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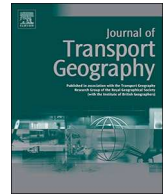
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Reinterpreting the role of primary and secondary airports in low-cost carrier expansion in Europe

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ABSTRACT

This paper discusses the long-term effects of low-cost carrier (LCC) presence at European airports and identifies the airports that have benefited the most from LCC consolidation since 2001. The research uses 'LCC Market Share', in terms of seats, to measure the relative importance of LCCs within each airport; and introduces 'EU LCA Rank' as a normalised metric of the capacity share of every airport in the European low-cost segment. It evaluates the trends between 2001 and 2019 in all airports in Europe using OAG supply information (seats by carrier). Results show two different phases of LCC rise in Europe, 2001 to 2008 and 2009 to 2019, marked by the effects of the financial crisis of the Great Recession. The analysis highlights the role that LCCs have played in boosting the growth of both primary and secondary airports. Indeed, despite the fact that LCCs have put many smaller airports on the European map, during the second phase of the period of analysis growth has been more significant for major airports and for a few airports that were keen to support the earliest development of LCCs. In that sense, this paper contributes to a better understanding of the historical and contemporary dynamics in European LCCs choice of airports and, in particular, the long-term effects that this disruptive business model have had for airports. This is increasingly important in the context of a potential recovery path from the effects of the response to the Covid-19 pandemic. This paper also attempts to settle academic discussions that attach LCC development to secondary/regional airports disregarding the wide range of strategies used by airlines and airports.

1. Introduction

The growth of low-cost carriers (LCCs) around the world triggered substantial changes in airport planning, operations and in the airport business in general (de Neufville, 2008; Graham, 2013; Jimenez et al., 2013). The availability of underutilised but fully functional airports with minor or no commercial service, particularly in Europe and the USA, often provided a fertile environment for some LCCs to grow unencumbered. So, whilst there is a general agreement that there are important differences among low-cost carriers (Mason and Morrison, 2008) and that there is not a single monolithic model (Dobruszkes, 2013), it appears to be ingrained in academic and policy literature that LCCs are characteristically intertwined with 'secondary' or 'regional' airports, to the point that it is considered an archetypical feature of the LCC business model (Ahmad et al., 2018; Barbot, 2006; Barret, 2004; Budd et al., 2014; Dobruszkes, 2006; Francis et al., 2004; Franke, 2004; Gillen and Lall, 2004; Graham, 2013; Graham and Shaw, 2008; Tavalaei and Santalo, 2019; Zhang et al., 2008). Correspondingly, as

Tavalaei and Santalo (2019, p. 445) describe it "two distinguishable types of airports have emerged one oriented to attract LCCs, and the other specialised in serving legacy or major airlines"; the first type is usually dubbed a 'low-cost airport'.

The notions of having clearly distinguishable types of airports, with LCCs being attached to smaller secondary airports, is being increasingly challenged by the most recent developments in the networks of the most archetypical LCCs. In this regard, Fageda et al. (2015) discuss different forms that the low-cost airline business model can take and consider that the archetypical LCC that has operated in regional secondary and/or primary airports is usually the ultra-LCC type. The authors highlight that the share of archetypical LCCs tends to be higher on routes with a high proportion of leisure travellers, often originating from airports close to cities. In a similar vein, Suau-Sanchez et al. (2016a, 2016b) highlight that, in the 1990–2009 period, Ryanair was the main engine for seat capacity deconcentration away from major airports, whilst other major LCCs like easyJet and Vueling concentrated their capacity in larger airports. In other words, only a small number of

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LCCs, headed by Ryanair, were operating from secondary airports or airports at the lower end of the airport hierarchy.

Therefore, although there is evidence that LCCs do operate in different types of airports, the idea that secondary airports are a major part of the definition of the LCC model still remains widely accepted, in the same way that large airports are seen as the home to full-service network carriers (FSNC) exclusively. A few steps have been taken to improve understanding of the real association between airports and types of airlines, but these consider a limited sample of airports. (Dobruszkes et al., 2017; Dziejdzic and Warnock-Smith, 2016; Jimenez et al., 2017; Wong et al., 2019). Hence the myth of the LCC at the secondary airport has been maintained.

To address this misunderstanding, this paper provides a longitudinal analysis of LCC development matched to a precise definition of airport type using data on all scheduled airlines in all European airports during the period 2001 to 2019. The research introduces new metrics that assess the relative importance of LCCs at individual airports, as well as showing the relative importance of individual airports in the entire European low-cost market.

The structure of the paper is as follows. Firstly, it discusses the state of the art regarding 'low-cost airports' and the relationship between LCCs and 'secondary' airports. Secondly, it presents the scope and methods for the analysis, especially the metrics to measure the relative participation of airports in the low-cost market. Thirdly, it describes the historical and contemporary evolution of LCCs at an aggregated level, and finally it details the effects at the airport level.

2. Literature review

2.1. Defining primary, secondary and regional airports

The discussion outlined above assumes that there is a common understanding on the definition of airports, especially in the contrast between primary and secondary categories. To develop a sharper distinction, a starting point can be the concept of multi-airport system (de Neufville and Odoni, 2013) which acknowledges that large metropolitan regions are served by several airports, one being the primary airport with the largest share of metropolitan traffic, and the rest are secondary, which absorb the traffic spill from the primary or focus on lower yielding or specific traffic categories, particularly when mandated by government regulations (de Neufville, 1995).

Moving to those airports outside a multi-airport system can be a bit more complicated and dependent on particular national perspectives or national institutional frameworks. For example, regional airports are sometimes associated with peripheral regions (e.g. Lian and Rønnevik, 2011), but in other occasions any airport not serving country capitals is considered a regional airport (e.g. Suau-Sanchez et al., 2016a, 2016b; Tapiador et al., 2008). Therefore, in the literature we can find that airports as different as Tromsø Airport – a 2 million passengers airport serving a city of 75,000 inhabitants in the north of Norway – and Manchester Airport – a 28 million passengers airport serving a metropolitan area of 2.8 million passengers – are both tagged as regional airports.

To overcome this confusion, we apply a user centric perspective to define the different types of airport. Primary airports are the largest airports in multi-airport systems and airports acting as the main or only gateway in large urban areas and cities. Secondary airports are those that have significant commercial traffic,¹ but are not the largest, in multi-airport systems. Finally, regional airports are peripheral to the main urban and metropolitan regions and have a relatively small size in

¹ De Neufville and Odoni (2013, p. 111) associates "significant airports" to those that serve more than one million passengers per year, but generalises it as "facilities that contribute meaningfully to the air transport services of a metropolitan region".

terms of passengers.

This distinction can be used to follow the long-term evolution of airports in Europe, and their path along the airport hierarchy. In particular the evolution can be paired with information on changes in the proportion of low-cost carrier traffic, both at individual airports and in the European context generally.

2.2. The origin of the myth of LCCs and secondary airports

Barret (2004) is very often cited for his exploration of the differences between legacy carriers and LCCs regarding airport choice. His table presenting "the airport requirements of low-cost airlines" (established from an interview with Ryanair's CEO) still receives significant attention because it describes the archetypical features of a 'low-cost airport', where the facilities and amenities make airports and terminals more attractive to LCCs. This was certainly crucial to support the explosive growth of Ryanair to become the largest intra-European airline. As de Neufville (2008) noted, "the ascendancy of low-cost airlines entails an increased importance and expansion of low-cost airports and airport facilities", in such a way that LCCs catalysed the surge of 'low-cost airports', not vice versa. However, Jimenez (2015, Chapter 5) shows there is no correlation between facilities and LCC prevalence at European airports suggesting that the idea of a "low cost airport could be misleading. Summarising this experience is the observation that "one of the core characteristics of Low-Cost Carriers is their use of secondary and regional airports" (M. Dziejdzic and Warnock-Smith, 2016).

Research has begun to recognise that "nothing is fixed as the market constantly evolves and carriers modify their strategies in order to achieve growth" (M. Dziejdzic and Warnock-Smith, 2016). As an example, Dobruszkes et al. (2017) found LCCs transitioning to major airports in Europe and USA, Suau-Sanchez et al. (2016a, 2016b) show that only Ryanair and WizzAir had a major impact upon secondary airports. In addition, a shift in Ryanair's strategy around 2009–2010 entailed a transfer of a large number of flights from secondary to main airports in a search for higher yield passengers and larger volumes of demand, as de Wit and Zuidberg (2012) pointed out there are structural reasons for LCCs to adapt their business model. In these plans only London Heathrow, Paris Charles de Gaulle and Frankfurt am Main were ruled out according to Ryanair's CEO (M. Dziejdzic and Warnock-Smith, 2016; Rothwell, 2010). Yet, seven years later Ryanair opened a base at Frankfurt am Main, undeniably a primary airport, shifting part of the network it had at Frankfurt Hahn airport, one of the early archetypes of a 'low-cost airport'. Even Heathrow has not been spared by LCCs. For example, Vueling and Eurowings offered almost one million seats there in 2018. Moreover, easyJet stated they would operate from Heathrow if a new runway is built (easyJet, 2015), and the effect of the response to the Covid-19 pandemic on the availability of slots at primary airports may transform this reality further from 2020 onwards.

Although airline behaviour is the key aspect defining the traffic composition at airports, airports and tourism authorities become influential as they wanted to attract different types of airlines (Halpern and Graham, 2013). It is hard to capture changes in management focus or managerial attitude with objective data, particularly as the relationship between airports and airlines is increasingly mediated by individual contracts and agreements of a confidential nature (D'alfonso and Nastasi, 2014). The appendix of Dziejdzic and Warnock-Smith (2016) consolidated several examples of LCCs using different types of airports, irrespective of their hierarchy, provided there was strategic alignment between the airline expectations and requirements, and what the airports were able to offer.

This diverse array of experience and airline behaviour suggest there is a need to refine our understanding of the LCC expansion utilising a refined definition of airport type. This will provide a foundation to identify dominant trends along with new, disruptive developments that may suggest how the future may unfold in the post Covid-19 world.

3. Scope and methods

3.1. Scope and data

The analysis is focused on the development of LCCs in Europe using OAG schedules (2020) on annual supply of seats per airline at the airport level. Airlines were classified as mainline and low-cost following the OAG classification. Although OAG does not publish any criteria for that selection, over 90% of the aggregated supply in the low-cost category along the period of analysis was provided by 11 airlines that are widely recognised as LCC by researchers and practitioners (business model transformations and bankruptcies are considered by OAG, see Appendix A for a timeline of European LCCs): Ryanair, easyJet, Norwegian, Vueling, Wizz Air, Pegasus, Germanwings, TUI fly, Transavia, Jet2.com and Eurowings. Moreover, given the large number of airlines included in the dataset a more detailed analysis of every one of the them was considered a cumbersome activity that would not bring additional insight at the aggregated level. LCCs from outside of Europe (i.e. Air Arabia, Flydubai, Scoot) are also considered in the analysis as they provide low-cost services, yet only account for 0.5% of all aggregated seats.

The geographical boundaries for the analysis are limited to the countries in OAG regions EU1 (Western Europe) and EU2 (Eastern/Central Europe) – see Table 1. This denomination includes Russia, Turkey, along with countries in the Caucasus and the Balkans. The inclusion of these regions that are often overlooked allows for an analysis of the expansion of LCCs to the East.² Geographical information for all airports in the database was obtained from OpenFlights (2019) and complemented with the Great Circle Mapper (Swartz, 2019) for records not available on OpenFlights.

The temporal scope of the analysis covers annual data for the years 2001 to 2019, as limited by OAG data availability. We acknowledge that our period of analysis starts after the deregulation of the European aviation market, which is considered to start in 1997 after the third liberalisation package was implemented. Yet, it is close enough and widely covers the expansion and consolidation of the LCC model and allows for the analysis of the effects of other major external events, i.e., the terrorist events of 9/11 in September 2001 and the 2008 financial crisis.

3.2. Measuring airports participation in the low-cost market

This research incorporates two metrics to measure the participation of European airports in the low-cost market. *LCC Market share* represents the proportion of seats provided by LCCs, in relation to the total seats provided by all airlines at every airport. This metric applies to each individual airport irrespective of its location. Hence the data ignores the special situation of airports within Multi-Airport Systems, which is explored in Jimenez et al. (2017).

The use of available seats may be slightly different than the market share measured in terms of passengers, but the availability of data across all airports during the entire period of analysis makes it a more suitable alternative. It is important to acknowledge that compared to the number of passengers, the number of seats may slightly underestimate LCC market share given higher load factors for LCCs. This effect is not deemed significant to alter the trends found in this research.

The research uses two variables: *EU LCA Rank* and *EU LCA Share*. In order to calculate *EU LCA Rank* for a given airport *i* in year *t*, it is

² Note that as the expansion of LCCs in these regions is not as prevalent as in Western Europe, figures for the ‘market share of LCCs in Europe’ might appear to be lower from those reported elsewhere. Yet, since our analysis and results are mainly reported at the airport level, this does not affect the findings of this paper.

Table 1

Geographical scope following OAG “Europe” regions EU1 and EU2. Source: Adapted from OAG (2019).

EU1 - Europe: Western Europe		EU2 - Europe: Eastern/Central Europe	
Austria	Ireland	Albania	Latvia
Belgium	Iceland	Armenia	Moldova
Switzerland	Italy	Azerbaijan	Montenegro
Cyprus	Luxembourg	Bosnia and Herzegovina	Macedonia
Germany	Malta	Bulgaria	Poland
Denmark	Netherlands	Belarus	Romania
Spain	Norway	Czech Republic	Serbia
Finland	Portugal	Estonia	Russia ²
Faroe Islands	Sweden	Georgia	Slovenia
France	Turkey	Croatia	Slovakia
United Kingdom ¹		Hungary	Ukraine
Gibraltar		Lithuania	
Greece			

¹ Includes England, Guernsey, Isle of Man, Jersey, Northern Ireland, Scotland and Wales.

² Only the European part, approximately up to the Ural Mountains.

necessary to determine first the market share of every airport in the European low-cost market. *EU LCA Share* accounts for all the seats provided by the *k* airlines that are LCC ($k \in LCC$) at airport *i*, in relation to all seats provided by all airlines in all airports that year, as in Eq. (1). This value is then normalised by dividing it by the maximum value for a particular year, as in Eq. (2).

$$EU\ LCA\ Share_{it} = \frac{\sum_{k \in LCC} Seats_{kit}}{\sum_k Seats_{kt}} \tag{1}$$

$$EU\ LCA\ Rank_{it} = \frac{EU\ LCA\ Share_{it}}{\max_{i \in I} EU\ LCA\ Share_{it}} \tag{2}$$

EU LCA Rank is the proportion of the market share of every airport in the European low-cost market, normalised in relation to the market share (*EU LCA Share*) of the airport with the largest number of LCC seats. This way, the largest ‘low-cost carrier airport’ every year gets a rank value of 1 and all the values for the other airports are proportional to the level recorded at the largest one. This feature also allows the metric to account for the year-on-year variation whilst maintaining a normalised comparable value.

4. LCC growth in Europe 2001–2019

In 2001 LCCs provided 5.3% of total seats available in the European market (37 million out of 701 million seats). Between 2001 and 2019 European air travel supply doubled, yet the low-cost market grew 14 times its size at the turn of the millennium. Thus by 2019 LCCs had captured 37.3% of the capacity share, providing 534 million seats out of 1.43 billion in total for all the airlines (see Fig. 1). Naturally, the bulk of this growth has been concentrated in Western Europe (EU1 region), as it is a larger market than Eastern and Central Europe (EU2 region). Nevertheless, the EU2 region grew more significantly after 2004, both for low-cost and non-low-cost services. This is certainly associated to the enlargement of the European Union to the East, with the accession of Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia in 2004; as well as the successive integration of Romania and Bulgaria in 2007.

The effect of foreign LCCs in northern Africa and the Middle East, as well as from low-cost long-haul services was stronger particularly after 2010 but by 2019 they accounted for only 4.2% of all seats provided by LCCs at European airports, and 1.5% of the entire supply by all airlines.

4.1. The effect of LCC ascendancy for airports

At the beginning of the period of analysis, underutilised airports

Evolution of available seats at European airports

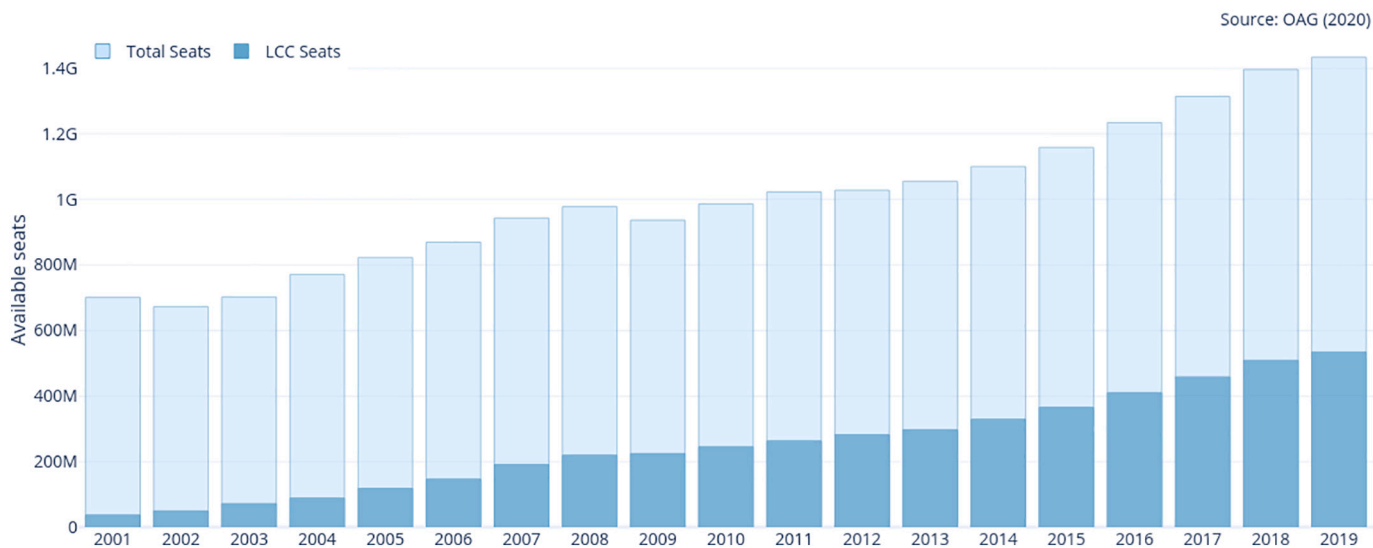


Fig. 1. Evolution of available seats at European airports by type of carrier (interactive version).

represented the best opportunity for start-up LCCs, whereas the larger main airports were the natural choice for converted charters and legacy spin-offs, given that parent companies were already operating there.

The value of the Herfindahl-Hirschman Index (HHI) over time shows a rapid decline in market concentration as the rapid rise of LCCs spread through many airports (see Fig. 2). The reduction is even more apparent in the EU2 region, but this is more a reflection of the very low number of LCC services initially, many of which were focused on

Prague, before the Eastern extension of the EU as previously discussed. In fact, the effect of deconcentration in the EU2 region only becomes visible when analysing the entire European market after 2004. Although the low-cost market can be characterised as ‘unconcentrated’ (from the airports perspective in the terminology of the US Department of Justice and the Federal Trade Commission (2010)), after 2009 changes in concentration can be deemed practically negligible with the HHI stabilising around 0.012 (120 points). This seems consistent with

Airports HHI

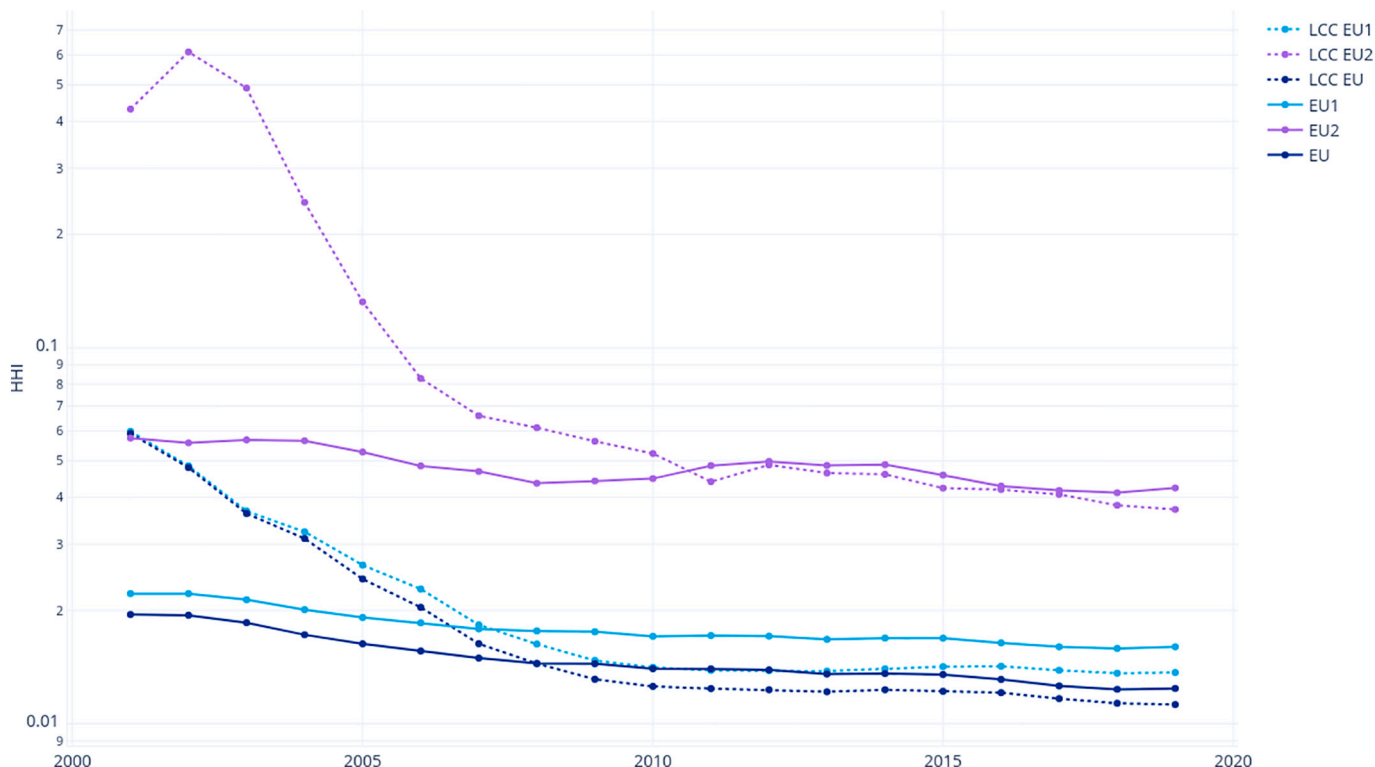


Fig. 2. The HHI index (in a logarithmic scale) for airports in Europe by region and market segment. Source: Own calculations from OAG (2020).

the different patterns of deconcentration and concentration found by Suau-Sanchez et al., 2016a in their analysis of data from 1990 to 2009.

The pattern shown in Fig. 2 suggests two different phases in the rise of LCCs in Europe and their effects on airports: 2001 to 2008 and 2009 to 2019. The breaking point between the phases coincides with the nominal end of the Great Recession (Temin, 2010) in Europe, as the global financial crisis of 2007–2008 has been dubbed.³ At the beginning of the first phase, the impact of the events of September 11/2001 was already undermining the position of incumbent legacy carriers (Ito and Lee, 2005; Kim and Gu, 2004; Mason, 2005). At the time, LCCs were not large enough to be a big threat, but they had started eroding the position of charter airlines (Williams, 2001). At the beginning of the second phase, amid worsening economies, LCCs were able to provide lower fares to more price-conscious passengers; yet legacy carriers were already restructuring by developing or acquiring LCCs to defend their position, particularly in the intra-European market. At the same time, during the second phase there has been more convergence between airline business models, with LCCs becoming more hybrid and legacy carriers adopting operational and commercial practices of LCCs (Daft and Albers, 2013; Lange et al., 2019; Lohmann and Koo, 2013).

Consequently, as the second phase did not experience more deconcentration, airports with new LCC services were not capturing a significant proportion of growth in relation to the total size of the market. Hence the bulk of the growth remained in main airports and in those that were able to capitalise the initial phase of LCC rise. This is visible by analysing the two metrics considered in the research. These are shown for a selection of airports in Fig. 3 with *LCC Market Share* on the horizontal axis and the airport ranking in the European low-cost market (*EU LCA Rank*) in the vertical axis. It is clear how primary airports like Barcelona (BCN), Amsterdam (AMS), Dusseldorf (DUS) and Palma de Mallorca (PMI) have moved upwards and to the right, indicating a stronger participation in the low-cost segment overall. Whereas secondary airports that had attained a high market share of LCCs at the beginning of their expansion (i.e. London Stansted, STN, Brussels Charleroi, CRL, Rome Ciampino, CIA and Paris Beauvais, BVA) have, for the most part, fallen in rank within Europe.

London Gatwick (LGW) and Istanbul Sabiha Gokcen (SAW) are particular cases of large secondary airports that have adapted to the influx of LCCs to the point that these airlines are now the largest share of their business and they both figure prominently in the European ranking. London Luton (LTN) and Milan Bergamo (BGY), in contrast, are smaller secondary airports traditionally regarded as ‘low-cost airports’ that have managed to secure a strong position in the segment at European level.

These are illustrative cases but provide a good introduction to the overall trend in all the airports in the dataset. Fig. 4 shows the same metrics of participation in the low-cost segment for all airports in the dataset in 2001 and 2018 represented by size. It is evident how the market share of LCCs has grown considerably at larger airports (larger circle sizes), usually primary ones. Whilst there is only a handful of smaller airports, usually secondary and regional, that retain a high rank in the low-cost segment at European level, despite being highly dominated by LCCs (right hand zone in Fig. 4).

This trend can also be observed, in general terms, by analysing the statistical relationship between the number of seats provided by LCCs and the total number of available seats at every airport. Although naturally there would be multicorrelation between these two variables, the analysis of Pearson correlation coefficient (r) would indicate the

³ The effect of the Great Recession in shifting the mindset of airport managers to pursue LCC services more actively will become apparent, although it is not widely covered in academic literature. As an illustration, Bloomberg's article on Ryanair expansion to major airports reports how “big-city airports are also keener to talk to Ryanair after the recession” (Dziedzic and Warnock-Smith, 2016; Rothwell, 2010).

degree to which LCCs contribute to overall traffic in an aggregated way. In fact, the correlation coefficient for all the airports in 2001 was only 0.27 indicating a very weak relationship, yet by 2019 it increased to 0.69. Therefore, the coefficient of determination (r^2) increased from 7% to 48% during the period of analysis, meaning a much stronger association between LCC traffic and overall airport traffic.

5. Ranking airports in the European low-cost market

In 2001, the top 25 airports in the European low-cost segment (see Table 2) provided 77% of all seats provided by LCCs. The UK dominated the market amidst explosive growth of Ryanair and easyJet, along with some of the first low-cost subsidiaries that legacy carriers established, like Go and Buzz. At the time, continental Europe was in a phase of corporate exploration of legacy subsidiaries, and charters in transition, like Deutsche BA and Eurowings in Germany, and Transavia in the Netherlands. EasyJet expansion in Continental Europe had a stronger expression at main airports like Geneva (GVA), Nice (NCE) and Barcelona (BCN); whilst Ryanair pursued growth at smaller airports with its first continental base at Charleroi (CRL) in Belgium. The shock of the 9–11 attacks in New York and its subsequent impact on the global airline industry stimulated the growth of low-cost supply in Europe and by 2002, LCCs provided one third more seats than in 2001, whilst all the other airlines reduced capacity by 6% in the same period.

By 2007, London Gatwick (LGW) was able to capture easyJet growth outside of Luton (LTN), whilst Stansted (STN) consolidated Ryanair expansion. A nascent Vueling would eventually merge with Clickair to position Barcelona El Prat (BCN) highly in the low-cost map. Ryanair kept on promoting smaller airports like Frankfurt Hahn (HHN), Girona (GRO), Rome Ciampino (CIA), and most notably Milan Bergamo (BGY), with some help of a Wizz Air poised for growth. Norwegian put Oslo (OSL) and Scandinavia with it, on the map as well. In a sense, this was the beginning of the end of a golden era for secondary and regional airports and their role in the low-cost market segment in Europe. Nevertheless, the financial crisis put a short break to growth and, by the end of 2009, LCC capacity grew only 2.4% in relation to 2008, whilst all other airlines reduced capacity by 6% in the same period (see Fig. 1).

Capacity reduction from non-low-cost carriers provided an opportunity for LCCs to turn to major airports more easily. Thus by 2013 fewer secondary airports ranked high in the European low-cost market: Charleroi (CRL), Bergamo (BGY) and Ciampino (CIA), along with Luton (LTN) and Stansted (STN). In fact, Barcelona (BCN) moved past Stansted as the largest provider of LCC seats in Europe in 2011, just after opening a new passenger building in 2009, amid the financial crisis. Another significant appearance in the top rank is Istanbul Sabiha Gokcen (SAW), which captured the explosive growth of Pegasus Airlines. By 2013, however, the top 25 airports (in terms of EU LCA Rank) accounted for only 43.8% of all LCC seats in Europe, confirming the deconcentration in the airport side seen in Fig. 2.

By 2019, seats available on LCCs still grow faster than other airlines (5% vs. 1% year on year) but consolidation and convergence of business models meant fewer changes for the top airports in the market segment. Barcelona (BCN), Gatwick (LGW), Stansted (STN) and Sabiha Gokcen (SAW) have established leading positions. Interestingly, Luton (LTN) and Bergamo (BGY) are the only traditionally ‘secondary’ airports that remain in the top 25 ranking, in positions 6th and 15th respectively. Budapest (BUD) and Antalya (AYT) signal the consolidation of Wizz Air and Pegasus as major players; whereas Oslo (OSL) and Copenhagen (CPH) tell a similar story for Norwegian.

5.1. Becoming a ‘low-cost airport’

Fig. 5 shows the distribution of seats provided by LCCs in 2001. There were only nine airports in Europe where LCCs provided 50% or more of the available seats, i.e. where LCCs dominated: London Stansted (STN), London Luton (LTN), Liverpool (LPL), Dortmund

Evolution of selected airports in the European low-cost segment

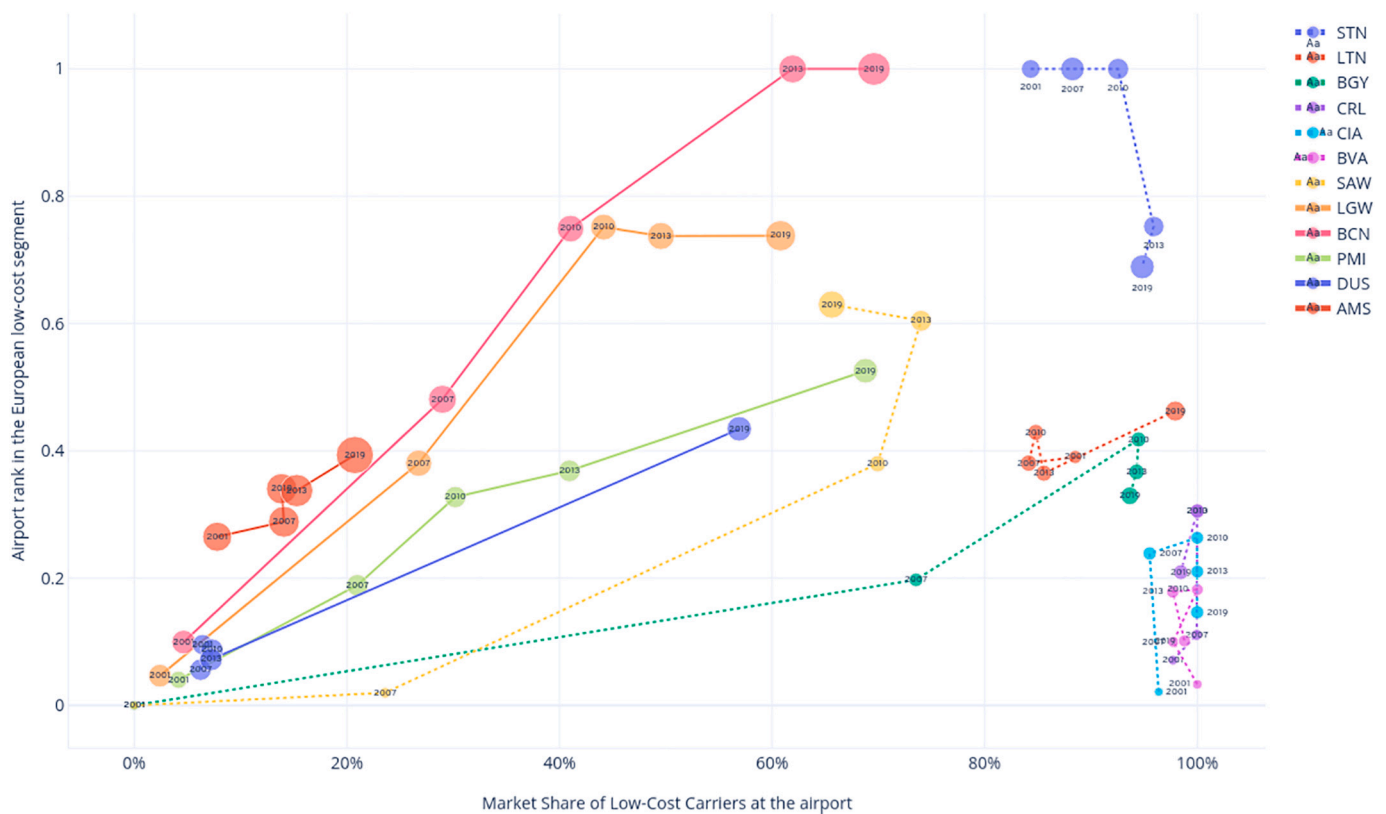


Fig. 3. Evolution of selected airports in the low-cost segment (interactive version). Source: Own calculations from OAG (2020).

(DTM), Glasgow Prestwick (PIK), Brussels Charleroi (CRL), Frankfurt Hahn (HHN), Paris Beauvais (BVA) and Venice Treviso (TSF). These secondary and regional airports were seen as the ‘low-cost airports’ at the time, as they provided uncongested and cheap facilities for LCCs. They were all located in the EU1 region, which highlights the role of the European market liberalisation policy as a catalyst for LCC growth.

However, during the second phase of LCC rise in Europe more airports embraced the low-cost model, at the same time that legacy carriers struggled to provide similar levels of growth after the Great Recession (see Fig. 6). By 2019, the increase of LCC participation at larger main airports is noticeable in the European geography (see Fig. 7). Particularly at Oslo (OSL), Dublin (DUB), Manchester (MAN), Milan Malpensa (MXP), Berlin Tegel (TXL) and Geneva (GVA), where LCC market share is now above 40%. As well as in Madrid (MAD), Rome Fiumicino (FCO), Paris Orly (ORY), Copenhagen (CPH), Stockholm Arlanda (ARN), Lisbon (LIS), Brussels (BRU), Athens (ATH), Moscow Vnukovo (VKO), Prague (PRG) and Ankara (ESB), all of them capital airports that, despite being rather late adopters of the low-cost trend, reached market shares above 20% for LCCs.

Indeed, by 2019 there are fewer airports with less than 10% LCC market share, such as London Heathrow (LHR), Frankfurt (FRA), Istanbul (IST), Zurich (ZRH), Sheremetyevo (SVO) and Domodedovo (DME) in Moscow, Kiev Boryspil (KBP), along with ‘city’ airports like London City (LCY), Milan Linate (LIN), Belfast City (BHD) and Stockholm Bromma (BMA). Interestingly, Greek airports are not dominated by LCCs either.

The airports that have become dominated by LCCs (*LCC Market Share* of 50% or more), and at the same time have secured a relatively important position in the low-cost segment at European level (in terms of *EU LCA Rank*) could be seen as ‘the major low-cost’ airports in

Europe, considering their ability to attract LCCs, irrespective of their actual costs or the characteristics of their facilities. They include airports like Barcelona (BCN), Gatwick (LGW), Stansted (STN), Sabiha Gokcen (SAW), Palma de Mallorca (PMI), Luton (LTN), Dusseldorf (DUS), Tegel (TXL), Malaga (AGP), Bergamo (BGY), Alicante (ALC), Cologne (CGN), Budapest (BUD) and Schoenefeld (SXF). In a way, their history reflects the trends of LCCs in Europe.

It is possible to identify 16 pioneer airports in the low-cost segment and, likely because of this, they set what became a standard for the kind of ‘LCC’ airport⁴ that some academic literature still refer as a “requirement” for LCCs (Tavalaei and Santalo, 2019). These airports enjoyed a sort of golden era up to the Great Recession. As discussed above, some of them were able to retain a strong position after that, particularly Stansted (STN) – despite the turbulent years of disagreements between its management and Ryanair (2008–2012)–, Luton (LTN), Charleroi (CRL) and Ciampino (CIA) – where additional growth is difficult due to capacity constraints, and to a lesser extent Paris Beauvais (BVA). However, the shift of some carriers (mainly Ryanair) to main airports and the growth of other types of LCCs proved challenging for several of these pioneering airports. For example, Hamburg Lubeck (LBC) bankrupt in 2014, Brescia (VBS) with virtually no passenger service since 2011, and Glasgow Prestwick (PIK), which went back to government ownership in late 2013, Frankfurt Hahn (HHN) continued to lose services after reaching a staggering throughput of 4 million passengers in 2007. The City of Derry (LDY) and Carcassonne (CCF) airports never really took off, they remain rather stable but critically

⁴Uncongested, simple layout, normally single-story buildings with few amenities, but overall, willing to support the nascent business model of new entrants and converted charters.

European airports participation in the low-cost (LCC) market

Source: Own calculations from OAG (2019)
Note: Circle size shows Total seats

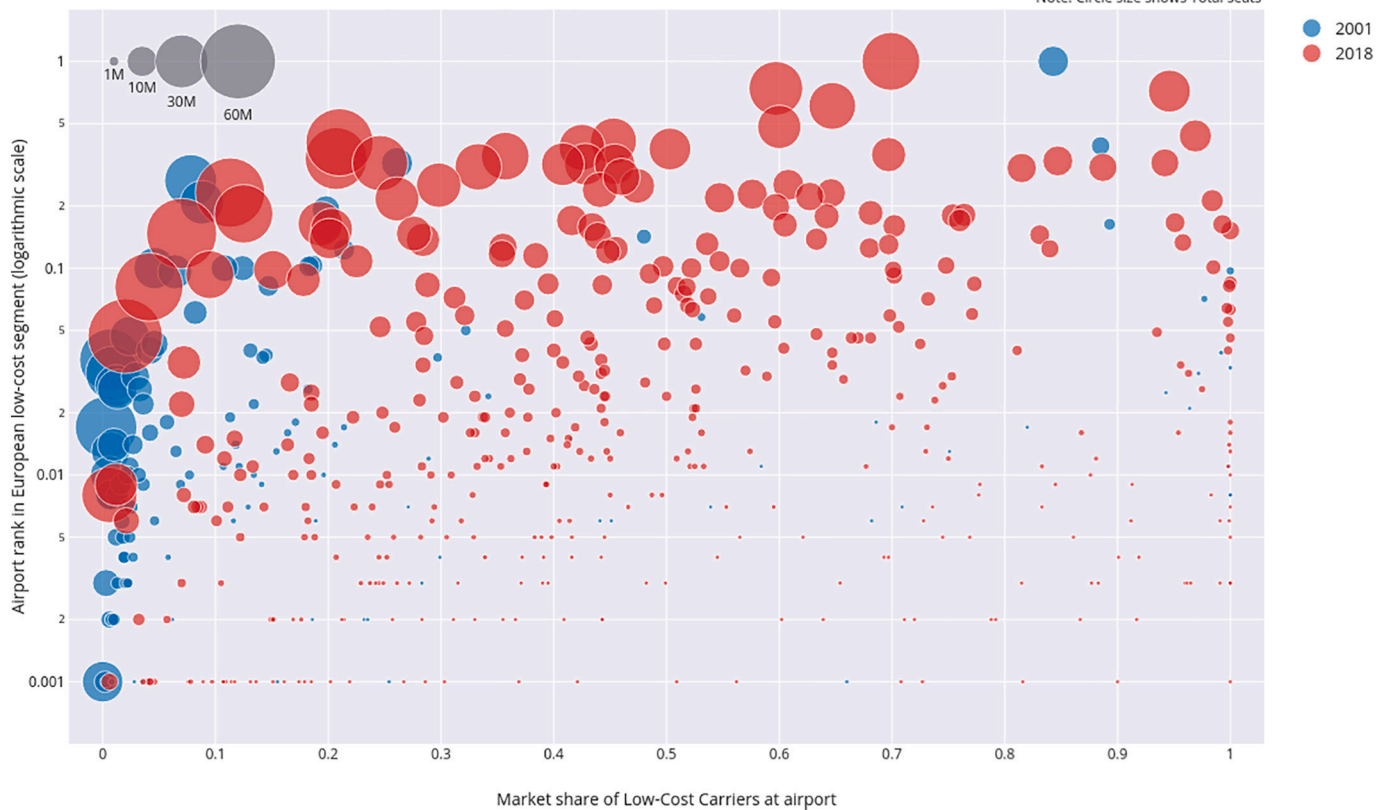


Fig. 4. Participation of European airports in the low-cost segment in 2001 and 2018 (interactive version).

Table 2

Top 25 airports by EU LCA Rank in 2001, 2007, 2013 and 2019.

Source: Own calculations from OAG (2020).

2001				2007			2013			2019		
Rank	Airport	EU LCA rank	LCC market share	Airport	EU LCA rank	LCC market share	Airport	EU LCA rank	LCC market share	Airport	EU LCA rank	LCC market share
1	STN	1.000	84.3%	STN	1.000	88.3%	BCN	1.000	61.9%	BCN	1.000	69.6%
2	LTN	0.390	88.5%	BCN	0.481	29.0%	STN	0.753	95.9%	LGW	0.738	60.8%
3	DUB	0.322	26.1%	DUB	0.466	43.3%	LGW	0.738	49.5%	STN	0.689	94.8%
4	AMS	0.265	7.8%	LTN	0.381	84.1%	SAW	0.604	74.0%	SAW	0.630	65.6%
5	MUC	0.208	8.8%	LGW	0.381	26.8%	OSL	0.458	40.9%	PMI	0.526	68.8%
6	TXL	0.192	19.8%	CGN	0.310	61.7%	PMI	0.369	40.9%	LTN	0.463	97.9%
7	LPL	0.163	89.3%	AMS	0.289	14.1%	BGY	0.367	94.3%	DUS	0.435	56.9%
8	BFS	0.142	48.0%	MAD	0.277	11.0%	LTN	0.365	85.6%	AMS	0.393	20.7%
9	EDI	0.123	21.4%	OSL	0.276	29.3%	DUB	0.355	38.2%	OSL	0.393	44.5%
10	CGN	0.103	18.6%	LPL	0.245	94.3%	AMS	0.338	15.3%	DUB	0.389	43.1%
11	GLA	0.102	18.3%	CIA	0.239	95.5%	AGP	0.335	61.5%	TXL	0.374	52.7%
12	GVA	0.100	12.4%	SXF	0.237	82.5%	MAD	0.331	17.4%	AGP	0.369	72.6%
13	NCE	0.100	10.8%	BFS	0.233	92.8%	ORY	0.325	24.2%	MAN	0.352	44.5%
14	BCN	0.100	4.6%	AGP	0.218	37.0%	MXP	0.313	38.3%	MXP	0.336	39.9%
15	PIK	0.097	100.0%	GRO	0.208	95.1%	CRL	0.305	100.0%	BGY	0.329	93.6%
16	DUS	0.096	6.4%	HHN	0.200	99.5%	ALC	0.286	70.2%	ORY	0.324	36.3%
17	AGP	0.082	14.7%	BGY	0.197	73.5%	CPH	0.286	25.5%	ALC	0.324	83.8%
18	CRL	0.071	97.7%	BRS	0.193	75.2%	GVA	0.258	37.7%	MAD	0.319	19.2%
19	STR	0.061	8.2%	PMI	0.189	21.0%	CGN	0.255	61.4%	FCO	0.308	23.9%
20	DTM	0.058	53.1%	STR	0.188	36.8%	MAN	0.254	27.7%	CGN	0.305	85.8%
21	BRS	0.050	32.2%	EMA	0.187	84.7%	ARN	0.250	25.2%	CPH	0.295	32.8%
22	LGW	0.047	2.4%	CDG	0.183	6.4%	FCO	0.243	14.5%	AYT	0.291	42.8%
23	HAM	0.043	4.6%	ORY	0.182	14.2%	SXF	0.221	78.7%	VIE	0.282	30.3%
24	PMI	0.040	4.2%	GVA	0.180	31.2%	EDI	0.220	48.3%	BUD	0.269	62.5%
25	ALC	0.040	13.1%	EDI	0.167	37.5%	CIA	0.210	100.0%	SXF	0.265	90.1%

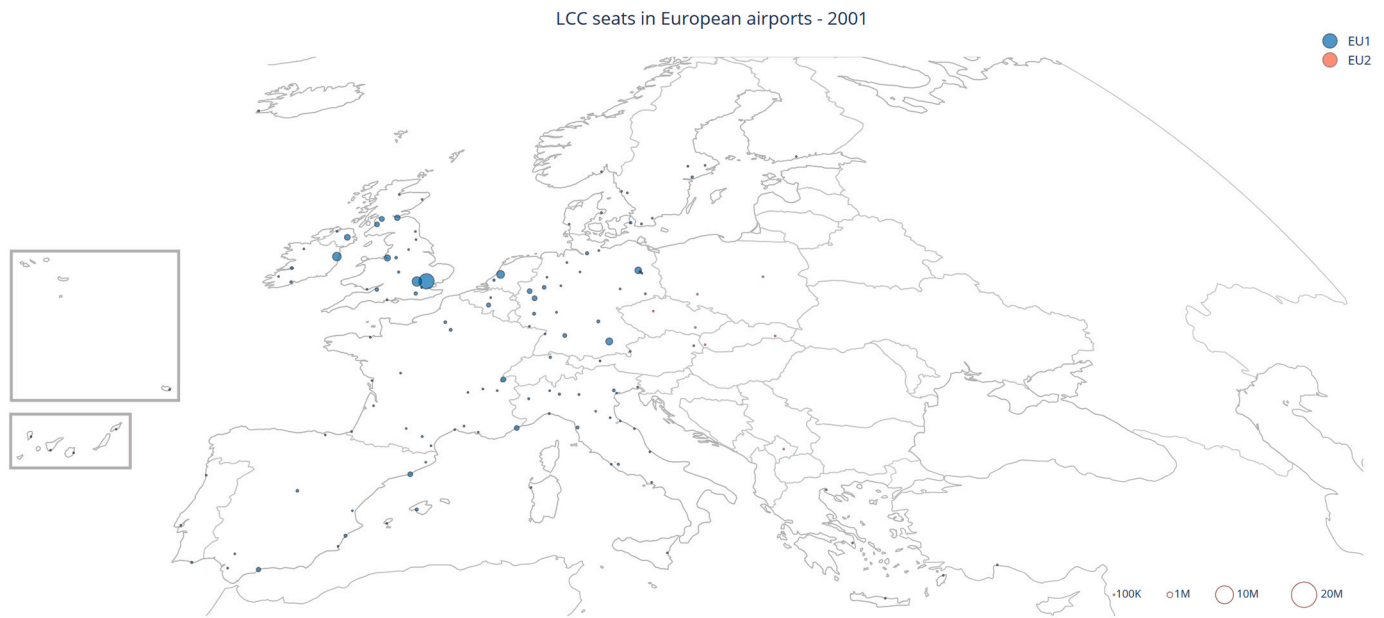


Fig. 5. Geographical distribution of LCC seats across European airports by region – 2001 (interactive version).
Source: Own calculations from OAG (2020).

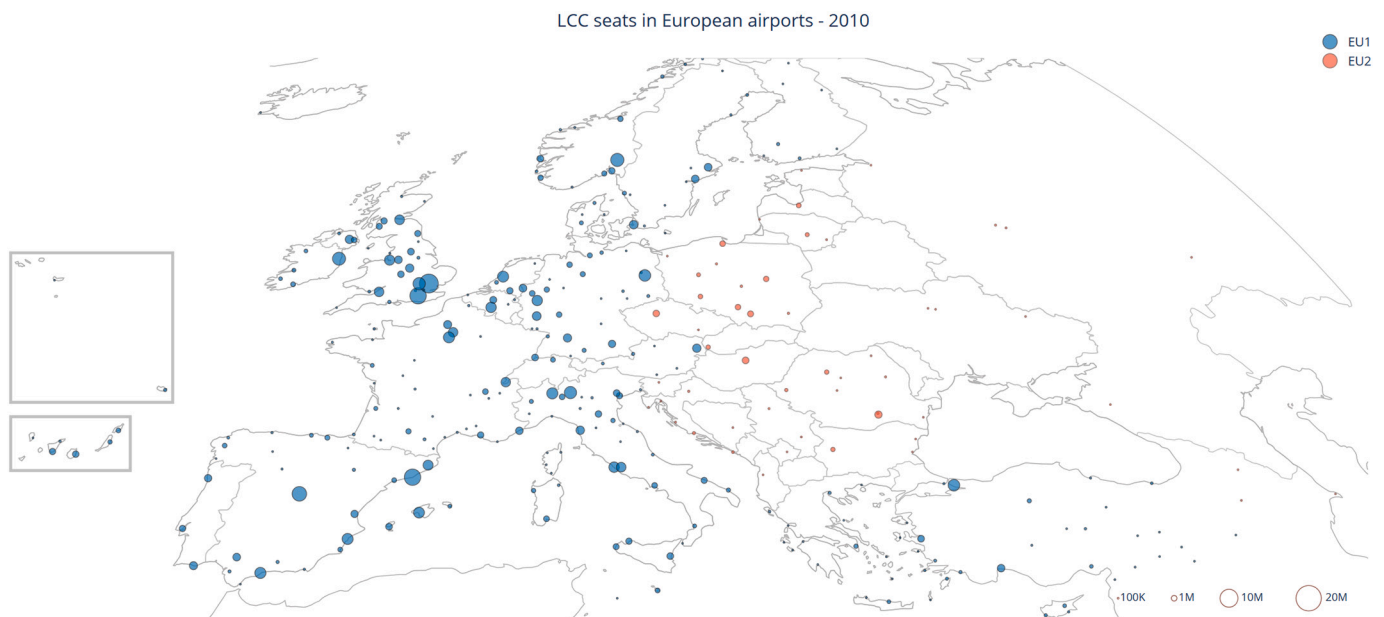


Fig. 6. Geographical distribution of LCC seats across European airports by region – 2010 (interactive version).
Source: Own calculations from OAG (2020).

dependent on Ryanair, especially CCF.

By 2007, there is a surge in the number of smaller airports trying to ride the wave of LCC growth. All the pioneers remained then, except for Brescia (VBS). Bergamo (BGY) took the lead in Italy, Girona (GRO) started blossoming in Spain, Stockholm Skavsta (NYO) and Oslo Torp-Sandefjord (TRF) consolidated as secondary airports for their respective cities, Berlin Schonefeld (SXF) banked on the possibility of becoming Berlin's main airport (whenever Brandenburg airport opens), and expansion started in eastern Europe, particularly in Poland.

By 2013, transition towards larger regional airports is evident. These airports were previously spokes for their respective national legacy carriers, as well as origins and destinations for charter services. It

also marks the rise of Barcelona⁵ (BCN) and Istanbul Sabiha Gokcen (SAW) as leaders in the low-cost market. A small number of secondary cities, traditionally considered regional airports but now large enough to be deemed primary ones, greatly benefited from the expansion of LCCs towards until then untapped markets, such as Porto (OPO) in

⁵ The rise of BCN in the low-cost segment was favoured by the bankruptcy of Spanair and the opening of the Madrid - Barcelona high speed rail that made the high frequency 'air bridge' between the cities redundant. In addition, the opening of a major new terminal, right after the recession, fostered growth for Vueling and created ample space on the previous terminals for other LCCs.

LCC seats in European airports - 2019

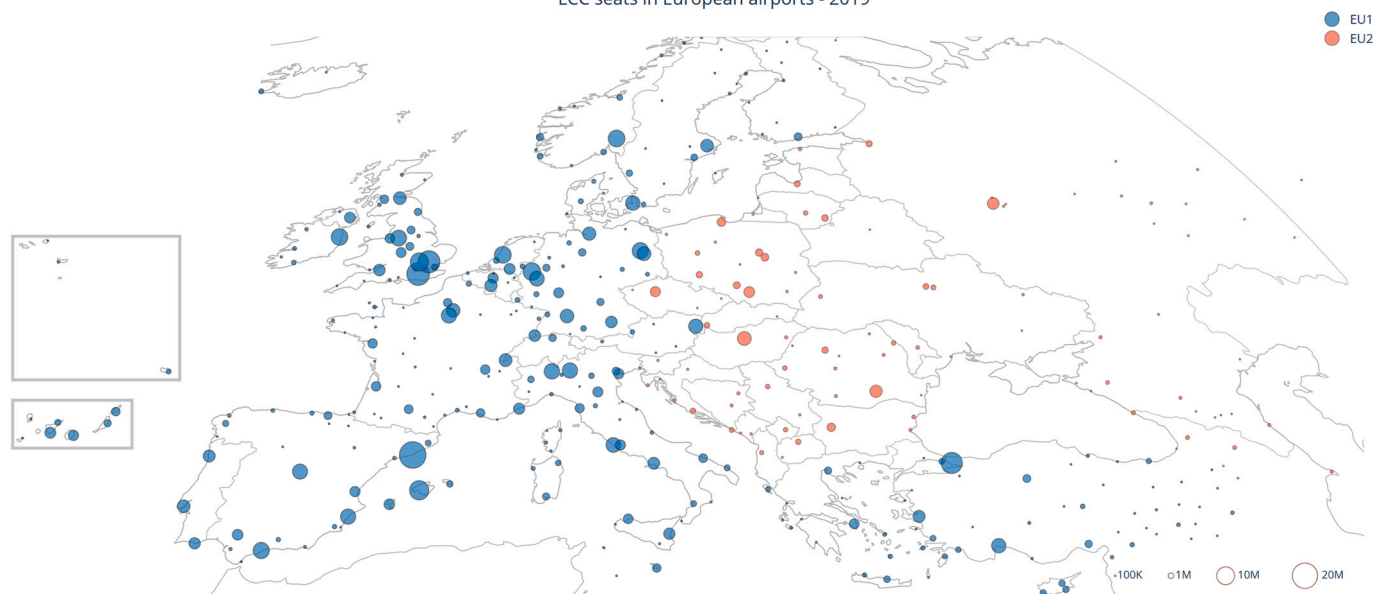


Fig. 7. Geographical distribution of LCC seats across European airports by region – 2019 ([interactive version](#)).
Source: Own calculations from [OAG \(2020\)](#).

Portugal, Valencia (VLC) in Spain, Eindhoven (EIN) in the Netherlands, and Krakow (KRK) and Gdansk (GDN) in Poland. To what we can add the traditional tourist destinations across the Mediterranean, from Faro (FAO) to Cyprus but sparing Greece. Expansion to the East sees Budapest (BUD) gain a significant position after Malev went bankrupt and other airports emerging in Romania.

In fact, some airports were purpose built or redeveloped for LCCs but their fortunes were divergent. Oslo Rygge (RYG) had a short life between 2008 and 2016. Maastricht (MST) had its best year in 2013 but could not really consolidate a stable significant service. Trapani (TPS) in Sicily exemplifies the case of military airports opening to LCCs but not quite securing a significant position either as Ryanair moved to other bases; whilst Warsaw Modlin (WMI) is the other face of the same coin and has gained a significant position by 2018. Naturally, other airports built at the time with the purpose of attracting LCCs have not been able to achieve significant scale, or any growth, such as Beja in Portugal, Logrono, Castellon and Murcia International (finally opening in 2019) in Spain,⁶ or Paris Vatry in France.

By the end of the period of analysis, several large and mostly primary airports joined Barcelona (BCN) in leading the low-cost segment, such as Gatwick (LGW), Dusseldorf (DUS), Stuttgart (STR) and Palma de Mallorca (PMI), along with Bucharest Otopeni (OTP) and Sofia (SOF) in Eastern Europe. Remarkably, and despite the role that LCC traffic has had in growing most French airports, only four airports could be deemed ‘most low-cost’ in France: Nantes (NTE), Paris Beauvais (BVA), Lille (LIL) and Carcassone (CCF). Similarly, even though there is a marked dominance of LCCs in the Mediterranean and the Canary Islands, Mykonos (JMK) is the only airport in Greece with a strong position in both markets. Secondary airports remain ‘the most low-cost’ for Scandinavia, and no airports could reach this denomination for Iceland, Finland, Russia, Estonia, Latvia, Belarus, the Czech Republic, most of the Balkans (except Croatia and Macedonia) and Malta. That is not to say that LCCs have not grown in these locations (see Fig. 7), rather incumbent legacy carriers still hold a significant position, or the market is too small in relation to the whole of Europe.

⁶ Not to mention Ciudad Real Airport, even though it was not planned exactly as a ‘low-cost’ airport.

6. A note on the impact of the response to the Covid-19 pandemic

The 2020 Covid-19 pandemic became the most important disease outbreak impacting air traffic worldwide, significantly diminishing airline activity during the first quarter of 2020. Although the effect of the response to the pandemic is not the main scope of this paper, it is important noting a few relevant aspects in relation to the findings of this research. Early analyses on the impact of Covid-19 on air transport ([Suau-Sanchez et al., 2020](#)) suggest that LCCs have been more resilient than FSNC. LCCs are less exposed to long-haul international traffic, which is crucial for the hub structure of some network carriers and is subject to increased uncertainty about the response from governments around the world, as opposed to regulations within Europe itself.

Indeed, as Fig. 8 shows, the decline of seats supplied during March and April 2020 was much steeper for FSNCs than for LCCs while the recovery trend after lockdown measures and travel restrictions started easing in Europe by July 2020 look similar for both types of carriers. During April 2020 the supply of LCCs and FSNCs was practically the same at a level of 7.8 million seats each, which brought the market share of LCCs to 49.7%, compared to 38.7% for April 2019. By May 2020 LCCs provided 54.0% of total capacity in Europe. This data, nevertheless, does not consider load factors that were presumably very low during the peak of the pandemic in Europe. This is particularly important as Wizz Air suddenly became the largest airline in Europe during April 2020, and London Luton (LTN) the seventh largest airport (see Table 3). Similarly, as the pandemic spread unevenly across all geographies, with Russia and parts of eastern Europe experiencing a raise in cases much later than central and western Europe, some LCCs may prove more resilient as their denser networks provide more opportunities across a larger number of routes.

In addition, [Albers and Rundshagen \(2020\)](#) suggest that the heterogeneity of government bailout packages in Europe could affect the level playing field and compromise the efficiency, innovation and service quality of ‘flag carriers’, which could give an advantage to independent LCCs. In addition, there is the belief among industry experts that LCCs will focus on the larger markets, where volumes of passengers and yields are higher, and reduce their activity in the smaller airports ([Suau-Sanchez et al., 2020](#)). This would likely maintain the trends in the markets as seen in the analysis in this paper, rather than pose a

Available seats per month and airline type

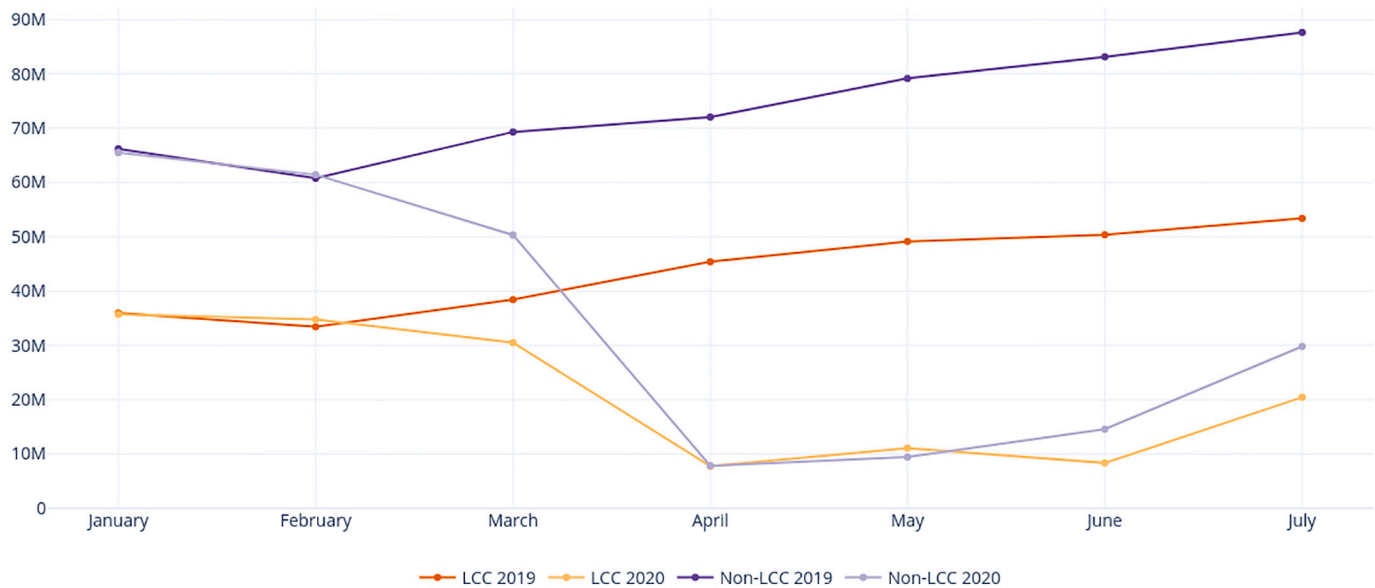


Fig. 8. Available seats by airline category during the Covid-19 pandemic in 2020 as opposed to the same period in 2019. Source: OAG (2020).

Table 3

Top 10 carriers and airports in Europe by seats provided in April 2020. Source: OAG (2020).

Rank	Carrier	Seats	Rank	Airport	Seats
1	Wizz Air	2,511,421	1	VKO	546,577
2	Ryanair	1,154,034	2	DME	520,211
3	Pobeda	994,707	3	SVO	487,570
4	Aeroflot	865,824	4	LHR	459,485
5	Easyjet	843,954	5	LED	382,955
6	S7	486,682	6	AMS	346,996
7	Pegasus	484,235	7	LTN	320,711
8	SAS	406,712	8	CDG	309,313
9	Lufthansa	353,573	9	FRA	305,916
10	Wideroe	331,478	10	OSL	294,098

disruptive change.

7. Conclusions

The analysis presented in this paper reveals that primary, secondary and regional airports have all supported the growth of low-cost carriers in Europe, though over time the focus has shifted. There are two clearly defined phases that reflect that change, expressed in a transition from secondary and regional to primary airports as the main suppliers of LCC seats. The breaking point between the two phases coincides with the end of the global financial crisis of 2007–2008, signalling to the potential effect of the recession on market demand, on the strategies for airlines, both LCC and FSNC, and on the management of airports. During the first phase (2001–2008), underutilised airports represented an opportunity for the growth of LCC start-ups and secondary, and regional, airports emerged. While primary airports hosted converted charters and legacy spin-offs where parent companies already operated.

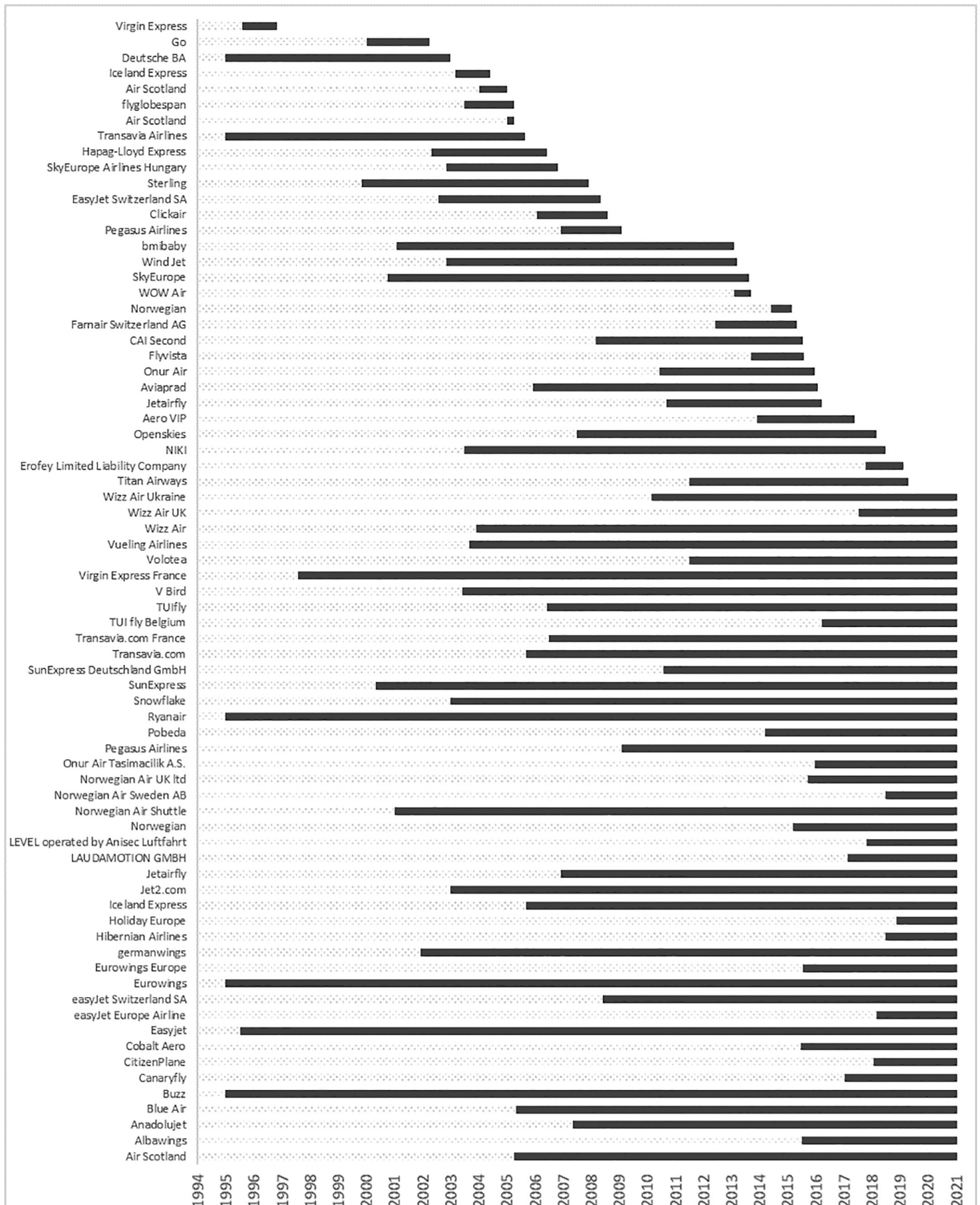
Secondary airports that pioneered in the low-cost segment in the early 2000s eventually became a standard for the kind of airport that

academic literature still considers a “requirement” for LCCs. However, with virtually all airports having come LCC services (only a handful of commercial airports in Europe had less than 10% market share by LCCs in 2019), it seems evident that an airport’s character as primary, secondary or regional is not as relevant as it once was for low-cost services. This finding may be particularly interesting for other world regions, such as Latin America, Asia and Africa, where secondary airports are not widely available but where the low-cost market has started to develop. It also extends the findings in recent research that was restricted to smaller samples or cases (Dobruszkes et al., 2017; Dziedzic and Warnock-Smith, 2016) and, hopefully, contributes to reinterpreting the role of all types of airports in the expansion of LCCs in Europe.

However, the shift of LCC growth towards primary airports in Europe, including that of long-haul low-cost airlines, is beginning to exacerbate the capacity constraints at major airports. This has left available capacity at many smaller secondary and regional airports. Will this opportunity have the same effect upon LCC operation as it did in the early 2000s? Could new disruptive business models emerge, especially considering the convergence between LCC and FSNC models, and the resulting hybridisation in the intra-European market (Ahmad et al., 2018; Fageda et al., 2015; Klophaus et al., 2012)? This is a particular concern for smaller airports that are more susceptible to shifts in airline strategies (Dziedzic et al., 2019).

The current socio-political context differs from the early 2000s. The increased awareness of the effects of climate change and the impact of aviation on global warming and air quality may increase pressure to cut subsidies, especially at secondary and regional airports, and introduce taxation or other financial measures to limit the growth of commercial aviation. On the other hand, this could also foster the development of small electric or hybrid aircraft that could use capacity at secondary airports and drive political will to sustain subsidies for clean air transport.

Appendix A. Timeline of Low-Cost Carriers in Europe as classified by OAG



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