdf](https://wizzair.com/static/docs/default-source/downloadable-documents/corporate-website-transfer-documents/annual-reports/ar-f19-final-(web-indexed)_6afd66af.pdf). Accessed 30 Dec. 2022.

“The World of Air Transport in 2020.” *The World of Air Transport in 2020*, <https://www.icao.int/annual-report-2020/Pages/the-world-of-air-transport-in-2020.aspx>.

Yimga, Jules. “Airline on-Time Performance and Its Effects on Consumer Choice Behavior.” *Research in Transportation Economics*, vol. 66, 2017, pp. 12–25., <https://doi.org/10.1016/j.retrec.2017.06.001>.

Zeigler, Patrick, et al. “Low-Cost Carrier Entry at Small European Airports: Low-Cost Carrier Effects on Network Connectivity and Self-Transfer Potential.” *Journal of Transport Geography*, vol. 60, 2017, pp. 68–79., <https://doi.org/10.1016/j.jtrangeo.2017.02.011>.

Zou, Li, et al. *Journal of Transport Economics and Policy*, vol. 49, no. 1, 1 Jan. 2015, pp. 149–166., <https://www.ingentaconnect.com/content/lse/jtep/2015/00000049/00000001/art00009>.