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The impact of the COVID-19 crisis on the US airline market: Are current business models equipped for upcoming changes in the air transport sector?

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ABSTRACT

We address the impact of the COVID-19 crisis on the US airlines market and discuss the benefits and limitations of current business models in a context of increasing socio-economic uncertainty and stringent environmental regulations. Drawing our data from the Bureau of Transportation Statistics and 10-K/A reports, we undertook an exploratory study of the performance of the 10 main passenger airlines in their domestic operation during one year. We found that, although major losses occurred industry-wide, ultra-low-cost and low-cost airlines fared better than full-service network carriers did in terms of financial performance. We argue, nevertheless, that such apparently successful business models are not necessarily adaptive to address future industry changes.

1. Introduction

Airlines are at a crossroads where their business models need a careful reassessment. The drastic drop in demand caused by the COVID-19 crisis (Forsyth et al., 2020) has pushed their financial resilience to the limit, with the majority of them requiring very substantial support from governments to keep them afloat (Abate et al., 2020). However, not all airlines have been affected to the same degree. Additionally, the reasons why some business models might have proved to be more successful during the crisis may not necessarily be adaptive to the expected changes in post-COVID-19 times. Assessing both issues will precisely be the objective of this paper.

As data started to become available, researchers began analysing the early impacts of the pandemic on air transport, providing key contributions to understand the scope of the crisis. In this regard, Suau-Sanchez et al. (2020) have assessed the main characteristics of their operations to analyse their financial performance during the first year of the pandemic. We assess the main characteristics of their operations to identify the differences in performance among airlines and their respective business models. Additionally, compared to earlier articles that used data from the first few months of the crisis, our study covers one full year, 2020, which allows for a broader perspective.

On the other hand, with a focus on the long-term impact, Suau-Sanchez et al. (2020), have assessed plausible future trends. They suggest that some effects of the crisis might have brought permanent changes in the characteristics of demand that will transform the sector. Additionally, Neves and Reidl (2020) point out that socio-economic and health shocks are likely to become more frequent, increasing the risk for the whole value chain. Moreover, as pointed out by several authors, aviation’s impact in climate change will definitely influence the industry’s future (Baumeister and Leung, 2021; Lee et al., 2020), especially in terms of regulation. Thus, considering that the airline sector has traditionally had low profitability margins (Grewe et al., 2021; Maclure and Duval, 2020) and has historically shown to be very vulnerable to external factors (Brown and Kline, 2020; Raynes and Tsui, 2019; Rose, 2021), a careful reflection on the future of the industry is not trivial. We contribute to this discussion, therefore, by focusing on the implications for airlines.

We carried out our analysis in two steps. First, we present an exploratory study of the domestic operation of the 10 main US airlines to analyse their financial performance during the first year of the pandemic. We assess the main characteristics of their operations to understand which elements contributed to better navigate the crisis. In a
second step, we assess how the changing trends in the sector might affect different business models and discuss the possibility of transitioning towards more resilient and sustainable models. Hence, the paper is organized as follows: Section 2 reviews previous works dealing with airline business models and with the impact of COVID-19. Section 3 describes the methodology and data used for the analysis. Section 4 first presents the results of the exploratory study and then delves into the discussion. Finally, Section 5 summarizes our conclusions.

2. Literature review

2.1. Airline business models

Airline business models have evolved over time adapting to the conditions of the regulatory framework and to the changing markets. One major change was produced by the liberalization of markets which started in the US in 1978 and, eventually, expanded to other markets worldwide (Doganis, 2010). This created the opportunity for new players to enter the market with different business model approaches, prominently, the low-cost model. Some of the characteristics of low-cost carriers (LCC) that distinguish them from the full-service network carriers (FSNC) have been the operation of point-to-point network instead of hub and spoke, uniformity of the fleet, greater labour productivity, higher seat density, increased aircraft utilization and unbundled fares with ancillary services offered for a fee (Magdalina and Bouzaima, 2021). However, given the dynamic nature of the commercial air travel industry (Mason et al., 2013), the classification of airline business models in these two categories does not appropriately describe the reality of the market and the airlines that compose it. Some of the LCCs have over time adopted some of the characteristics of the FSNCs (Lohmann and Koo, 2013) and FSNCs have also been forced to use some of the strategies of the LCCs, such as selling ancillary services, to stay competitive.

In this regard, Mason and Morrison (2008) developed a product and organizational architecture approach (POA) that allowed to classify and compare airlines within a business model based on a number of variables representing their organization and operation. In a similar line, Lohmann and Koo (2013) suggested that, rather than classifying airlines in discrete categories, it is more adequate to place them in a continuum. This idea brought up the concept of hybrid airlines, which could be placed along a spectrum between the FSNCs and LCCs models. Further delving into the hybrid business model concept, Magdalina and Bouzaima (2021) conducted a study of European airlines in which, through a clustering process, they defined four categories: FSNCs, LCCs and two hybrid in between. Bachwich and Wittman (2017) also refer to the phenomenon of LCCs adopting practices that bring them closer to the FSNCs and, in a study on the US market, describe how this led to the emergence of ultra-low-cost carriers (ULCC) with a distinct business model. Although with different nomenclature, this approach is consistent with the idea of hybrid business models. In this case, the traditional LCCs have become the hybrid model and the ULCCs have filled the void at the end of the spectrum.

An additional phenomenon linked to the growing number of LCCs was the creation of airline-within-airline models. This was the response of FSNCs that created their own LCCs airline or brand within their company (Raynes and Tsui, 2019). However, although some of these airlines have managed to succeed for example in Europe (e.g. Transavia) or in Asia (e.g. Scoot), there has been a high failure rate. In the USA many of the legacy airlines unsuccessfully attempted this option, and currently there is none in operation.

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2.2. Airlines and external shocks: lessons from COVID-19

The passenger air transport industry as it is today is quite vulnerable to external factors (Gössling, 2020). Brown and Kline (2020) classify the exogenous shocks in three categories: macroeconomic events, insecurity and terrorism, and health and safety. The recovery of the sector after recessions created by these shocks has been widely investigated. However, there is no consensus on whether economic shocks cause transitory or permanent impact on the growth trends in the sector (Gudmundsson et al., 2021). The COVID-19 crisis provides an opportunity to further study the impact of external shocks in the industry. The academic consensus is that it is an unprecedented crisis (Gössling, 2020; Magdalina and Bouzaima, 2021; Scheiwiller and Zizka, 2021), which spurred research in different fields related to the industry (Sun et al., 2021).

The literature about the early stages of the pandemic focused on the impact of the crisis on airlines’ business models and strategies, and an immediate interest was in fact drawn to the initial responses of airlines. Albers and Rundshagen (2020) categorize these responses into four groups: retrenchment, preserving, innovating, and exit and resume. They also differentiated among the responses with a short-term focus from those with a longer one. Within these initial reactions, some attention was also given to the communication strategies during the crisis linked to reputational issues of airlines (Scheiwiller and Zizka, 2021). Other studies analyze what we can learn from this crisis in terms of managerial responses to exogenous shocks. In this regard, Amankwah-Amoah (2020b) provides a conceptual framework that distinguishes among internally generated and externally imposed strategic and tactical responses in the short and long terms. Additionally, Brown and Kline (2020) highlight the importance of environmental scanning in enhancing the ability to face external shocks and how airline managers missed forewarning of the risks of a pandemic provided by previous events such as the 2002-2004 SARS outbreak. Also on this issue, Linden’s work provides guidance to aviation managers on how to manage and prepare for external shocks based on a combination of short-term reaction with long-term planning (Linden, 2021).

Placing the focus on the long-term, some authors have addressed whether the COVID-19 crisis will have permanent effects and whether the crisis has provided an opportunity to transform the aviation industry in line with the requirements linked to societal challenges such as climate change. In this regard, Suau-Sanchez et al. (2020) identify structural aspects that will shape airlines’ medium and long-term actions. These structural elements include supply, demand, regulation and business ethics. For his part, Gössling (2020) provides a critical perspective of the airline industry pre-pandemic, stressing its vulnerability and dependence on state-aid, which has become even more apparent during the COVID-19 crisis, as evidence of the need for change. He also raises the existence of negative externalities linked to the industry such as the spread of diseases and the impact on climate change, and accordingly suggests that shifting towards business models that focus on profitability rather than revenue would allow to have more robust airlines with a smaller climate impact. However, Amankwah-Amoah (2020a) warns of the risk of airlines and other industry players sidestepping environmental initiatives and the challenge in maintaining momentum for such practices in times of crisis.

Finally, considering the great dependence of airlines on public support during the crisis, another group of articles has focused on aspects related to the role of governments and how public policies affected airlines. Abate et al. (2020) analyse the factors that define the willingness of governments to support airlines and the different types of support schemes. They also look into the implications of governmental support in terms of competition, ownership and the environment. Providing a complementary perspective, Akbar and Kislowski (2020) reflect on the complexity of nonmarket strategies of airlines in the COVID-19 context, which includes aspects related to compliance with governmental regulation, dependence on support schemes and legitimacy perception. Broadening the scope of the analysis, MacIree and Duval (2020) review the key policy issues in the industry in the post-COVID-19 era. Among these, they identify the key role of governments in the definition of support mechanisms for the different actors in the aviation value chain.
3. Methodology and data

For effectively analysing and comparing the reaction of various airlines to an external phenomenon—in our case, the COVID-19 pandemic—the characteristics of the phenomenon, as well as the context, must be similar for all of the parties involved (Sartal et al., 2017). The effect of the pandemic on the air transport sector has differed by region and time. For example, airlines in China were already very affected in early 2020, whereas in Europe and the United States, they were still operating almost normally at that time. Additionally, the reactions and support plans of governments have been different among countries and regions. Thus, we chose to perform the study of airlines in a specific country, the United States, which has a very relevant share of global traffic (Gössling and Humpe, 2020), and where the characteristics of the crisis have been similar for all players. Our focus is on domestic data to avoid the distortion of international operations, as not all operators offer international service, and different international markets have also been impacted diversely. Although some differences in terms of travel restrictions at the state level have been present in the United States, they should not substantially alter the results of the study, as the majority of the sample carriers operate nation-wide.

Considering domestic aviation operation in the United States, only regular scheduled passenger flights were used (we did not include cargo and charter airlines in the analysis). We also decided to exclude small regional operators and the three main regional carriers: Envoy, Republic and Sky West. In the case of the latter, although they represent a significant amount of traffic, they operate exclusively to service other carriers’ regional operations, sometimes for more than one, and do not have an independent business model comparable to that of airlines which operate under their own brands.

Based on these requirements, the sample for the study is composed of 10 airlines that operate regular passenger transport at the domestic level. This sample guarantees ample representativeness, as it constitutes more than 90% of the total domestic scheduled traffic. It also provides a representation of different business models. In Table 1 the airlines in the sample are presented according to their size, ownership and, using the categories defined by Bachwich and Wittman’s (2017), their business model: FSNCs, LCCs and ULCCs. Complementarily, more in line with the idea of a spectrum or continuum in which airlines can be placed, instead of discrete categories (Jean and Lohmann, 2016; Lohmann and Koo, 2013), thorough the analysis, direct comparison among airlines is carried out and a proxy variable for the business models is used to observe differences.

To carry out the analysis, we resorted to financial and operational data from the Bureau of Transportation Statistics (BTS), as well as from the 10-K/A reports that publicly traded airlines have to submit annually. We used data for 2020 and then compared it with pre-COVID-19 figures to assess the impact of the COVID-19 period. For the pre-COVID-19 timeframe, data from the previous five years (2015–2019) were used to ensure that they were representative of the general performance of the sector and to avoid drawing conclusions from specific, out-of-the-ordinary data for any of the airlines in 2019.

As a first step, in order to provide a general understanding of which airlines have been more affected, the airlines were analysed according to their variation in profitability, productivity and efficiency among the two periods. These variables were also measured for pre-COVID-19 years to differentiate existing trends from those resulting from the COVID-19 crisis. The variation in net income between the two periods was measured to assess the changes in profitability. We selected the variation in net income per revenue passenger miles (RPM) flown to proxy productivity. Efficiency was then evaluated by calculating the percentage of net income over the operating revenue. Other variables related to the characteristics and operations of airlines were also used to identify patterns and differences among them. These include the business model, the size of the airline, changes in the size of the operation, major costs and environmental performance. These variables are presented in relation to the changes in profitability. Although the correlations shown do not necessarily mean that a cause-effect relation exists, they help with understanding relevant trends. The calculations used are presented in Table 2.

4. Results and discussion

4.1. Financial impact of COVID-19 on airlines

For properly contextualizing the impact of COVID-19, it is useful to start with the reference of how airlines were performing in the pre-COVID-19 years. In this regard, all airlines in the sample were profitable,

| Table 1 |
| List of studied airlines. |
| Airline | Ownership | Business model | Size (Domestic ASM 2019 in thousands) |
| American Airlines | Publicly traded | Full-Service | 152,743,872 |
| Southwest Airlines | Publicly traded | Low Cost | 152,036,929 |
| Delta Airlines | Publicly traded | Full-Service | 149,873,192 |
| United Airlines | Publicly traded | Full-Service | 130,409,396 |
| Alaska Airlines | Publicly traded | Low Cost | 56,710,525 |
| Jet Blue Airways | Publicly traded | Low Cost | 48,974,567 |
| Spirit Airlines | Publicly traded | Ultra-Low Cost | 37,107,423 |
| Frontier Airlines | Privately owned | Ultra-Low Cost | 26,511,287 |
| Allegiant Air | Publicly traded | Ultra-Low Cost | 15,558,758 |
| Hawaiian Airlines | Publicly traded | Full-Service | 14,145,762 |

*The specificities of Hawaiian Airlines, linked to its geographic location far from the continent, cause it not to fit clearly in any of the categories above. Our decision was to place it within the FSNC group, although it can be argued that it does indeed share some characteristics and performance traits with LCCs.

| Table 2 |
| Variables and calculations used. |
| Variable | Calculation |
| Profitability | Pre-COVID-19 reference period: \( \text{avgnetincome}_2015 - \text{avgnetincome}_2019 \) | \( \text{avgnetincome}_2014 - \text{avgnetincome}_2018 \) |
| Productivity | Pre-COVID-19 reference period: \( \text{avgrevenuepassengermiles}_2015 - \text{avgrevenuepassengermiles}_2019 \) | \( \text{avgnetincome}_2015 - \text{avgnetincome}_2019 \) |
| Efficiency | Pre-COVID-19 reference period: \( \text{Totalrevenuepassengermiles}_2020 - \text{Totalrevenuepassengermiles}_2019 \) | \( \text{totalnetincome}_2015 - \text{totalnetincome}_2019 \) |
| Business model | Measure 1: Qualitative | Measure 2: Business model proxy: \( \text{Totalrevenue}_2019 \) |
| Size | Measure 1: Total available seat miles | Measure 2: Total number of operated flights |
| Salaries | Salary cost per ASM | \( \text{Totalavailableseatmiles}_2019 \) |
| Fuel | Fuel cost per ASM | \( \text{Totalfuelconsumption}_2019 \) |
| Environmental performance | Fuel use per RPM | \( \text{Totalrevenuepassengermiles}_2019 \) |
and as shown in Fig. 1, although with different intensities, they were growing. As expected, the picture changes radically when one looks at the data from the COVID-19 period. All airlines suffered unprecedented drops in their net incomes between the pre-COVID-19 reference period and 2020, and they all have accumulated substantial losses. The decrease in net income from the domestic operation from the pre-COVID-19 reference period to the COVID-19 period is 289% on average. However, not all airlines have been equally impacted. For example, although Allegiant Air has managed to contain the variation to about 160%, Delta Airlines has dropped a staggering 481%. Delta Airlines was the airline with a higher percentage of pre-COVID-19 growth, and the one that accumulated a higher percentage of losses in 2020. However, when one looks at the rest of the airlines, no evidence seems to point to a direct link between the growth before the crisis and the losses that occurred during the crisis. It is also worth noting, for scale, that although the highest growth was 21% during the pre-COVID-19 period, the losses in all cases have been more than 160%.

To complement the picture of the airlines’ performance, we assessed the impact of COVID-19 from a productivity perspective. When one looks at the net income per RPMs flown (Fig. 2), even deeper differences among airlines can be appreciated. Although the average of our sample shows a loss of 8.6 cents of a USD per mile, Frontier Airlines managed to keep it just under 1 cent per mile. On the opposite end, Delta Airlines lost more than 22 cents per mile flown. For comparison purposes, pre-COVID-19 productivity is also shown in Fig. 2. As in the case of profitability variation, no evidence exists of airlines performing better before the COVID-19 crisis. Again, for most of the sample, the magnitude of losses more than doubles that of the profit before the pandemic.

Some insights can also be obtained from the analysis of the efficiency of airlines before and during the pandemic. We compare the share of profit/loss over the total operational revenue in pre-COVID-19 and in COVID-19 times (Fig. 3). The average value for the pre-COVID-19 period was 8% but with substantial differences among airlines. In this regard, the most efficient was an ULCC, Allegiant Air, which was followed by Southwest Airlines and Hawaiian Airlines. When one looks at data from 2020, it is easy to observe the extent to which losses have exceeded revenue. In the data from the COVID-19 period, we can appreciate how the decrease in revenue made it impossible to avoid deep losses. As in previous figures, no direct correlation exists among the performance of each airline before and during the pandemic.

Therefore, all three variables (profitability variation, productivity and efficiency) show a consistent picture of a hard-hit sector but with varying impacts on different airlines. Although limited data are available and a long-term analysis will probably shed more light on the reasons for such differences, the currently available information can be used to delve a bit further into what has made some airlines struggle more than others.

4.2. Results by business model

From a management perspective, it is interesting to analyse whether airlines with different business models have been affected differently. As there is not a unique definition of the concept business model (Kalakou and Macário, 2013) a clarification on its use in this paper is due. Without entering into detail into the definition—which Mason and Morrison (2008), Lohmann and Koo (2013) and others have addressed in depth—we can define a business model as how a company operates and how it creates value for its stakeholders (Casadesus-Masanell and Ricart, 2010). By looking at the data on the net income variation results of the different airlines, a first hint emerges, showing how LCCs have generally coped better than network airlines have. Fig. 4 provides a graphical representation of such differences. In this figure, the airlines are
classified according to the abovementioned types of business models: FSNC, LCC and ULCC. Complementarily, an additional, more nuanced, measure is taken that uses revenue per RPM as a proxy of the business model (Fig. 5). Both figures show a consistent picture—one where a correlation between the business model and the short-term impact of the COVID-19 crisis can be observed. As mentioned before, Hawaiian Airlines has some specificities that make it more complex to assign it to one of the business models. In this regard, Fig. 5 shows how Hawaiian Airlines’ performance coincides more with that of the LCCs.

In terms of efficiency, differences by business model can be observed, too. Referring back to Fig. 3, it can be seen how the three ULCCs are the ones that managed to maintain their expenditures closer to their revenue throughout the crisis. Differences between LCC and FSNC airlines are not so obvious. Although Southwest Airlines and Alaska Airlines performed a bit better, they are closely followed by United Airlines. Also, Jet Blue Airways, a LCC, did worse that United Airlines and American Airlines did according to this specific criterion.

Although the correlations linking financial performance and business model are worth taking into consideration, they do not necessarily imply causation. In this regard, the analysis further delves into the role of other variables, which helps with obtaining a more detailed description of the characteristics of the airlines that had more solid, or weaker, performance during the first year of the pandemic.

4.3. Operational variables

First, considering the sudden halt in operations, it is worth looking at whether the size of the operations before the pandemic has been a conditioning factor in managing the crisis. In this sense, the data in Fig. 6 compare the net income variation with the total domestic ASMs in pre-COVID-19 times. This figure suggests that the size of operations could play a role to a certain extent, with larger airlines and larger workforces and fleets having a harder time with adjusting to the new demand characteristics. However, this conclusion should be made cautiously given that a certain association exists between the business model and size. That is, although most FSNC airlines are among the biggest airlines, no example of a big ULCC exists. Moreover, Southwest Airlines, despite being one of the largest airlines, has comparatively fared better during the crisis than other smaller airlines with similar business models have. If size in terms of the number of flights is analysed (Fig. 7), a very similar result is obtained, with the only remarkable difference being Southwest Airlines, which operates a larger number of shorter flights compared with the other large airlines. This could indicate that the link between size and the effect of the crisis is not so strong, or, alternatively, that Southwest Airlines is an outlier.

It is also important to look into different tactics in terms of adapting the size of the operation to the drop in demand (Fig. 8). Here, it is worth noting that airlines did not have the capacity to make decisions based only on demand and their own strategies. For them to be eligible to benefit from the support scheme that the US Government has defined through the Coronavirus Aid, Relief, and Economic Security (CARES) Act (US Congress, 2021), certain conditions in terms of minimum services needed to be abided by (Hotle and Mumbower, 2021). The decrease in the volume of operations was measured via ASMs and the number of flights. As the results are virtually the same using both measures; they are presented based on the ASMs only. In this regard, one can observe how those who applied deeper cuts in their operation have managed to better contain their losses. In analysing these results, one
should not overlook the fact that significant differences exist in terms of operating costs among airlines. In general, lower-cost models tend to have lower operating costs, which allows airlines to operate flights at lower losses in times of low load factors. Also, note that ULCCs and LCCs focus their operations on the domestic markets, with passengers starting their journeys domestically whereas FSNCs also rely on the international feed for their domestic operations. International operations were further reduced than the domestic ones were due to strict travel restrictions among countries. To a greater extent, this has impacted the operations of the airlines with higher shares of international traffic.

An additional aspect to be addressed is whether significant links exist among the main operating costs of airlines and their performance during the crisis. The focus was put on the two major operational costs: salaries and fuel. For workforce expenditures, we did not use data from 2020, as the CARES Act influenced the expenditure in salaries. As mentioned earlier, the CARES Act made financial aid conditional on not laying off personnel. Instead, we used data from 2019. Thus, it must be taken into account that what is being analysed is not the different strategies of airlines in terms of salary expenditure during the crisis. Rather, what is being analysed is the performance of airlines with different cost structures and hence different business models during non-crisis periods. By looking at the data from 2019 (Fig. 9), we can observe a general trend showing that those with higher expenses in salaries per ASM before the crisis have suffered heavier losses. Although this trend seems to be quite logical, some specific cases deviate from it. For example, although Delta Airlines had a lower expenditure in salaries compared with airlines with similar business models, such as the United Airlines or American Airlines, it performed worse. In contrast, whereas Southwest Airlines had higher wages per ASM, it outperformed not only the FSNC but also the rest of the LCC group and even some of the ULCC group.

In terms of fuel expenditure, following the same criterion as in the wage spending analysis, data from 2019 are used (Fig. 10). Considering that airlines use hedging in their fuel purchases (Morrell and Swan, 2006), using data from 2020 would be more suitable for an analysis of the benefits and risks of such a practice than for the study of business models. In this case, again, the overall picture provides an intuitive reading: those airlines spending less on fuel per ASM have adapted better to the crisis. A closer look, though, allows one to see some interesting differences. For example, Allegiant Air, although it had a higher cost of fuel compared with the other airlines with the same business model, it managed to compensate for it in other expenses and performed better overall in financial terms.

The final aspect of the airlines operations to consider here is the environmental performance of the airlines in relation to their financial performance during the COVID-19 crisis. Although the environmental impact of airline operations goes beyond their greenhouse gas emissions, these present the biggest challenge (Huang et al., 2020; Lu, 2009). Considering that the majority of emissions related to air transport are linked to the fuel burned during the operation of flights, the variable used to measure environmental performance is the fuel consumption per RPM. This measure allows one to account for environmental performance drivers, such as the load factor, the configuration of cabins and the efficiency of the planes used (Figs. 11 and 12).

In this instance, data from 2019 and from 2020 have been used to compare the performance before and during the pandemic. In general terms, both graphs consistently show that more fuel-efficient and thus less-polluting airlines have managed to contain their losses better. Using this measure, which takes into account RPM, it becomes apparent that airlines operating with denser cabin configurations have better environmental performance. It is worth noting that this reflects their performance but not necessarily their proactivity in terms of their environmental commitments.

4.5. Does a case exist for more resilient and sustainable business models in post-COVID-19 times?

The first part of section 4 has assessed which type of airlines have managed to endure the COVID-19 crisis better, providing relevant information in terms of different business models’ capacity to react to unexpected crises. Although differences among carriers have been significant, as mentioned earlier, drastic losses have been suffered sector wide, which will take time and resources to recover from (Hotle and Mumbower, 2021). With this in mind, in this section, we reflect on the viability of current business models in post-COVID-19 times. In this regard, taking into account the high vulnerability of the air transport
These requirements are specially challenging to meet, with business decrease in the quantity of flying (International Energy Agency, 2021). Models yielding low profitability margins. Costs, others entail higher expenses (Grewe et al., 2021). Good examples the increase in the globe externalities linked to the sector (Kılıç et al., 2019; Leviákangas, 2021; Lu, 2009; Rleye et al., 2020) should not be dismissed, either. It is worth noting that although only a small fraction of the world’s population flies (about 11.1% in 2018), the negative effects are global (Gössling and Humpe, 2020).

In this regard, the environmental impact of air transport, most notably in terms of climate change (Lee et al., 2020), is one of the key challenges that aviation will have to face in the coming years. The need to improve environmental sustainability in the sector has been on the table for a while, and before the COVID-19 crisis, numerous regulation initiatives were already in place, such as the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) sponsored by the ICAO, the European Union Emissions Trading System (EUTS) or other country-level measures. Additionally, although trade-offs may exist among productivity and decarbonisation efforts (Sartal et al., 2020), on the airlines’ side, there seems to be a growing commitment (Amankwah-Amoah, 2020b), with some of the main operators, including Delta Airlines or the Lufthansa Group, among others, having recently pledged to become climate neutral by 2050.

However, for the ambitious goal set in the Paris Agreement—to keep the increase in the globe’s temperature under 2 degrees Celsius (UNFCCC, 2015)—intensified collective action will be required. In considering the pursuit of a greener operation, although some of the measures, such as efficiency improvements, allow for the reduction of costs, others entail higher expenses (Grewe et al., 2021). Good examples are the use of sustainable alternative fuels (SAFs) or the implementation of more restrictive carbon pricing schemes, including taxes. Also, most scenarios where emission reduction targets are met include a necessary decrease in the quantity of flying (International Energy Agency, 2021). These requirements are specially challenging to meet, with business models yielding low profitability margins.

Taking all of the above into account, a question arises about whether it is possible to advance towards more resilient business models, which have a smaller environmental impact. In this regard, as Tan et al. (2017) showed in a study on the airline sector, a favourable moderating effect of environmental performance on financial performance linked to companies with slack resources. Thus, shifting to models focused on profitability rather than on revenue could be a step forward in this direction (Gössling, 2020). Additionally, some of the effects of the COVID-19 crisis might have created some conditions related to the characteristics of supply, changes in the behaviour of flyers and the role of governments, which, to a certain extend, could favour advancing in this direction.

In terms of the characteristics of the supply, a rise in fares is likely to occur during the next few years. One of the causes of the increase will be that airlines need to recover from the losses and start paying off the accumulated debt. According to a report by McKinsey (2021), the rise in prices linked to this factor could amount to a 3% in a scenario of the repayment of the additional debt in 10 years. Also, in the short term, the disappearance of some airlines and the radical cut in the number of destinations from others will create a more consolidated market (Suau-Sánchez et al., 2020), which could accommodate higher prices and thus higher profit margins. The shrinking of supply, however, is not even across all markets. In this regard, Europe will probably see a higher degree of consolidation of the market, as even before the COVID-19 crisis, some important players, such as Thomas Cook, had gone down. In the case of the US market, where no airline with a significant share of the market has gone bankrupt, the recovery of the supply will be more dependent on the capacity and strategies for bringing it back.

Progressive changes in the behaviour of flyers might also determine what business models can be more successful. Changes related to environmental concerns are likely to have an impact, as concerns for sustainability seem to be a growing factor in making decisions about flying (Baumeister and Onkila, 2017). Moreover, the pandemic might have enabled an opportunity window to accelerate the transition towards more sustainable mobility (Schmidt et al., 2021). Additionally, as the International Energy Agency (2021) argued, through such examples as the effectiveness of the use of face masks, the COVID-19 crisis might have contributed to raising an awareness of the potential of behavioural changes. This environmental awareness could also increase the willingness to pay a premium to compensate for the footprint of flying (Wild et al., 2021).

Another change in behaviour that the pandemic has triggered is the decrease in business travel. The increase in the use of digital meeting tools, which the lockdowns during the pandemic forced, has made them a convenient, cost-effective and socially acceptable way of conducting business. Although this type of travel is progressively coming back with the easing of restrictions, a part of the reduction is expected to be permanent. In this regard, estimations suggest that it will recover to only 80% of pre-pandemic levels by 2024 (McKinsey, 2021) and it might not recover to previous levels in terms of the share of demand (Suau-Sánchez et al., 2020). In this instance, again, the scenarios are quite different among countries and regions. For instance, in the European context, the rail transport infrastructure is well developed, and a stronger regulatory pressure exists through carbon pricing. Thus, it might be plausible for a change in behaviour to materialise to a higher extent. However, it is harder to imagine this happening in the US, where fewer alternatives are available.

Besides the structural and conjunctural changes that the COVID-19 crisis caused or accelerated, the most decisive role in defining the playing field for airlines will be that of governments as key regulators. The extraordinary amounts of financial support made available to the sector provide governments with better leverage for pursuing stronger regulations linked, for example, to environmental concerns (Abate et al., 2020; Avogadro et al., 2021). In this regard, it is illustrative to note the French government’s decision to make financial aid to Air France conditional on the withdrawal of its shortest domestic flights, which could easily be substituted with travel by rail. This example is meaningful in two ways. On the one hand, it shows the possibility of using political leverage to promote a more sustainable sector. On the other hand,
strongly on incomes from this market segment. This would create the shrinking of the market in a more permanent way is confirmed, this would lead to a moderate increase in fares.

Assuming that such a scenario with higher fares and a more central role of environmental sustainability materialises, the impact on current business models should be considered. To the extent that the supply continues to be reduced compared with pre-COVID-19 times, and in the context of growing demand, the rise in fares due to less competition could provide room for airlines across the board to try to improve their profit margins. However, this will be very dependent on the level of efficiency that each airline will manage to achieve. It also remains to be seen whether the sector will re-enter the inertia of competing through almost exclusively price strategies when the supply and demand eventually reach a similar balance as in pre-pandemic times.

It must also be taken into account that the characteristics of the short- and medium-haul markets are not the same as the ones for the long-haul markets are. Whereas low and ultra-low-cost models are well established in the short and medium-haul markets, the case for low-cost long-haul is not so clear (Fageda et al., 2015; Whyte and Lohmann, 2015). Although some success can be observed in Asia with examples of airlines such as AirAsia, and although some authors make the case for the possibility of this type of model (Albers et al., 2020), the pandemic has put into question the viability of such an option in markets like the transatlantic. The cease of Norwegian’s transatlantic flights serves as an example of this. The entrance of Jet Blue Airways into the transatlantic market is also interesting in this respect. Although it is a low-cost airline for its short-haul operation, it has entered this market with a closer model to those of the network carriers with state-of-the-art premium offerings in business class, just as it has already been doing in the US transcontinental market. Considering the demise, at least momentarily, of the low-cost long-haul operation, which pulled network carriers to drop fares (Soyk et al., 2021) and to adjust to some of the low-cost revenue-generating strategies, a drift back towards more conventional models might occur moving forward. This should lead to a moderate increase in airfares and therefore income from this type of travel. Thus, it can be expected that network carriers that have traditionally dominated the market will continue to do so.

Regarding the increase in operating costs due to external factors, such as higher taxes or more expensive fuels, these costs would most likely be directly transferred to passengers through a proportional increase in air fares. Although the potential disincentivising effect of such an increase would affect all airlines, it could be more damaging for business models that are based on low fares, as they focus on leisure travel, which is more sensitive to the elasticity of demand (Larsson et al., 2015). Additionally, if part of the demand is price induced (Gössling et al., 2019), ultra-low-cost airlines would have a harder time of attracting these types of customers. As for business travel, if the shrinking of the market in a more permanent way is confirmed, this would be especially challenging for FSNC models, whose revenues rely strongly on incomes from this market segment. This would create the need to redefine their revenue strategies in such a way that the generation of revenue would be distributed more evenly between leisure travel, which is usually booked further in advance, and business travel.

5. Conclusions

The results of the exploratory analysis of the US domestic market have shown how the business model—with the financial and operational characteristics that go with it—have made a difference in terms of the extent of the impact of COVID-19. Models based on lower costs and on the lowest fares have been more successful than FSNCs have been in facing the effects of an unexpected crisis. Data suggest that running a leaner operation provides a substantial advantage in a situation where the lack of demand drastically decreases the opportunities to generate revenue to compensate for structure and operating costs. It is worth noting how the differences among business models became apparent only during the crisis. During the five years leading up to the pandemic, in which a general and steady growth of demand allowed all airlines to increase their profitably, differences among airlines were present but did not necessarily rise from the type of business model.

The second part of the discussion has argued that current business models do not adequately equip airlines to face unexpected crises due to their perennial low profit margins. Considering the vulnerabilities of the sector and the socioeconomic externalities linked to it, the changes that the COVID-19 crisis has brought can be seen as an opportunity to reconsider the suitability of the models based on high volumes and low profit margins, as well as the desire to advance towards more sustainable models (Martínez Senra et al., 2012).

It has also been argued that we are advancing towards a new paradigm where environmental sustainability will be a central factor (Carou, 2021). However, the extent of this shift will be conditioned by the role of all of the stakeholders in the value chain, mainly manufacturers, airlines, flyers and regulators. Among these, states and the sectoral international organizations in which they meet will play a crucial role in establishing the rules of the game.

In terms of the limitations of our research, the focus on a specific market makes it necessary to be cautious regarding the possibility of drawing general conclusions from the study. Also, as events are still recent, the insights that can be obtained at this moment in time reflect a short-term impact. As data become available, further research could delve into the long-term performance effects of the crisis, as well as the impact in different business models.

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CRediT authorship contribution statement

Pol Fontanet-Pérez: Conceptualization, Data curation, Methodology, Visualization, Writing – original draft. José H. Vázquez: Conceptualization, Methodology, Writing – review & editing. Diego Carou: Conceptualization, Methodology, Writing – review & editing.

References

Ahate, M., Christidis, P., Purwanto, A.J., 2020. Government support to airlines in the aftermath of the COVID-19 pandemic. J. Air Transp. Manag. 89, 101931. https://doi.org/10.1016/j.jairtraman.2020.101931.

Air France’s bailout “climate conditions” explained | Transport & Environment [WWW Document]. n.d. URL https://www.transportenvironment.org/publications/air-frances-bailout-climate-conditions-explained (accessed 7.27.21).

Albers, S., Daft, J., Stabenow, S., Rundshagen, V., 2020. The long-haul low-cost airline business model: A disruptive innovation perspective. J. Air Transp. Manag. 89, 101878. https://doi.org/10.1016/j.jairtraman.2020.101878.

Albers, S., Rundshagen, V., 2020. European airlines’ strategic responses to the COVID-19 pandemic (January-May, 2020). J. Air Transp. Manag. 87, 101863. https://doi.org/10.1016/j.jairtraman.2020.101863.
Wild, P., Mathys, F., Wang, J., 2021. Impact of political and market-based measures on aviation emissions and passenger behaviors (a Swiss case study). Transp. Res. Interdiscip. Perspect. 10, 100405. https://doi.org/10.1016/j.trip.2021.100405.