

REBUILDING AIRLINES NETWORKS IN THE POST-COVID-19 ERA: NEW NETWORK CONFIGURATIONS IN EUROPE?

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Abstract

After the standstill generated by the COVID-19 outbreak, airlines were forced to adapt their operations and strategies to the new market requirements and constraints both in terms of supply and demand. The initial recovery included many short-term decisions for survival. Yet, as the market recovers, sometimes in new forms, airlines are rebuilding their networks for a new long-term future. In this chapter, we compare the pre- and post-pandemic network configurations of a selection of European airlines using a combination of network structure, topology, and connectivity indicators, which help understand airlines' network economics. As a general trend, low-cost carriers have recovered faster than full-service ones, in many cases already exceeding pre-pandemic supply volumes. However, our study shows the high heterogeneity of responses and post-pandemic network structures across business models. While some airlines have kept very similar structures, adapting to the demand change, some have opted for a bolder strategy, already growing their networks compared to pre-pandemic levels. Also, in some cases, new regulations or other external events have forced the changes in networks. Finally, although data still showed long-haul markets a little behind compared to pre-pandemic figures, signs such as the continued passenger increase and the ramp up of aircraft orders by airlines point towards a full recovery leading back to a sector based on continued traffic growth.

Keywords

COVID-19; Aviation; Crisis Recovery; Airline Networks

1. Introduction

There is no precedent in recent history of such a severe and widespread health-related global crisis like the one caused by COVID-19. With a calculated total number of deaths caused by the virus of almost 7 million (World Health Organization, 2023) and a GDP drop of 5% in 2020 alone (United Nations, 2020), the social and economic impacts have been devastating. Likewise, the crisis has drastically impacted commercial aviation

(Suau-Sanchez et al., 2020), with a decrease of 50% in the number of seats offered and revenue losses of over 370 billion USD for airlines in 2020 alone (International Civil Aviation Organisation, 2022). Both airlines and governments had to respond quickly to minimise the crisis's effects, which resulted in a prolonged decline in demand. Recovering from such a profound shock and restoring the entire value chain to operation has proven challenging. In this context, this chapter aims to identify significant strategic changes made by airlines in their network configurations and understand the reasons behind them.

Despite the large impact of COVID-19 on aviation, when writing this book chapter, there is optimism regarding the global traffic volume, as it is expected to recover fully. According to IATA (2022), most regions are anticipated to return to or exceed pre-pandemic traffic levels by the end of 2023. In OECD countries, domestic traffic had already returned to pre-pandemic levels by the end of 2021 (OECD, 2022).

As the spread of the pandemic has been contained, we have entered a new period in which the constraints for airlines related to COVID-19 have been lifted. This period marks the establishment of a "new normal in commercial aviation operations, providing an opportunity to assess airlines' recovery and examine how the sector has transformed. Most recovery analyses focus on traffic volume (Czerny et al., 2021; Gudmundsson et al., 2021; Michelmann et al., 2023; Sun et al., 2023); however, we need more knowledge on how airlines are configuring their networks to reach 2019 traffic levels. In this study, we aim to evaluate the post-pandemic recovery of European airline networks and analyse the strategies they adopt in their operations. We will also investigate whether any aspects have permanently changed or if the sector is reverting to pre-pandemic "business as usual".

It is worth noting that the configuration of airline networks, encompassing the destinations, schedules, and routes, plays a critical role in their strategies and business models. It affects not only capital and operational expenditures but also has implications for regional economies, such as job creation (Goedeking, 2010) and competitive advantages (Bel & Fageda, 2008). Therefore, our analysis will focus on two perspectives: first, an examination of general trends in the aviation sector at the aggregate level, and second, a closer look at how individual airlines have reshaped their operations pre and post-COVID-19.

The chapter's structure is as follows: Section 2 reviews existing literature on pandemic recovery in the aviation sector and airline networks. In Section 3, we present the methodological framework. Section 4 discusses results and implications from three

points of view: an assessment of the entire post-pandemic European aviation commercial network, a deeper analysis of different business models and market segments, and an airline-specific focus. Finally, Section 5 summarises the main conclusions and suggests potential areas for further research.

2. Literature review

2.1. Networks as critical elements of airline strategies

Airline networks have been researched from different perspectives; a few examples follow. Some studies focus on defining an optimal network structure. A study on the Western European market (Adler & Berechman, 2001) evaluates the most profitable hub-and-spoke network, finding that a two-hub network with one major international hub and a secondary hub is the preferable solution. Flores-Fillol (2009) assesses the effect of deregulation on airline networks, concluding that hubbing strategies are preferable in the context of low transportation costs. Additionally, Fageda & Flores-Fillol (2015) consider the impact of congestion in airports in the definition of networks, showing that airlines prefer hub-and-spoke configurations even if it implies higher social costs. Other studies compare airlines using hub-and-spoke and point-to-point networks (Marti et al., 2015), finding, in a study about Spain, that airlines operating a hub-and-spoke network are less efficient. Relevant to the study of the impact of COVID-19, Lordan et al. (2014) review the literature on the robustness of airline route networks to unexpected external events, concluding that besides the incipient works from a theoretical perspective, more applied studies should be conducted. Voltes-Dorta et al. (2017) study the impact of airport closures on air transport networks in terms of passenger delays, finding the impact to be greater in airports with higher non-alliance traffic. The environmental costs of using a hub-and-spoke network are studied by O'Kelly (2012), introducing the role of public policy instruments such as carbon taxes to influence network definitions decisions by airlines.

The relevance of studying airline networks is that, at a more fundamental level, the success of an airline business relies on its network and efficient operation, as they determine the economies that can be generated. In particular, network economies, which encompass density, scope and scale economies, are crucial in this context. Density economies arise when the marginal cost of transporting an additional passenger on a nonstop route falls as traffic on the route increases. This involves operating large volumes of traffic in point-to-point markets or using trunk routes with two hubs (dog-bone

networks), which have long been considered essential in the airline industry (Brueckner et al., 1994; Caves et al., 1984). Similarly, scope economies reduce unit costs by offering two or more related services jointly instead of separately (Holloway, 2008). They come into play when airlines offer different products (origin-destination markets) through the same route. This encourages the development of trunk routes that combine various products by providing connections at a hub, thus aiding density economies. Hence, the combination of density and scope economies enables airlines to reduce unit costs by utilising larger aircraft and serving origin and destination (OD) markets with lower demand that would otherwise be unsustainable. Furthermore, scale economies reduce unit costs by spreading out fixed costs over more units of output, considering the additional output can be sold at a profit (Holloway, 2008). Hub airports or airport bases enable them and play a critical role in determining the size of operating bases, the network structure, and the allocation and utilisation of resources (Burghouwt, 2016).

These network economies are essential in defining airline business models, understood as how a company operates and creates value for its stakeholders (Casadesus-Masanell & Ricart, 2010). The economics push airlines to build hub-and-spoke networks that are a key element of full-service network carriers (FSNC), the traditional and, for a long time, widely predominant business model. However, low-cost carriers (LCCs) present a challenge to this model by operating less complex point-to-point networks, which require lower traffic densities to remain economically viable and reduce overall operational costs (de Wit & Zuidberg, 2012; Fageda et al., 2015). LCCs primarily target leisure travellers who prioritise affordable prices and are less concerned about factors like flight frequency or onboard amenities. LCCs introduce additional revenue streams through ancillary services to compensate for lower fares. These services include seat selection, baggage fees, priority boarding, and in-flight food and drink purchases (Magdalina & Bouzaima, 2021).

However, classifying airlines into two discrete business-model categories does not reflect to its full extent the complexity of the actual airline spectrum (Lohmann & Koo, 2013; Magdalina & Bouzaima, 2021; Mason & Morrison, 2008). The definitions of business models become blurred as airlines incorporate features prototypical of either model based on their specific needs and strategic choices (de Wit & Zuidberg, 2012). This hybridisation of business models (Lohmann & Koo, 2013; Magdalina & Bouzaima, 2021; Mason & Morrison, 2008) is also reflected in network structures. Some of the low-cost carriers do offer connections in their main bases. Also, the exclusive use of secondary airports, which

used to be a typical characteristic of LCC such as Ryanair or Wizz Air, is no longer the norm (Jimenez & Suau-Sanchez, 2020). Additionally, some try to attract business travellers by clustering several arrival and departure times and increasing frequencies to offer more convenient connectivity. Thus, each airline defines a tailor-made model and network that better suits its needs and allows it to better compete in the markets they operate.

2.2. COVID-19 and networks

The COVID-19 pandemic has been the most significant crisis in aviation history, prompting extensive research to comprehend its implications from various perspectives and disciplines (Sun et al., 2022). The research concentrating explicitly on the pandemic's effect on airline networks is particularly relevant to our study.

Li et al. (2021) studied the spatiotemporal variation of the worldwide air transportation network (WATN) induced by COVID-19. They highlight the significant difference among network performance in different countries and regions linked to the different intensities at different times and diversity in prevention policies. Zhou et al. (2021) also study the WATN in the context of the pandemic but with a focus on airports and considering different levels of disruption. They find that the critical connections are mostly between bridge airports. That is, the nodes connecting a hub and a peripheral node do not often have the redundancy in connections of hubs, providing them with robustness. Sun et al. (2020) conducted a study on the impact of COVID-19 through the lens of complex networks at different levels: worldwide airport networks, international country networks, and domestic airport networks. Relevant from a social and health perspective, they identify a delay in the reaction of the aviation industry of about two months, which, in hindsight, due to the role of air travel as an infection vector, meant missing the opportunity to contain the virus and avoid it becoming a pandemic.

From an airline perspective, Ye et al. (2023) studied the impact of COVID-19 on the world airline network, assessing its robustness and the risks of failure for airlines. They find the higher vulnerability of airlines that do not operate routes as a monopoly and thus compete in the same segments with other airlines. They also assess different demand recovery scenarios and how each would impact airlines differently. Other studies from an airline perspective focus on specific regions or countries. For example, Sugishita et al. (2024) studied the US domestic airline network during the pandemic, finding that FSNC were less flexible in terms of adjusting their networks than regional and LCC, which made

quick changes which allowed them to contain better revenue losses (Fontanet-Pérez et al., 2022). Focusing on Europe's three main LCCs Zhang et al. (2023) conducted a study comparing the networks of Ryanair, EasyJet and Wizz Air before and during the pandemic. Their assessment shows the airlines competing with each other by increasingly expanding their networks into markets which incumbent LCCs had served.

However, most existing literature on networks and COVID-19 primarily concentrates on the pandemic period. To the best of our knowledge, there is, to date, only one study by Sun et al. (2023) that utilises post-pandemic data to evaluate the impact on the air transport networks after the pandemic. The study employed passenger numbers and load factors before and after the pandemic to identify various types of markets based on their recovery levels and spatiotemporal characteristics, revealing a heterogeneous recovery pattern across markets. In this regard, differences among regions are observed, with Asia recovery being slower than in other regions. Also, domestic markets recovered faster than international ones. In our research, we also contribute to the post-pandemic assessment using data from both pre and post-pandemic periods, but with a specific focus on airline networks. This approach allows us to examine how different airlines with distinct business models have restructured their networks and the subsequent implications for the post-pandemic European airline industry. By analysing these network operational strategies, we aim to gain insights into the recovery process and potential transformations in the industry following the pandemic.

3. Methodology

Our study analyses the operation of airlines in Europe in two different periods, September 2019 and September 2022. The first period represents the pre-pandemic period, while the second is the post-pandemic's beginning. The comparison of the two periods allows us to assess how the sector has changed after the pandemic. As the COVID-19 crisis affected different regions with different intensities at different times and the policies implemented in response were also different, the study focuses on airlines based in a specific region, Europe, to enhance comparability (Fontanet-Pérez et al., 2022). The analysis is based on data from September 2019 and 2022, as it is considered the month that better represents the operation's average, leaving out the peaks of the high season and the periods with the lowest activity.

To carry out our study, we use data on routes operated in 2019 and 2022 from the Official Airline Guide (OAG, 2022) database, which provides disaggregated data at the airline

and route levels. The original data set displays 161 airlines based in Europe that operated in either or both periods. However, of these, only 98 operated in both periods. Operations from non-European airlines have only been considered for the general market analysis regarding supply and for assessing competition but are not considered in the specific analysis of airlines.

Although, as mentioned above, the number of operators based in Europe active in both periods is almost one hundred, the market share shows that a much smaller number of airlines operates most flights. Therefore, the studied airlines have been ordered from biggest to smallest to include in the analysis only those accounting for 90% of total seats offered in September 2022, which leaves us with a sample of 27 airlines that are the ones that were considered for the business model and airline-specific assessments.

Regarding ownership, the European airline market comprises a few large groups, some large independent airlines and some smaller actors. Thus, the Lufthansa Group¹, the International Airlines Group² (IAG) and the Air France-KLM³ Group aggregate a large number of operators and of the total market share. However, each group has different airlines with their brand, strategy and business model. Hence, our analysis takes each operating airline as the unit of analysis, not the groups. When relevant, though, the group perspective has also been considered. When comparing differences between business models, weighted averages have been used to accurately represent each airline's market share. Also, considering the different airline sizes, the analysis used percentage variations between the two periods, thus facilitating the comparison between airlines.

Our work focuses on studying airline networks through a selection of network structure, topology and connectivity indicators that allow us to conduct a granular analysis of airlines' supply from which different relevant aspects of changes in their strategies and implications for business models can be derived. In this context, the measurement of supply volume involves considering the number of total seats and available seat kilometres (ASK). To assess the size and configuration of networks, the analysis incorporates the number of nodes in the network of each airline and the count of OD pairs. These networks are further categorized into short-haul, medium-haul, and long-haul flights, allowing for a comprehensive examination of different market segments over time. To enhance insights into connectivity and supply for specific markets, the number

¹ The Lufthansa Group includes Lufthansa, SWISS, Austrian Airlines, Brussels Airlines and Eurowings.

² IAG includes British Airways, Iberia, Aer Lingus, Iberia Express, LEVEL and Vueling.

³ Air France-KLM Group includes Air France, KLM and Transavia.

of weekly frequencies is also taken into account. In cases where airlines operate multiple types of fleets, information on the size of the aircraft used, in conjunction with frequencies, provides pertinent data on variations in supply strategy. Lastly, changes in the type of markets airlines opt to operate in are analysed by considering the number of competitors per route.

Analysing these variables allows to identify different potential strategies to be pursued by airlines both to face the impact of the pandemic and to manage the recovery. In this regard, one strategy can be to modify the supply volume. This can be done by reducing (or enlarging) the size of the network, discontinuing (starting) service between some of the existing nodes, or reducing (increasing) the number of frequencies or seats offered. Another strategy might be reconfiguring the network, no longer serving some destinations but starting to serve new ones. This may include also changing the role of some nodes that can, for example, become bases with greater connections. Observing the data from this perspective also allows for identifying some of the abovementioned network economies that the specific strategy might contribute to generating.

3. Results and discussion

3.1 Looking at the broad picture.

The comparative analysis of the European commercial aviation network at the aggregate level gives us a global perspective of the state of play in the early post-pandemic. Traffic in Europe in September 2022 was still 17.7% lower than in the same month in 2019 in total ASKs and 13.28% lower in total seats offered. The lower percentage of ASK compared to seats confirms that shorter-haul traffic is recovering faster than long-haul traffic. However, current trends and analysis seem to converge in the confidence of an imminent full recovery of pre-pandemic traffic figures. At the moment of writing, in spring 2023, EUROCONTROL monitoring data showed the total number of flights to be just under 10% lower than in the same period in 2019 (EUROCONTROL, 2023a). In line with our analysis, EUROCONTROL's data also showed that domestic and intra-European routes recovered faster than long-haul routes (EUROCONTROL, 2023b)

Regarding the market size by the number of active operators, we find an almost equal figure in the two periods (294 in September 2019 vs 292 in September 2022). However, these airlines are different in both periods. Some carriers could not survive the sudden drop in demand caused by COVID-19, while some new ventures emerged as the effects

of the pandemic were winding down. Of the total number of airlines that flew in either or both periods, 235 operated in both, 59 only in 2019 and 57 only in 2022. This means that although the number of operators is similar, the commonality in both periods is 79.93% and thus, 20.07% of operating airlines are different from one period to the other. Comparing this data with that from previous years, we find that this variation of around 20% in three-year periods is not uncommon. However, the market share of airlines operating in only one period differed. Whereas airlines that ran only in 2019 accounted for 4.12% of the total seats in the market, for those operating only in 2022, it was 2.62%. Thus, we observe a slight increase in market share by incumbent airlines.

Also relevant in terms of analysing European commercial air transport is the market concentration perspective. Regarding airports, using the Herfindahl–Hirschman index (HHI)⁴, we can appreciate no significant variation between the two periods. Some differences might be observed in specific airports, but the general picture stays the same as airports' traffic volumes, and distribution is very much linked to population distribution (Suau-Sanchez et al., 2014). Regarding airlines, however, we observe a slight decrease in competition with an HHI in September 2019 of 291.13 vs 358.23 in September 2022. In this regard, market concentration in aviation after sector crises seems to be the norm and has been observed in the past, for example, in the 2008 economic downturn (Calzada & Fageda, 2014).

3.2. Differences by airline business model.

Further delving into the data, we can observe the differences in both periods in terms of traffic volume per type of operation (long, medium or short-haul⁵) and among different business models (Table 1). When looking at the evolution by type of operation, we can verify how long-haul travel was still significantly below the levels of the other types of travel, with an evident recovery of medium-haul and short-haul, almost at 2019 levels.

⁴ The Herfindahl–Hirschman is a market concentration measure that helps determine market competitiveness. It is calculated by squaring the market share of each firm participating in the market and then summing the results. The lower the index the closer to perfect competition with a maximum score of 10.000 which would indicate a monopoly. A market with an HHI under 1,500 is considered competitive, between 1,500 and 2,500 moderately concentrated and above 2,500 highly concentrated.

⁵ As defined by EUROCONTROL Short-haul flights are those with a length up to 1.500 km, medium-haul comprises flights between 1.500 and 4.000 km and flights beyond 4.000 are considered long-haul <https://www.eurocontrol.int/publication/eurocontrol-data-snapshot-18-56-lower-emissions-53-less-flights>

Table 1. Variations in total seats offered by business model and type of operation between pre- and post-pandemic periods (09/2019 vs 09/2022). *

Airlines by business model	All		Long-haul		Medium-haul		Short-haul	
	Δ 9/2019- 9/2022	S. Dev	Δ 9/2019- 9/2022	S. Dev	Δ 9/2019- 9/2022	S. Dev	Δ 9/2019- 9/2022	S. Dev
All Carriers	-5.33%	21.06%	-16.65%	19.71%	4.05%	24.71%	-3.41%	32.58%
Full-Service Network Carrieris	-17.92%	17.96%	-19.78%	10.39%	-10.54%	24.17%	-15.38%	39.34%
Low-cost Carriers	5.40%	19.05%	-	-	13.10%	23.30%	5.58%	23.91%

* The variation is calculated as the average difference in the two periods weighted by the market share of each airline in seats offered.

Data source: OAG.

If we look at the data by business model, we can observe how FSNCs, in general, were still struggling with an important part of their activity being dependent on the long-haul travel demand. In contrast, the aggregate data for LCC suggests that these have already exceeded pre-pandemic numbers in the medium and short haul⁶. As per leisure-focused airlines, only two of them are included in the studied sample, Condor and TUI, so the analysis at the aggregate level for this business model type is not appropriate. In both cases, they were still operating substantially below pre-pandemic levels.

3.2.1 Supply variations

Next, we considered different relevant parameters regarding network and operations to conduct a more nuanced comparison of airlines' operations in the two periods. In Figure 1, supply is represented through the total seats offered in the period. Also, the size and connections within each airline's network are presented through the variation in the number of nodes served and the number of OD. These results help visualise how the variation of operations depends on three variables: the number of airports in the network, the number of routes connecting these airports, and the number of seats offered for each airport pair. Where the variation is proportionally larger in the number of destinations, the network has been enlarged (or shrunk) more in terms of connectivity than in size. Examples of airlines shrinking their networks via the number of destinations are Air France, TAP, Air Europa and Virgin. As for airlines enlarging their networks via denser connections among existing nodes, we find the Ryanair, Transavia

⁶ For LCC long-haul, data is not presented as only a small number of airlines operate this type of travel and, for most of them, it represents a marginal share of their total operations.

and Wizz Air cases. Although less frequent, when the variation in nodes is larger than that of OD, the size of the network has played a more prominent role either by increasing or reducing it. Examples of this strategy are British Airways and Vueling, which have both discontinued service from some of their former nodes. In contrast, Icelandair or Jet2 have slightly higher increases in the number of nodes compared to the number of destinations. Finally, when the main variation is in terms of total seats offered, the strategy has been more centred on adapting the supply via the number of frequencies and the capacity of the planes used. This has been a common strategy to reduce supply and can be best observed in the cases of Lufthansa, Swiss, SAS or Easyjet. The data presented in Figure 1 confirms the faster recovery of LCC airlines, with four of the five airlines already offering supply levels above pre-pandemic times belonging to this business model. Also, we observe how the trend in supply volume, number of nodes and OD are aligned in most cases. However, in some cases, substantial differences suggest more deliberate strategy changes that are further analysed and interpreted in the next section.

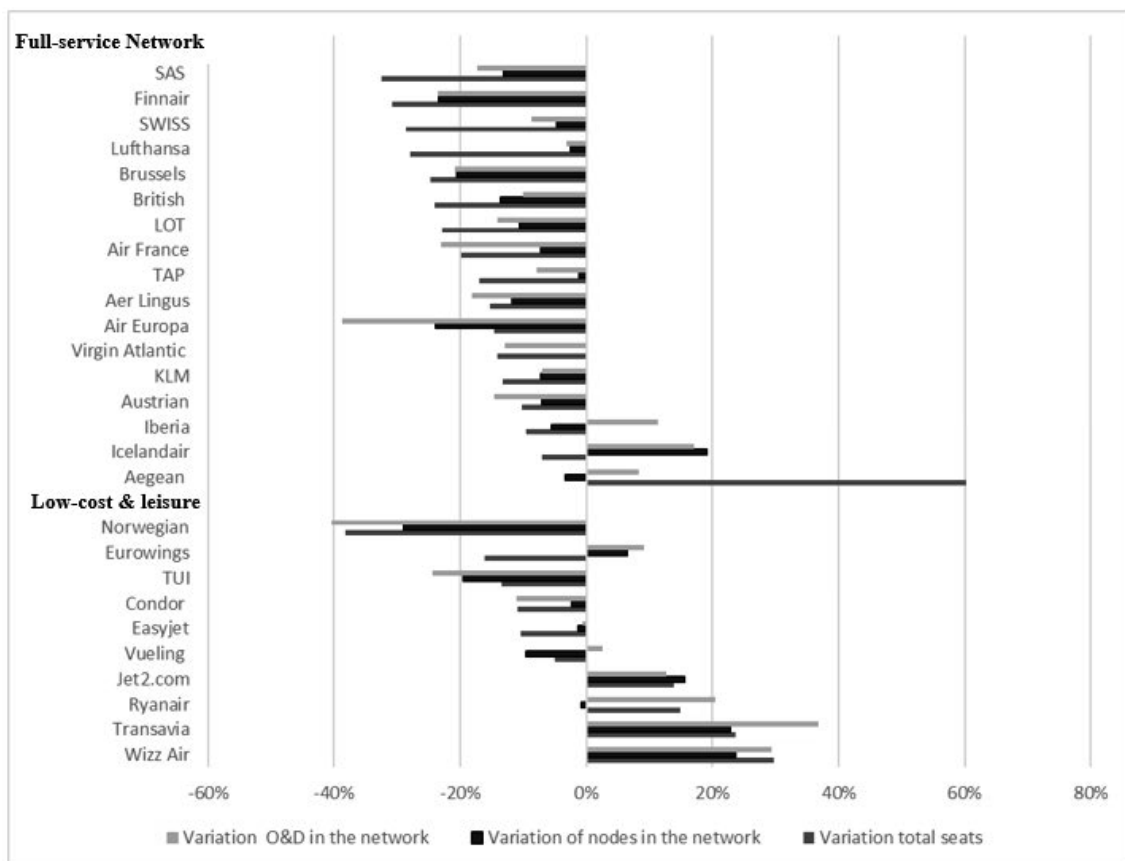


Figure 1. Variation in supply (09/2019 vs 09/2022).

Data source: OAG.

Figure 2 provides further details on supply variations by reflecting the change in the number of frequencies and the average size of planes used. Changing frequency numbers allows airlines to adjust demand and distribute aircraft use within the network. These changes, though, require considering external constraints such as slot availability in main airports. In terms of fleet, however, strategy changes can hardly be made in a short period. The availability of new aircraft and lease commitments often require long-term planning. Nevertheless, there is room for tactical changes within the existing fleet and its use. In line with this, comparing the two periods in our data set shows more frequency variations than average aircraft size. In general, most airlines still operate fewer frequencies than in the pre-pandemic period, but there is no clear business model pattern. What can be observed, however, is that for many airlines with lower frequencies, there is an increase in the average aircraft size. The most prominent examples are Eurowings, Austrian, Wizz Air and Air France. A general interpretation could go in the direction of airlines compensating for flying less often by providing more seats on each flight. Alternatively, it could show a shift towards longer haul destinations requiring bigger aircraft. Yet again, it is worth conducting individual assessments better to understand the underlying causes and decisions behind this data.

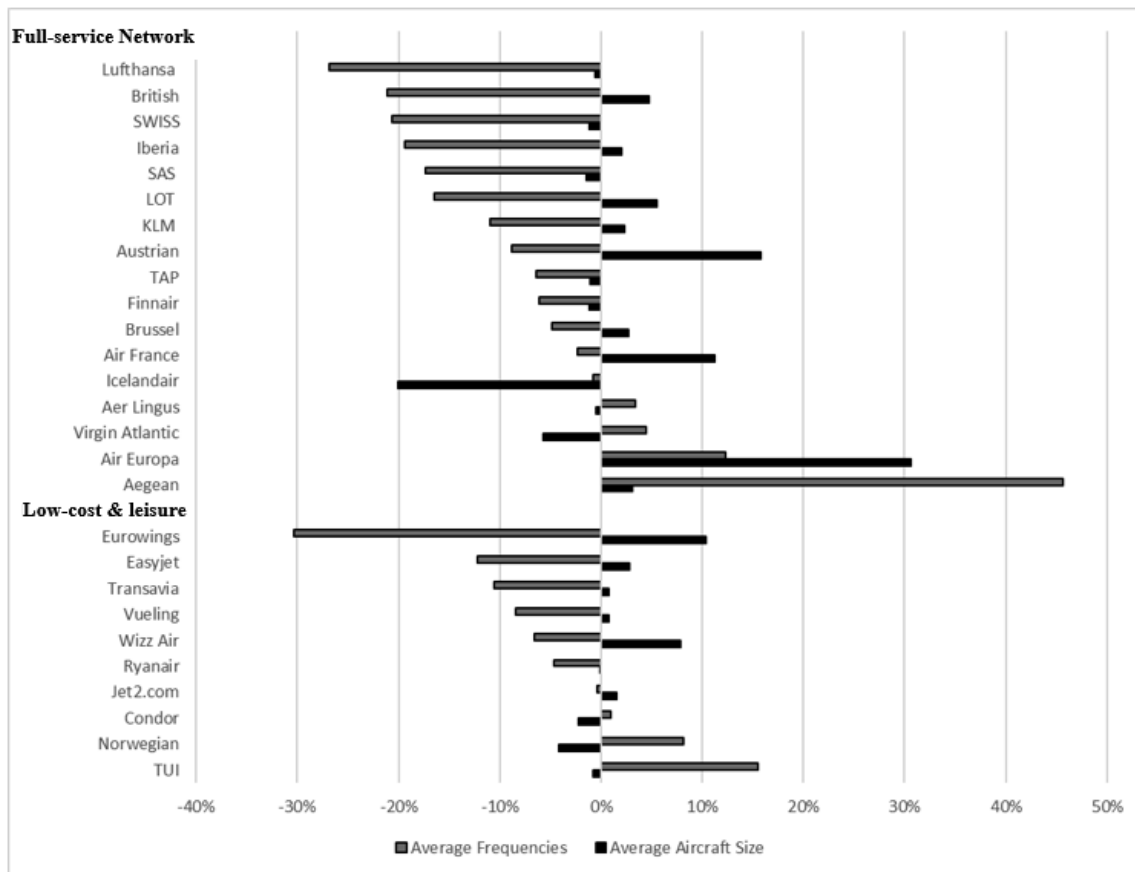


Figure 2. Variation in frequencies and aircraft size (09/2019-09/2022)*

Data source: OAG

* The average aircraft size is calculated using the number of seats offered in each flight

3.2.2. Competition and commonality of networks

Another factor considered has been the levels of competition airlines face in the different markets where they choose to operate. In this regard, Table 2 shows each airline's routes clustered by the number of operators and the variation between the two periods. Traditionally, some airlines have tended to operate routes with higher demand, so they often must compete with other airlines. In contrast, others focus more on thinner routes, sometimes to secondary airports, where they frequently operate in a monopoly. Often, airlines' strategies are made up of a combination of both. However, what is relevant for our analysis is not so much classifying different airlines according to their approach to the selection of routes but observing whether changes in strategy can be observed within the same airline in the two assessed periods. Results are ordered based on the variations in the number of monopoly routes. The table shows slightly higher variability in FSNC than in LCC, but no clear general pattern emerges from the data. On one end, Lufthansa and British Airways are leading the increase in the quantity of monopoly routes,

considering data in Table 3, which shows no increase in new routes. This can mainly be due to other airlines discontinuing certain routes where they competed. On the other end, Aer Lingus and Wizz Air show the most significant decrease in the share of monopoly routes. In the case of Aer Lingus, it seems to be a result of the decline of destinations. In the case of Wizz Air is the result of the expansion strategy further discussed in the next section. In this regard, it must be considered that the number of operators in a route is often not a decision by a single airline but a result of the market interactions and strategic choices of different airlines competing.

Table 2. Variation number of competitors per route (09/2019-09/2022)

Airline	% Monopoly routes			% Routes with 2 operators			% Routes with 3 operators			% Routes with >3 operators		
	09/2019	09/2022	Δ 9/2019-9/2022	09/2019	09/2022	Δ 9/2019-9/2022	09/2019	09/2022	Δ 9/2019-9/2022	09/2019	09/2022	Δ 9/2019-9/2022
Full-service Network												
Lufthansa	42.61%	50.97%	8.36%	39.94%	36.20%	-3.74%	13.05%	8.28%	-4.77%	4.40%	4.55%	0.14%
British Airways	44.22%	52.24%	8.02%	32.66%	27.76%	-4.91%	11.38%	13.06%	1.69%	11.74%	6.94%	-4.80%
Iberia	38.14%	45.43%	7.30%	30.51%	25.89%	-4.62%	18.08%	19.04%	0.96%	13.28%	9.64%	-3.63%
LOT	65.83%	68.93%	3.10%	26.67%	19.90%	-6.76%	5.00%	8.25%	3.25%	2.50%	2.91%	0.41%
Virgin Atlantic	16.13%	18.52%	2.39%	35.48%	37.04%	1.55%	38.71%	29.63%	-9.08%	9.68%	14.81%	5.14%
KLM	45.51%	47.86%	2.34%	35.22%	35.00%	-0.22%	12.62%	10.71%	-1.91%	6.64%	6.43%	-0.22%
Brussels	38.39%	40.72%	2.33%	42.65%	31.14%	-11.52%	16.11%	19.76%	3.65%	2.84%	8.38%	5.54%
Finnair	68.83%	69.31%	0.49%	21.86%	16.93%	-4.93%	6.07%	12.17%	6.10%	3.24%	1.59%	-1.65%
SWISS	46.83%	46.09%	-0.74%	43.65%	46.09%	2.44%	8.73%	6.96%	-1.77%	0.79%	0.87%	0.08%
Air France	45.74%	42.73%	-3.01%	34.89%	41.87%	6.97%	13.69%	12.15%	-1.54%	5.68%	3.25%	-2.42%
TAP	37.33%	34.00%	-3.33%	35.48%	39.00%	3.52%	21.66%	21.00%	-0.66%	5.53%	6.00%	0.47%
SAS	33.10%	27.56%	-5.54%	40.61%	34.38%	-6.24%	20.19%	25.28%	5.10%	6.10%	12.78%	6.68%
Aegean	32.92%	26.15%	-6.76%	40.00%	35.38%	-4.62%	17.92%	22.31%	4.39%	9.17%	16.15%	6.99%
Air Europa	10.55%	3.28%	-7.27%	33.67%	25.41%	-8.26%	34.17%	37.70%	3.53%	21.61%	33.61%	12.00%
Austrian	43.50%	32.86%	-10.64%	36.99%	44.29%	7.29%	15.45%	19.05%	3.60%	4.07%	3.81%	-0.26%
Icelandair	53.66%	41.67%	-11.99%	41.46%	43.75%	2.29%	4.88%	14.58%	9.71%	0.00%	0.00%	0.00%
Aer Lingus	41.82%	23.33%	-18.48%	40.00%	54.44%	14.44%	15.45%	20.00%	4.55%	2.73%	2.22%	-0.51%
Low-cost & Leisure												
Jet2.com	25.08%	31.07%	6.00%	29.82%	33.11%	3.29%	23.39%	25.78%	2.39%	21.71%	10.04%	-11.67%
TUI	37.20%	40.63%	3.42%	25.39%	24.57%	-0.82%	20.77%	21.56%	0.79%	16.63%	13.24%	-3.40%
Transavia	40.63%	41.49%	0.86%	35.89%	35.04%	-0.85%	18.96%	16.36%	-2.60%	4.51%	7.11%	2.59%
Vueling	29.13%	28.88%	-0.25%	35.51%	38.75%	3.24%	23.99%	21.73%	-2.26%	11.37%	10.64%	-0.73%
Ryanair	63.66%	61.55%	-2.11%	20.33%	24.12%	3.79%	9.50%	9.73%	0.23%	6.50%	4.59%	-1.91%
Easyjet	40.55%	38.11%	-2.45%	33.24%	32.73%	-0.51%	14.63%	18.23%	3.61%	11.58%	10.93%	-0.65%
Eurowings	47.69%	45.25%	-2.45%	30.83%	29.24%	-1.59%	12.78%	13.36%	0.58%	8.70%	12.15%	3.46%
Condor	33.09%	29.62%	-3.47%	29.71%	29.89%	0.18%	17.87%	22.28%	4.41%	19.32%	18.21%	-1.12%
Norwegian	31.28%	24.18%	-7.11%	33.20%	33.10%	-0.10%	22.54%	27.23%	4.69%	12.98%	15.49%	2.51%
Wizz Air	77.19%	57.88%	-19.30%	16.00%	23.59%	7.60%	4.73%	13.78%	9.05%	2.08%	4.74%	2.66%

Data source: OAG.

Finally, we have also paid attention to changes in airline destinations before and after the pandemic. Table 3 shows the percentage of routes that were operated in both periods and those that were only served in one of the periods. This allows us to assess the commonality among the networks and measure the degree of change in the shape of the network. More

significant variations can be caused by a shift in strategy in the type of markets served or by a decrease or increase in the number of destinations offered in the two periods. We can observe how FSNCs generally have a higher percentage of routes operated in both periods than LCCs. See, for example, KLM, Lufthansa or TAP with very high percentage of commonality, and in each case with lower number of new routes. The lower commonality for LCC is often due to these already growing beyond 2019 levels, as observed in the higher rates of routes operated in 2022 only. This is clearly the case for Ryanair and Wizz Air which illustrate assertive growth strategies, both almost doubling the number of routes operated only in 2022 compared to the number only operated in 2019. Conversely, in the case of Norwegian it reflects the decision to stop operating long-haul routes.

Table 3. Share of routes by period of operation (09/2019-09/2022)

Airline	09/2019 only		09/2022 only		Both periods	
	Number of routes	% over total	Number of routes	% over total	Number of routes	% over total
Full-service Network						
KLM	23	7.75%	12	4.13%	256	88.12%
Lufthansa	52	8.31%	42	6.71%	532	84.98%
TAP	21	9.83%	12	5.76%	176	84.41%
Austrian	29	12.72%	11	4.82%	188	82.46%
SAS	55	14.14%	18	4.63%	316	81.23%
SWISS	29	12.03%	18	7.47%	194	80.50%
Iberia	30	7.89%	50	13.24%	295	78.88%
Icelandair	7	7.87%	14	15.73%	68	76.40%
Aegean	25	10.00%	35	14.00%	190	76.00%
Aer Lingus	34	17.00%	14	7.00%	152	76.00%
Air Europa	40	24.61%	1	0.62%	120	74.77%
British Airways	81	15.56%	53	10.24%	384	74.20%
Brussels	37	19.31%	15	7.67%	138	73.02%
Finnair	45	20.41%	16	7.11%	158	72.48%
Air France	108	20.28%	39	7.26%	384	72.45%
LOT	45	20.18%	28	12.56%	150	67.26%
Virgin Atlantic	15	25.86%	11	18.97%	32	55.17%
Low-cost & Leisure						
Jet2.com	38	5.46%	80	11.43%	578	83.11%
TUI	352	19.79%	99	5.56%	1328	74.65%
Transavia	32	6.11%	113	21.56%	379	72.33%
Vueling	86	13.23%	94	14.46%	470	72.31%
Condor	74	18.80%	51	12.92%	267	68.29%
Easyjet	313	17.53%	294	16.44%	1179	66.03%
Ryanair	556	13.03%	993	23.27%	2719	63.71%
Wizz Air	222	13.84%	432	26.93%	950	59.23%
Eurowings	145	18.18%	181	22.70%	470	59.12%
Norwegian	227	39.21%	74	12.78%	278	48.01%

Data source: OAG

3.3 Making sense of the reaction of Airlines.

Beyond the general trend presented by observing the aggregated data, a more granular analysis can be obtained by focusing on the airline level, with more relevant insights from a strategy perspective. For each airline, we can observe a specific combination of these variables reflecting their network development and structure strategy in the early stages of the post-pandemic period compared to pre-pandemic times. The tables and figures

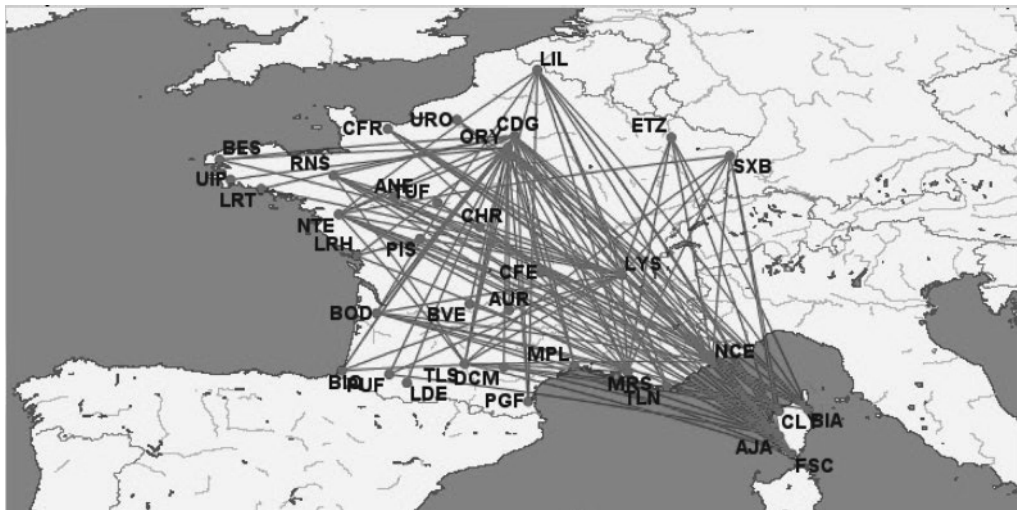
above provide data for European airlines operating 90% of the total supply. Further interpretation from a strategy perspective is provided for some of the airlines with distinct characteristics in their data that allow us to delve into different strategic choices. FSNC are presented first, followed by LCC.

3.3.1 Full-service Network Carriers

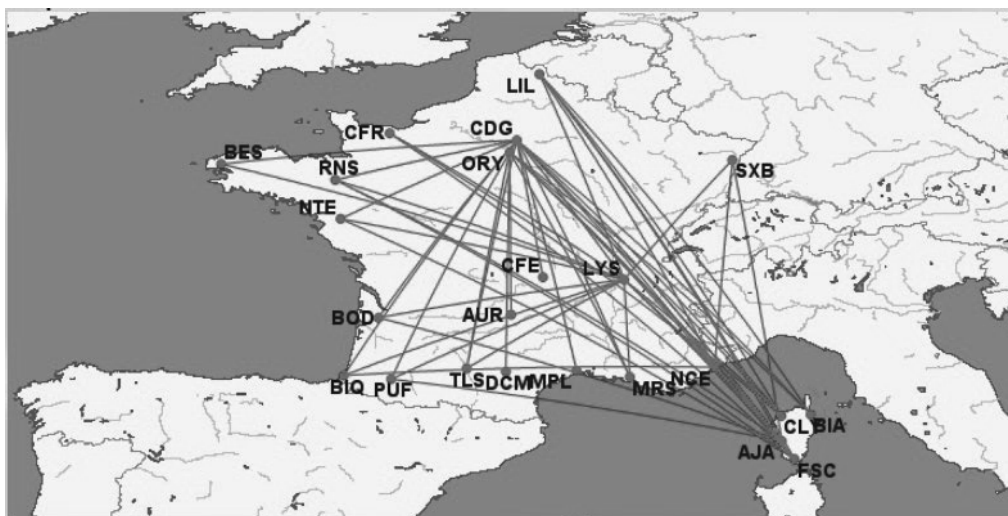
Lufthansa's network structure in the early post-pandemic is almost the same as before the pandemic, with only a minimal decrease of around 3% in the number of nodes and destinations (Figure 1) and with a high commonality with 85% of routes operated in the two periods (Table 3). This shows the airline has control over the German and central European markets. However, there is still a stark difference in supply, which still lags behind 2019 levels by almost 30%. This suggests that Lufthansa's strategy has been to recover most of the pre-pandemic destinations as soon as possible, although offering around 25% fewer frequencies (Figure 2). The share of routes operated in a monopoly has increased by over 8% (Table 2). However, this can be more a result of other airlines discontinuing some routes as it does not seem that Lufthansa has actively sought to enter new markets. We can also observe a minor decrease in average plane capacity in the fleet, partly due to the A380 fleet not being reintroduced. Regarding network economies, this data shows how Lufthansa has not changed strategy, continuing a classic hub-and-spoke-based network, which relies on demand to recover so that the density, scope and density economies can arise again at their full potential.

Air France's data shows supply below pre-pandemic levels by around 20% in terms of offered seats and the number of destinations (Figure 1). If we look at where these cuts have been made, they have been focused almost entirely on short-haul operations, which have decreased by nearly 40% (See Figure 3). This change in the operations is also reflected in the fleet usage, which shows an average increase in the aeroplane size of over 10% (Figure 2) caused by the decrease in the intensity of the use of planes with lower capacity for these routes. Also, the commonality of routes is slightly lower than the average of firms in the analysis (Table 3). The reasons behind these changes can be found in the conditions imposed by the French government as part of the rescue plan, which, as an environmental impact mitigation policy, required the airline to stop flights under 2,5 hours and that could be travelled by train (Transport & Environment, 2020). This is an interesting example of the use of political leverage to implement targeted regulations to reduce the environmental impact of aviation. This rule, initially linked to the specific case

of the rescue of Air France, has since become law, thus affecting all operators in the targeted routes (EURONEWS, 2023). The ban on short domestic flights has an impact on network economies. Removing some of the nodes in the network reduces the ability to fully exploit scope economies, as some of the products linking the discontinued nodes to their destinations via the central hub are no longer offered. However, as current agreements exist with the railway operator (SNCF) to commercialise combined services, this is partly mitigated. In terms of density economies, the impact is minor as, although through an alternative mode of transport, the customers will likely still need to travel to the hub airport in Paris to access the trunk routes to their final destinations. Also, scale economies in the hub might be reduced by losing the incoming flights from discontinued nodes.



AF Domestic network 2019: 122 OD

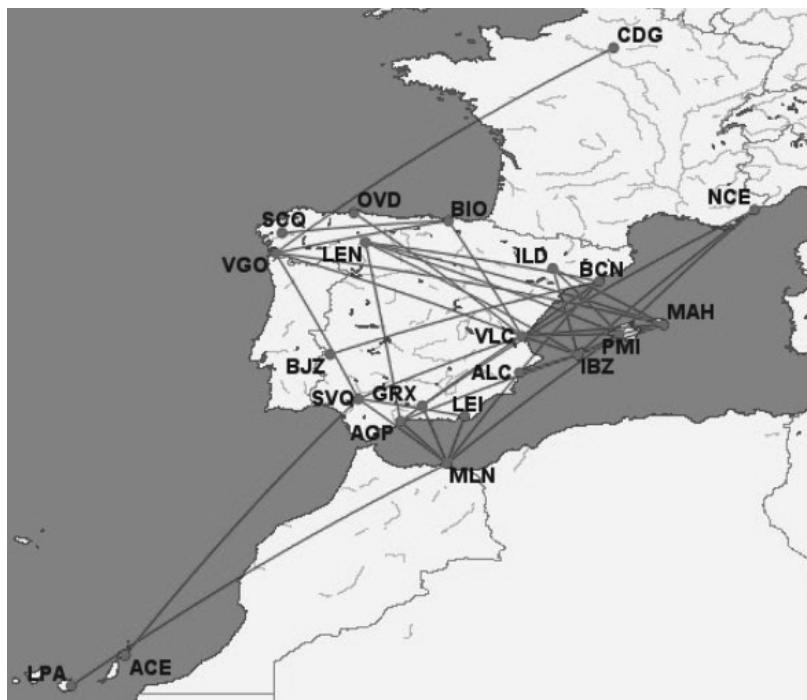


AF Domestic network 2022: 55 OD

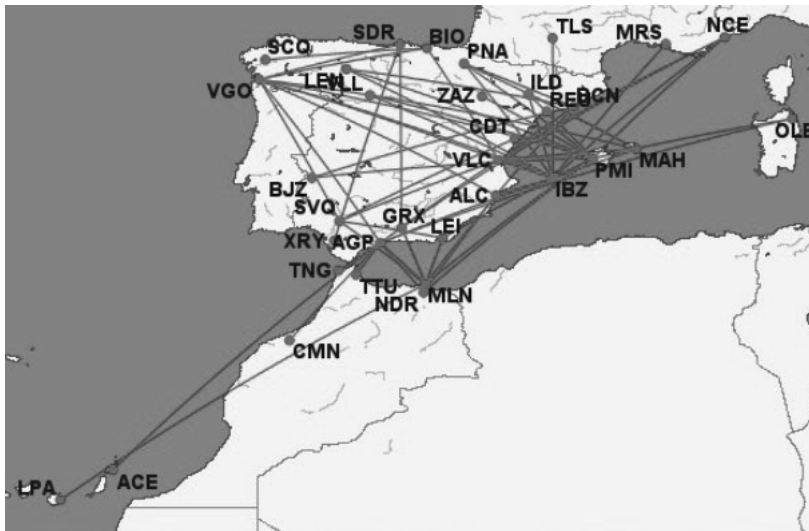
Figure 3: Air France domestic network 2019 and 2022.

Source: data from OAG and maps generated by the Great Circle Mapper (www.gcmap.com) - copyright © Karl L. Swartz.

As per Iberia, although it still shows supply levels below pre-pandemic times by around 10% and operates from fewer airports, it substantially increases the number of city pairs by over 10% (Figure 1). Interestingly, this growth is composed mainly of operations outside the airline's traditional core business model based on a hub-and-spoke strategy from their Madrid hub. These are mostly short- and medium-haul operations offering new direct connections away from the hub with lower frequencies and operated by regional partner Air Nostrum with regional jets (See Figure 4). Among these new routes, Iberia entered mostly destinations that were not operated by any airline. This move may seem inconsistent with the network economies' incentives of channelling traffic via a hub, as it offers routes bypassing the hub. However, the same route-level economies can sometimes be achieved using smaller aircraft and more efficient technology. Thus, we see how different sub-strategies within a primary strategy can also be implemented in response to specific market opportunities identified and with a competition perspective.



IB Non-hub flights 9/2019: 38 OD



IB Non-hub flights 9/2022: 62 OD

Figure 4: Iberia's OD not from or to main hub in Madrid 2019 and 2022.

Source: data from OAG and maps generated by the Great Circle Mapper (www.gcmap.com) - copyright © Karl L. Swartz.

In contrast to the general trend for long-haul operators, Air Europa has proportionally reduced its medium and short-haul operations to a larger extent than its long haul. Although the airline is still operating below pre-pandemic times (Figure 1), the more substantial long-haul operation is also reflected in the average plane size, which is 30% larger (Figure 2). In this regard, it must be noticed that its long-haul operation is mainly focused on Latin American markets, which reopened sooner than other international markets like the different regions in Asia. Also, the ongoing negotiations about a takeover by IAG may have caused the prioritisation of maintaining good financial results. They may have slowed down any plans to expand the short and medium-haul networks where it mainly competes with Iberia from the Madrid hub.

Aegean's data is eye-catching as there is a 60% increase in supply (Figure 1). Data suggests an increase in ODs, mainly corresponding to short-haul domestic routes in Greece. Many of these routes were operated in 2019 by their subsidiary Olympic Air and have now been transferred to Aegean. The large surge in supply corresponds to the fact that these domestic routes connecting mainland Greece and the islands and some other internal flights have higher frequencies than the average of the rest of the airline's flights, thus causing this increase (Figure 2). In this case, the change seems to respond more to an internal adjustment within the airline's group than any strategy specifically related to the pandemic recovery. The operation of these internal flights by Aegean helps better

visualise the extent to which network economies play an important role. Especially the service among the domestic destinations and the hub allows both to serve demand among these two points and to third ones via the hub, thus enabling scope economies.

Finnair's case is worth analysing because of the double challenge generated by the pandemic and the Russian invasion of Ukraine. For most airlines operating to Russia, the impact has been relatively small, with most withdrawing between 1 and 4 destinations. Finnair, however, which had 9 OD pairs, has suffered a more considerable impact. The ban on overflying rights has had a more significant effect, especially on airlines with substantial long-haul operations towards Asia, for which, in most cases, the most direct routes go through Russian airspace. Again, Finnair, whose long-haul business model was primarily based on the strategic location of its hub in Helsinki as a gateway to Asia, has been the most affected operator. Additionally, Asian markets, especially China, are following a slower recovery. These challenges are reflected in the data, which shows Finnair as one of the airlines with a more considerable decrease in total seats offered and the number of operated flights (Figure 1). The forced reduction in supply impacts the ability to exploit the density and scale economies.

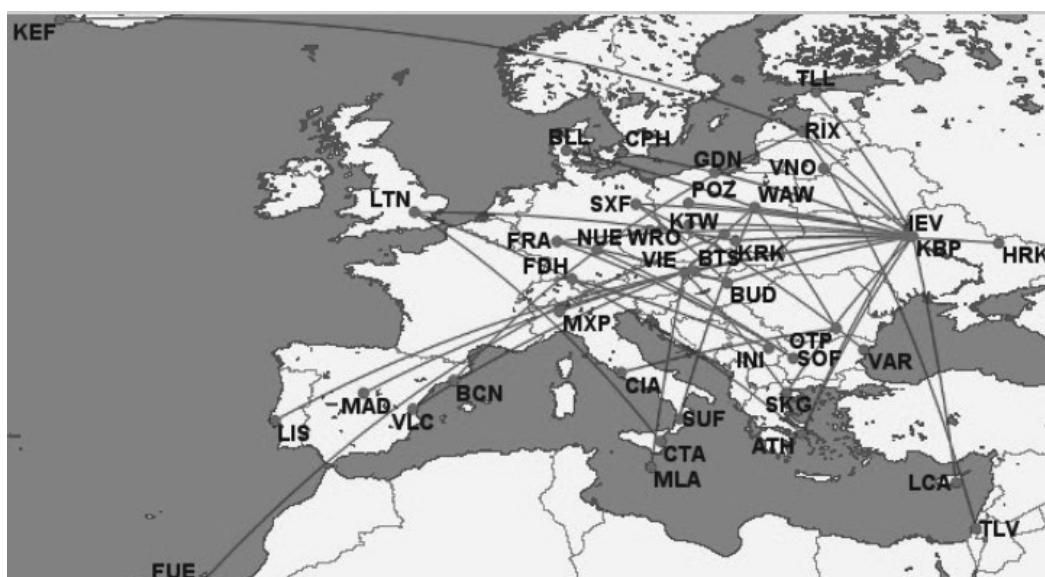
Finally, in the case of Icelandair, there is an increase in the number of destinations and nodes but with smaller supply volumes (Figure 1). The frequency level is only slightly lower at around -1% (Figure 2). If we look at the fleet structure, however, we notice a change explaining the supply decrease. Icelandair is replacing its ageing Boeing 757 fleet with newer Boeing 737 planes with lower passenger capacity. Also, Icelandair has added the new routes predominantly in markets with competition, thus decreasing the share of monopoly routes, which was previously over 50% (Table 2).

3.3.2 Low-Cost Carriers

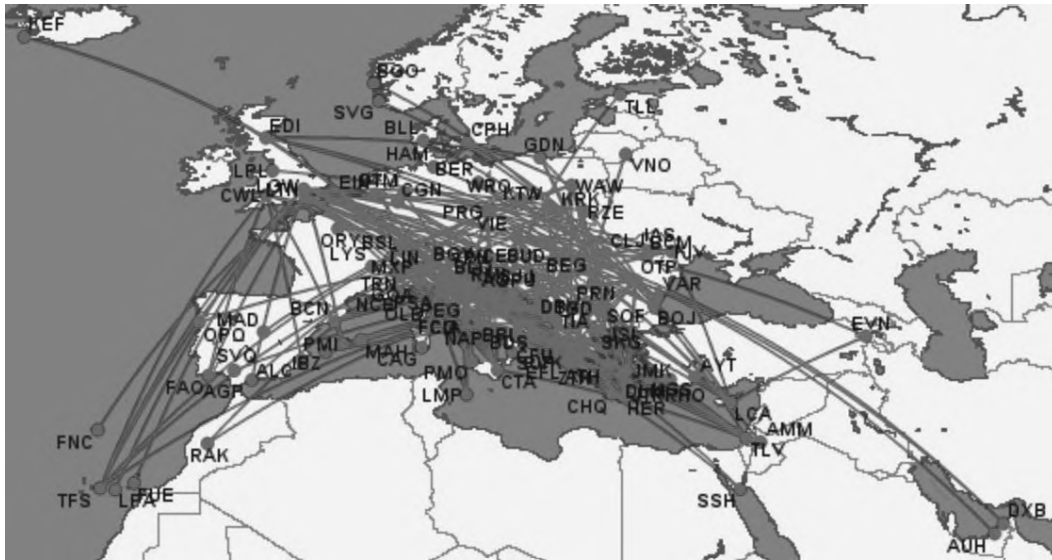
For LCCs, starting with Ryanair, by September 2022, its network had a very slightly lower number of nodes but a very substantial increase in the number of destinations at over 20%, which took the airline to a rise in the supply of almost 15% (Figure 1). In other words, the airline decided to focus the growth strategy on a more limited, but stronger, number of originating markets and increase the interaction between them. This means serving more city pairs within the existing network and allowing for growth while not increasing fixed costs associated with operating from more bases, thus improving economies of scale. Hence, regarding competitive strategy, Ryanair's network has changed substantially (Table 3). However, with a similar distribution in terms of

competition per route, it keeps being one of the airlines with a higher share of routes in which it has a monopoly (Table 2).

EasyJet has kept a similar network size in the two periods, with supply levels only about 10% lower than in the pre-pandemic period (Figure 1). However, although having similar numbers in quantity of OD and nodes, if we look at the actual OD served, we observe a much lower commonality, with only 66 % of the routes being operated in both periods (Table 3). Considering the growth trend in most LCCs, EasyJet's more modest data reflects the ongoing struggle by the airline. Indeed, EasyJet has not yet matched the recovery rates of other LCCs like Volotea, Wizz Air, Ryanair and Jet2.com. In fact, Ryanair's lead over EasyJet as Europe's biggest individual airline brand was extended (CAPA, 2023). Wizz Air has opted for a bold strategy with a significant increase in supply and markets of around 30% (Figure 1 and Table 3). This data confirms the comments by the airline's leadership about seizing the opportunity created by the market context to pursue a growth plan (Aviation Week, 2023). However, the growth in destinations has not been matched with a boost in frequencies, which have decreased by around 6% overall (Figure 2). Thus, the growth has been enabled, firstly, by expanding the fleet of the higher capacity A321s, which now represents a larger share of the fleet also composed of A320, and, secondly, by spreading the activity to new markets. Using bigger planes should allow Wizz Air to obtain better density economies if it manages to operate them at high enough load factors. That strategy has focused on routes already operated by other airlines, therefore decreasing the percentage of monopoly routes in their network, which was previously the highest in the market at 77% (Table 2 and Figure 5).



Wizz Air non-monopoly routes 9/2019 only: 43 OD.



Wizz Air non-monopoly routes 9/2022 only: 215 OD.

Figure 5: Wizz Air non-monopoly routes, September 2019 and 2022. Source: data from OAG and maps generated by the Great Circle Mapper (www.gcmap.com) - copyright © Karl L. Swartz.

For Eurowings, we observe an increase in the number of nodes and offered destinations but not in the supply level, which is still more than 16% below pre-pandemic levels (Figure 1). When looking at the operation, we observe how, for the most part, the new destinations are operated under the Eurowings Discover⁷ brand and are mainly leisure-oriented markets. Thus, reflecting a strategic decision within the Lufthansa Group to penetrate the leisure segment further, a new operation was launched from Frankfurt and Munich. This is also reflected in the average fleet size, which has increased by 10% (Figure 2), as some of these new destinations are long-haul operations, which were a much smaller share of Eurowings operations limited to a few destinations, almost all from Dusseldorf. Also, consequently, the resulting network is quite different with the inclusion of the new destinations, and the share of routes operated in both periods is one of the lowest at only 59% (Table 3).

With a 5% lower number of seats offered, Vueling is reaching pre-pandemic supply levels but with a different strategy in terms of the network. Operations were discontinued in 10% of airports, but the operation amounted to a net increase of 2.5% in the number of destinations served (Figure 1). The operation has been further concentrated in the more

⁷ In 2023 Eurowings Discover becomes Discover Airlines, operating independently from Eurowings, and focusing exclusively on the leisure segment.

relevant airports, and some small bases have been closed. That increases these airports' relative weight, enabling economies of scale improvement. The decrease in supply is explained by an almost 9% cut in average frequencies (Figure 2). Thus, we have a smaller network with better interconnection among the nodes but fewer frequencies. The increased interconnection allows better scope economies using the central hub in Barcelona and the main bases as connection points.

Norwegian's case is interesting mainly because of the impact of having stopped the long-haul operation. We observe an overall decrease in markets served and seats offered at almost 40% (Figure 1). Consequently, we observe increased frequencies, as their long-haul flights operated with lower frequencies than the short and medium-haul ones. Also, there has been a decrease in aircraft size as the whole twin-aisle fleet of 787s was removed (Figure 2). That has also resulted in a pretty different network shape and, in terms of competition, a lower share of monopoly routes (Tables 2 and 3).

As Norwegian was the leading player and pioneer in low-cost long-haul operations in Europe, the viability and future of this type of operation are worth considering. In the early post-pandemic scenario, we see how the new airline Norse Atlantic Airways has retaken some of the routes using the same type of fleet but with a much more limited scope for the moment. Level, a minor player in this market initially created to counterplay Norwegian's long-haul operations from Barcelona, has continued its operation to similar levels as before the pandemic. Other players like Condor, TUI, and now Eurowings Discover also offer low prices. Still, their focus is limited to the leisure market segment and often sold as part of bundle holiday packages. Thus, it remains to be seen if the low-cost long-haul model, which bases its viability on price and high passenger volumes in non-premium markets, will regain its importance and expand or remain a niche model for specific markets.

3.4. Emerging trends in the new normal

Our results show the European aviation market sliding back to business as usual. Although data still showed long-haul markets a bit behind compared to pre-pandemic figures, all signs point towards a full recovery leading back to a sector based on continued traffic growth as the predominant strategy. A strong indication of this trend is the significant increase in orders for new aircraft by numerous airlines, totalling nearly 1,200 new units in just the first five months of 2023 (Pfeifer, 2023). While our analysis has specifically centred on the European market, it is plausible to assume this is a global trend.

The surge in aircraft orders highlights the industry's optimism for a post-pandemic recovery and points to a broader and more positive outlook for the aviation sector worldwide.

Also, at the global level, our data found that the sector is slightly more concentrated in fewer airlines and groups. As previously pointed out, this is an ongoing trend that is usually accelerated in periods of crisis. This trend seems to continue in the post-pandemic with recent moves such as the acquisition of a share of ITA Airways by the Lufthansa Group or the intention of the Portuguese government to resell its stake in TAP for which some of the main groups have shown interest. The main implication of a more consolidated market could be an increase in fares.

Although the aggregated data analysis at the business model level has proved helpful in terms of identifying general trends, the assessment at the airline level has shown how the heterogeneity among airlines' responses is significant and thus worth studying individually. This is aligned with the previously discussed notion about the hybridisation of business models (Magdalina & Bouzaima, 2021; Fageda et al., 2015; Lohmann & Koo, 2013; de Wit & Zuidberg, 2012; Mason & Morrison, 2008). Our analysis confirms this idea as quite distinct strategies have been chosen by the airlines studied regardless of the business model. However, it is essential to highlight that the majority of airlines that had already surpassed pre-pandemic supply volumes by September 2022 fall within the low-cost spectrum. This achievement can be attributed to several factors. Firstly, these airlines were less impacted by the slower recovery of long-haul travel compared to their full-service counterparts. Moreover, their smaller organisational structures and lower fixed costs significantly facilitated their recovery from external shocks (Fontanet-Pérez et al., 2022). Furthermore, the predominance of point-to-point network models among low-cost carriers contributes to their flexibility, providing an advantage over hub-based airlines. The point-to-point model allows for more efficient and direct routes, enabling better adaptation to fluctuating travel demands and minimising the disruptions caused by hub congestions.

As noted above, the analysis has been carried out at the airline level but has also considered the dynamics within the airlines belonging to the same ownership group. In this regard, from our data, there seems to be little evidence of a strong coordinated strategy in any of the groups regarding how the recovery of supply has been organised. We have described the undertaking of the Lufthansa group in the leisure market through Eurowings Discover, but not many other examples have been detected. Thus, although

large-scale financial decisions, such as fleet acquisition, are considered at the group level, the airline level seems to have been prevalent in network and operations decision-making. Finally, in the context of the global climate change challenge, one of the concerns of academia is whether COVID-19 could trigger changes that lead towards a more environmentally sustainable and resilient sector (Gössling, 2020; Michelmann et al., 2023). Our research has found only modest evidence in this direction from a network structure perspective. As reported above, Air France is one of the exceptions, as very short-haul flights that meet certain alternative connectivity criteria have been removed per government regulation. Although these measures are considered to have a low environmental impact, particularly when compared to the significant effects of long-haul flights (Barros Pintos et al., 2023; Baumeister, 2019), they raise a critical point regarding the role and influence of policymaking at both the national and EU levels in shaping airline networks and strategies. In this regard, at the EU level, the overall carbon-neutrality goal by 2050⁸ and the aviation-specific Refuel EU initiative⁹ are set to have a significant impact, although challenges remain. On the one hand, it is crucial to assess the realistic potential of current policies that rely heavily on alternative Sustainable Aviation Fuels (SAF) to deliver the desired results, considering technological maturity and scalability constraints (Bardon & Massol, 2023). On the other hand, the focus should also be directed towards enhancing resilience and extending efforts beyond Europe. Achieving this goal requires adopting multi-stakeholder approaches and implementing coordinated regulations at both national and regional levels. These measures are essential to improving the aviation industry's ability to respond effectively to external shocks (Sun et al., 2021; Fontanet-Pérez et al., 2024).

4. Conclusions

In this chapter, we have assessed European airline networks as we enter a new normal, the impact of COVID-19 is winding down, and related travel restrictions have mostly been lifted. At the macro level, we have seen how, by September 2022, the overall market was still not back to pre-pandemic levels but seemed to be on track to recover traffic levels fully. Long-distance travel has been recovering at a slower pace than short haul.

⁸ 2050 long-term strategy: https://climate.ec.europa.eu/eu-action/climate-strategies-targets/2050-long-term-strategy_en

⁹ RefuelEU Initiative: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12303-Sustainable-aviation-fuels-ReFuelEU-Aviation_en

This has also made FSNC, for which this type of travel is a core part of their business, have also experienced slower recovery.

Diving into the airline-specific level, we observed different strategies. Some airlines like Lufthansa or Swiss have kept very similar networks and adjusted supply levels, mostly via reducing frequencies, waiting for demand to recover fully. Others have made some changes, such as expanding the point-to-point operation away from the main hub in the case of Iberia. Some of the observed changes have come from external regulatory pressures, as is the case of Air France and the shrinking of the domestic network. We have also seen how the pandemic forced some drastic changes, such as the case of Norwegian which decided to withdraw from the long-haul market completely. The bolder strategies have come from low-cost airlines such as Ryanair and Wizz Air, which have seen the reopening of markets as an opportunity to pursue a more aggressive growth strategy.

Our research paves the way for further exploration in two primary directions. On the one hand, the study could be replicated for other world regions to find similarities and differences in the evolution of airline networks in the context of COVID-19 recovery. Although, as mentioned, there seems to be a general trend towards full recovery and further expansion of markets, a case-by-case study would be relevant as the airline and regulatory context are different. For example, although the US market accumulates a similar share of the world traffic as Europe, substantial differences exist. In this regard, we observe the market is more concentrated in a smaller number of airlines due partly to a faster and more intense sector consolidation. Also, business models seem more homogeneous and less affected by the hybridization mentioned above, with a clearer division between classic FSNC, LCCs and ultra low-cost carriers. Additionally, the public financial support received in the context of the COVID-19 crisis was also more uniform in the US as it all depended on the same administration compared to the diversity of countries providing support to different extents within the EU.

On the other hand, conducting this assessment again in the future would allow to having a broader picture of the evolution and observe which of the changes in networks are just reactive to adjust to the demand recovery path and which are permanent changes that reflect a change in the airline's strategies.

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