ОРИГИНАЛЬНАЯ СТАТЬЯ

DOI: 10.26794/2587-5671-2024-28-1-177-187
UDC 336.64,336.67(045)
JEL L93, G32, G39

Assessment of the Financial Stability of Airlines with Different Business Models before, during and after the COVID-19 Pandemic

O.V. Savchina, D.A. Pavlinov
RUDN University, Moscow, Russia

ABSTRACT

The Russian airline market for the first time since the sharp decline in passenger traffic in 2020 showed growth rates of revenue per passenger-kilometre in 2021. This indicates a step towards recovery after the biggest crisis the industry has seen in all of history. The **purpose** of the study is to assess the financial stability of the Russian air carriers for the last three years: 2019 (pre-COVID-19), 2020 (COVID-19) and 2021 (post-COVID-19), with the help of **applying bankruptcy likelihood prediction models**. The analysis was conducted for 4 airlines, each of them having a different **business model** that they follow (national flag carrier, low-cost carrier, ultra-low-cost carrier and regional carrier). The market positions of each airline were identified, highlighting the rapid growth of low-cost carriers, even during the COVID-19 crisis. The same cannot be said for full-service airlines, which have fallen the most in both profit and traffic. **Calculations** of bankruptcy models showed that low-cost airlines were more financially stable during the COVID-19 pandemic, while full-service air carriers experienced uncertainty during 2020 and only gradually recovered in 2021. **These results** coincide with other research regarding which business model is less vulnerable during crises, however this is very dependent on the region in which airlines operate in: both low-cost carriers and full-services airlines, according to other authors, show high financial sustainability. Such contradiction in the current research highlights the relevance of further analysis in this area to provide answers that are more concrete.

Keywords: financial stability; financial distress; bankruptcy; aviation sector; COVID-19 pandemic; full-service carriers; low-cost carriers; financial analysis; air transport

For citation: **Savchina O.V., Pavlinov D.A. Assessment of the financial stability of airlines with different business models before, during and after the COVID-19 pandemic. *Finance: Theory and Practice*. 2024;28(1):177-187. (In Russ.). DOI: 10.26794/2587-5671-2024-28-1-177-187**

INTRODUCTION

The COVID-19 pandemic was the worst shock in history for the aviation industry: in 2020, world passenger traffic decreased by 60.2% (from 4.6 billion passengers carried in 2019 to 1.8 billion passengers carried in 2020). The 2020 volumes were the lowest they have been since 2003, according to data from the World Bank.[1] The International Air Transport Association (IATA) forecasts accumulative losses of $ 201 billion in 2020–2022 for the airline industry.[2] Though such losses have been unheard of before, yearly revenue losses were present even in pre-COVID-19 years [1], and bankruptcy has been an issue since the peak of the liberalization of the industry: for example, the first major bankruptcy in the U.S. occurred in 1982 with the airline Braniff [2]. Such a crisis makes the survival of many airlines around the world doubtful: the airline industry has always had a high bankruptcy rate, and, according to data from Bloomberg, at least 68 airlines have entered or exited bankruptcy since early 2020.[3] These market tendencies highlight a high relevance and importance of studying the degree of financial stability of air carriers.

To battle an increase of bankruptcy probability, many airlines implemented measures of financial and operational optimization, such as rationalizing

[1] The World Bank Data: Air transport, passengers carried. URL: https://data.worldbank.org/indicator/IS.AIR.PSGR (accessed on 26.10.2022).

[2] Losses Reduce but Challenges Continue — Cumulative $ 201 Billion Losses for 2020–2022. 04.10.2021. URL: https://www.iata.org/en/pressroom/pressroom-archive/2021-releases/2021–10–04–01/ (accessed on 27.10.2022).

[3] The Airlines Still Facing Risk of Bankruptcy as Travel Returns. 25.02.2022. URL: https://www.bloomberg.com/news/articles/2022–02–24/the-airlines-still-facing-risk-of-bankruptcy-as-travel-returns (accessed on 05.11.2022).

route networks, retiring aircraft from their fleet, firing personnel. Several government measures were also implemented, as aviation was the focus for countries worldwide, due to the importance of this sector for population mobility and the fact that many other industries depend on it. For example, the aid included government-backed commercial loans and guarantees, recapitalization, flight subsidies, nationalization, the deferral of taxes and charges, grants and private equity [3]. However, the financial aid has been described by some as unequal, as select governments have chosen to support mostly flag carriers. This, in return, can significantly decrease competitiveness on the air transport market, leading to a regression in the liberalization of this industry [4].

Throughout 2021, for most markets both domestic and international passenger traffic continued to be lower than pre-COVID-19 levels. However, the same could not be said for the Russian airlines, during the 2021 calendar year, the Russian domestic air market was the only market to have witnessed a growth in revenue per-passenger-kms (RPKS) — by 24.2%, according to IATA.[4] This indicates that analyzing how the Russian airlines were performing financially is possible in three-time frames: the pre-crisis year with both a strong domestic and international market (2019); the crisis year of 2020, with an almost non-existent international market and a weakened domestic market (2020); and the post-crisis year of 2021, with a stronger than ever domestic market and a recovering international market.

The goal of this article is to assess the financial stability in 2019–2021 of the 4 Russian airlines: Aeroflot (full-service carrier, IATA code — SU), Pobeda (low-cost carrier, IATA code — DP), NordStar (regional carrier, IATA code — Y7) and Smartavia (ultra-low-cost carrier, IATA code — 5N). The latter is a relatively new airline business model: it differs from traditional low-cost airlines by having significantly lower unit costs (by offering an even more aggressive unbundling of fares), generating a larger portion of ancillary revenue, and having lower unit revenue [5]. We aim to identify how well these airlines have recovered from the pandemic crisis financially, as well as what business model has proven to be more effective.

MATERIALS AND METHODS

To identify the role of each airline of the Russian aviation market, we have analyzed the data from the official website of the Federal Agency for Air Transport of the Russian Federation and selected key operational and industry-specific indicators.[5]

For identifying the size and age of each airline's aircraft fleet, we used the industry analytical tool PlaneSpotters.[6] With this tool, we also identified the number of active, parked and arrested aircraft. Information on the exact location of arrested aircraft was received from the flightradar24 database.[7] With this geographic information system (GIS) we were also able to get updated data on the current route network of each airline as of October 2022.

After identifying identical routes between each airline, we used the airlines' official websites to retrieve data on their current air fare prices from Moscow airports. We calculated the weighted average air fare by 1000 km (this considers flight frequencies and the distance of each airline route).

Finally, the flight efficiency, measured by the share of delayed flights and the average flight delay time, was done with the help of the flightradar24 tool (it includes historical data on the scheduled departure time (STD) and the actual departure time (ATD) for each flight by airline). Data for October 2022 was collected, and the indicators were calculated per norms of the Federal Aviation Administration[8] (FAA, U.S.), which indicates that a delayed flight is one where the flight is delayed by more than 15 minutes from its schedule time.

[4] Passenger Demand Recovery Continued in 2021 but Omicron Having Impact. 25.01.2022. URL: https://www.iata.org/en/pressroom/2022-releases/2022–01–25–02/ (accessed on 05.11.2022).

[5] Official website of the Federal Agency of Air Transport of the Russian Federation. URL: https://favt.gov.ru/dejatelnost-vozdushnye-perevozki-perevozki-passazhirov/ (accessed on 28.10.2022).

[6] Plane Spotters — Airline Index Russian Federation. URL: https://www.planespotters.net/airlines/russian-federation (accessed on 29.10.2022).

[7] Flight radar 24 — Live Air Traffic. URL: https://www.flightradar24.com/data/airlines (accessed on 29.10.2022).

[8] Flight Delay Information — Air Traffic Control System Command Center. URL: https://www.fly.faa.gov/flyfaa/usmap.jsp?legacy=true (accessed on 05.11.2022).

Next, the financial stability of the selected airlines was defined by using three bankruptcy likelihood prediction models: Altman's Z-score model for emerging markets, the AIRSCORE model of Chow et al., and the P-model of Pilarski and Dinh. These models are used not only to identify the actual likelihood of bankruptcy for each airline, but also to in general highlight the current degree of financial stability and the main problems in financial performance [6]. A combination of an internal comparison and an external comparison will be conducted: on the one hand, each parameter (coefficient) of a given bankruptcy model will be compared for the years 2019–2021 within each airline (internal comparison); on the other hand, they will also be compared between each airline (external comparison) [7].

To calculate all financial indicators necessary for calculating the aggregate scores of the bankruptcy models, data from the balance sheets and income statements of the airlines will be used according to the Russian Accounting Standards.

RESULTS AND DISCUSSION

First, we will identify the role of each airline on the Russian aviation market. To do so, we have calculated and analyzed several industry-specific indicators in dynamics from 2015 (2016 for freight-related indicators) to 2021. It is important to note that the compound annual growth rates have been calculated twice: the first calculation shows how each air carrier grew before the COVID-19 crisis, and the second calculation includes the years of the COVID-19 pandemic. This is done to assess the degree to which each separate airline has been affected by the crisis. *Table 1* shows the results of our calculations.

As of 2021, the national airline Aeroflot still holds the leading position on the passenger market and this position has not changed since 2015. Pobeda holds 3rd place, increasing 4 positions from 2015. Smartavia and NordStar — the 9th and 15th places, respectively. Smartavia has increased by 12 positions since 2015, while NordStar has stayed the same. In terms of market positions, Smartavia has had the highest increase since 2015 among the airlines analysed.

When looking at CAGRs, we can see that the indicator that does not include COVID-19 years for Pobeda and Smartavia was the highest — both airlines grew rapidly, reaching peak passenger traffic volumes in 2021, and their growth was faster than the market average. Aeroflot grew slower than Pobeda and Smartavia, but growth rates were still higher than the market average. NordStar's growth had positive values but was still lower than the market average.

When including the COVID-19 years into the calculation of the CAGR, we can identify the following: out of the 4 air carriers, Aeroflot has suffered the most. The 2015–2021 value for the airline was also lower than the market average. This is well explained: as the main national carrier of Russia, Aeroflot had the highest number of international destinations in its' route network. When the COVID-19 pandemic started, all international destinations were closed for a portion of 2020 and recovered slowly during 2020–2021: this led to a sharp decline in passenger traffic for the airline. Pobeda, who also had a significant number of international destinations, was the 2nd in terms of CAGR decline. However, the indicator for Pobeda still had positive values and was higher than the market average. NordStar's CAGR fell only slightly. Smartavia was the only airline that witnessed a growth in CAGR, a result of the transition to an ultra-low-cost business model.

An airline's load factor indicates the effectiveness of sales for each airline. In 2021, Pobeda and Smartavia had the highest load factors, which is usually the case for LCC airlines. Aeroflot follows them, with NordStar holding the last position amongst these airlines by this indicator.

On the freight market, Aeroflot holds the 2nd place as of 2021, which has remained unchanged since 2015. Pobeda has increased its position on the market by 11 positions (the 6th place). Smartavia and NordStar had both worsened their positions on the market — by 1 position and 7 positions, respectively.

When looking at the CAGRs of the freight market, we can see that they did not decrease as much in the COVID-19 years as the CAGRs of the passenger market had. This is mainly because freight traffic grew during the crisis: air freight was an optimal way to transport medical equipment necessary for fighting the virus. So, CAGRs with COVID-19 years for most air carriers were still positive (besides NordStar, though they did decrease).

Table 1

Dynamics of Passenger — and Freight Related Indicators of Aeroflot, Pobeda, Smartavia, Nordstar and the Russian Airline Market on Average in 2015–2021

Indicator / Airline	Unit	Year(–s)	SU	DP	5N	Y 7	Market
Passenger-related indicators							
Passenger traffic (PAX)	MLN PAX	2021	21.4	14.4	3.6	1.2	**111.0**
PAX CAGR w/o COVID-19	%	2015–2019	9.3%	35.1%	29.3%	3.1%	**8.6%**
PAX CAGR w/ COVID-19	%	2015–2021	–3.3%	29.3%	30.7%	0.4%	**3.2%**
Market share by PAX	%	2021	19.3%	13.0%	3.3%	1.0%	–
Market share by PAX growth	p.p.	2015–2021	–9.1%	9.6%	2.5%	–0.2%	–
Market position by PAX	Position	2021	1	3	9	15	–
Change in market position by PAX	Number of positions	2015–2021	0	4	12	0	–
Passenger load factor (LF)	%	2021	74.3%	93.6%	88.1%	68.1%	**81.5%**
Change in passenger LF	p.p.	2015–2021	–5.0%	12.4%	18.3%	–3.1%	**1.8%**
Freight-related indicators							
Freight traffic (FRT)	THD tons	2021	187	65	3	5	**1 477**
FRT CAGR w/o COVID-19	%	2016–2019	6.6%	451.6%	–0.2%	–5.9%	**5.5%**
FRT CAGR w/ COVID-19	%	2016–2021	1.3%	188.6%	5.8%	–1.4%	**5.2%**
Market share by FRT	%	2021	12.7%	4.4%	0.2%	0.4%	–
Market share by FRT growth	p.p.	2016–2021	–5.3%	4.4%	0.0%	–0.2%	–
Market position by FRT	Position	2021	2	6	24	26	–
Change in market position by FRT	Positions	2016–2021	0	11	1	–9	–
Commercial LF	%	2021	60.5%	85.8%	82.2%	73.5%	**65.4%**
Change in commercial LF	p.p.	2016–2021	–4.5%	10.2%	8.7%	1.7%	**–2.3%**

Source: Compiled by the authors using data from the official website of the Federal Agency for Air Transport of the Russian Federation. URL: https://favt.gov.ru/dejatelnost-vozdushnye-perevozki-stat-pokazately/ (accessed on 28.10.2022).

As with passenger load factors, the highest freight commercial load factors were those of Pobeda and Smartavia. NordStar's commercial load factor is also higher than the market average, while Aeroflot's is lower. During 2016–2021 Pobeda, Smartavia and NordStar have also seen an increase in commercial load factor, while Aeroflot has witnessed a decrease.

Next, we will look at the current state of the fleet mix of each airline. *Table 2* includes data of the total number of aircraft overall and by type, and the average age of each airline's fleet mix. We can see that by size of their fleet, Aeroflot and Pobeda hold leading positions inside the TOP 10 (out of the TOP 35 Russian commercial airlines) — the 1st and 6th, respectively. Smartavia and NordStar have medium-sized fleets — they hold the 13th and 17th positions, accordingly. The same can be said for the average fleet age of these airlines: Pobeda and Aeroflot hold the 2nd and 3rd positions, while Smartavia and NordStar — the 10th and 20th positions, accordingly. Currently, the most diverse fleet mix is that of Aeroflot's. Pobeda and Smartavia, as it is usual for LCCs, have only one

Table 2

Size and Average Age of the Fleet Mixes of the Russian Airlines as of November 2022

Airline	Number	Ranking	Share	Average age	Ranking	Fleet mix	Status
Pobeda	41	6	5.1%	5.5	2	B737 (41)	40 active, 1 parked, 3 arrested
Aeroflot	173	1	21.6%	6.8	3	A320 (58) A321 (35) A330 (12) A350 (7) B737 (37) B777 (22) SU95 (2)	132 active, 41 parked, 2 arrested
Smartavia	13	13	1.6%	13.3	10	B737 (11) A320 (2)	12 active, 1 parked, 2 arrested
Nordstar	9	17	1.1%	17.8	20	B737 (9)	7 active, 2 parked, 1 arrested

Source: Compiled by the authors using data from PlaneSpotters. URL: https://www.planespotters.net/airlines/russian-federation (accessed on 29.10.2022).

main aircraft (Pobeda's case — only 41 Boeing 737s or the diversification of aircraft is minimal (11 Boeing 737s and 2 Airbus 320s for Smartavia). Though a regional air carrier, NordStar also follows the strategy of having only one aircraft type in its' fleet mix.

It is important to note that since the beginning of the 2022 sanctions crisis in Russia, the fleet mix of airlines has changed drastically: some air carriers have had their aircraft arrested overseas as lessors have obligated them to return the aircraft; others have had to park a significant number of aircraft due to the absence of maintenance services and/or a sharp decline in passenger traffic. Amongst Aeroflot, Pobeda, Smartavia and NordStar, 8 aircraft (3.3% of their accumulative fleet) have been arrested, 18.4% are parked, leaving 78.2% of their fleet currently being used. The Russian aviation authorities and airlines are currently solving the problem of aircraft arrests by re-registering all aircraft (specifically Airbuses and Boeings) under the Russian aircraft registration codes, and simultaneously removing the international registration codes.

Now we will analyse the current route network of each airline. Although the Russian air transport industry recovered well during the end of 2020 and all throughout 2021, thanks to the developed domestic market and key international tourist destinations re-opening (Turkey and Egypt), starting in February 2022, the Federal Agency for Air Transport strongly recommended airlines to restrict their international flights, as the risk of aircraft arrest was high. Although most aircraft of the Russian airlines have been reregistered, out of Aeroflot, Pobeda, Smartavia and NordStar only Aeroflot has been flying abroad: currently (as of October 2022), 66.7% of the total routes of Aeroflot are domestic, 12.0% are routes to CIS countries and 21.3% are routes to international destinations other than CIS countries (in total, international destinations account for 33.3% of Aeroflot's network). Pobeda and Smartavia mostly fly domestically, except for flights to Minsk, Belarus (CIS country), while NordStar flies only domestically (*Table 3*).

The analysis of the route networks of Aeroflot, Pobeda, Smartavia and NordStar helped us identify which routes are seen amongst all 4 of these airlines. Out of the top routes from Moscow, St. Petersburg, Minerlanye Vody, Makachkala and Krasnoyarsk are all present in the route networks of these airlines. These routes hold the 1st, the 2nd, the 9th, the 12th, and the 16th positions on the Moscow market in terms of number of weekly flights. We have identified these routes to analyse the current price policy of each airline. So, for all these airlines and routes, we calculated the average weighted air fare per 1000 km. We have done this for both economy air fares without the minimum

Table 3

Route Network Structures of Aeroflot, Pobeda, Smartavia and NordStar as of October 2022

Characteristic / Airline	SU	DP	5N	Y7
Base (hub) airports	Moscow Sheremetyevo Airport (SVO)	Moscow Vnukovo Airport (VKO)	Moscow Sheremetyevo Airport (SVO), Pulkovo Airport (LED), Talagi Airport (ARH)	Moscow Domodedovo Airport (DME), Yemelyanovo Airport (KJA), Alykel Airport (NSK)
Number of domestic destinations	50	33	11	12
Number of CIS destinations	9	1	0	0
Number of international destinations, except CIS	16	0	0	1
Share of domestic destinations	66.7%	97.1%	100.0%	92.3%
Share of CIS destinations	12.0%	2.9%	0.0%	0.0%
Share of international destinations, except CIS	21.3%	0.0%	0.0%	7.7%

Source: Compiled by the authors using data from flightradar24. URL: https://www.flightradar24.com/data/airports/russia (accessed on 07.11.2022).

of 23 kg of luggage and economy air fares with the minimum of 23 kg of luggage (*Fig.*). The results were quite contradictory: the airlines with low-cost models, Pobeda and Smartavia, should have the lowest airfares. This is the case with economy airfare without the minimum of 23 kg of luggage: Pobeda is the cheapest, NordStar and Smartavia are almost at the same level and Aeroflot is the most expensive. However, when looking at the economy airfare with the minimum of 23 kg, we see the following: Pobeda and Smartavia have the most expensive offerings, with Aeroflot and NordStar following them.

The identified tendencies with the economy airfare with the luggage minimum can be explained by two reasons: the first being that low-cost carriers have an additional economy airfare offering with luggage up to 10 kg, which is absent for Aeroflot and NordStar. This means passengers still have a choice of flying cheaper if their weight is minimal. However, this leads to Pobeda and Smartavia pricing higher for more luggage — this is a diversification of sorts. The second reason for Aeroflot having the cheapest economy airfare with luggage up to 23 kg, despite being a full-service air carrier, is to do with the large numbers of discounts it has been offering since the end of February 2022: the federal government had set out for airlines to carry at least 100 million passengers in 2022, and for this goal it had issued subsidies for each carrier passenger of the Russian airlines.[9] Aeroflot, as the flag carrier of the Russian Federation, is very much responsible for a large portion of this goal, so it has been in many ways following a price dumping strategy to attract more passengers.

Lastly, before assessing the financial stability of these airlines, we will analyze the flight efficiency of each airline as of October 2022. This will be done by looking at the current airline punctuality using two key indicators: the share of delayed flights and the average delay time. It is necessary to highlight that we will be looking at these two indicators separately for each airline, as comparisons of the value between these four airlines will be difficult to interpret as they fly to different hub airports and have various fleet mixes.

In October 2022, Aeroflot had the best flight efficiency amongst these 4 air carriers: the share of delayed flights totalled 13.0%, while the average flight delay amounted to 36.2 minutes. Smartavia and NordStar had a similar average flight delay time — 40.0 and 39.3 minutes, accordingly. However, the latter had a higher share of delayed flights — 47.0%

[9] Putin: the volume of air transportation in 2022 must amount to at least 100 million passengers. 31.01.2022. URL: https://tourism.interfax.ru/ru/news/articles/86540/ (accessed on 08.11.2022).

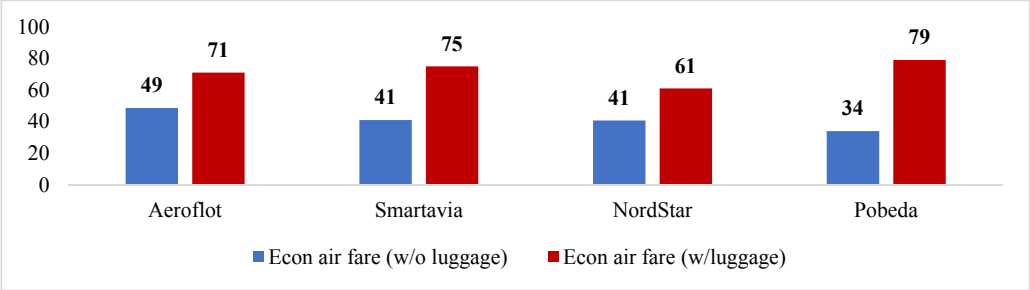

Fig. **Weighted Average Airfares Per 1000 kms of Aeroflot, Pobeda, Smartavia and NordStar as of November 2022, USD**

Source: Compiled by the authors using data from the official websites of Aeroflot, Pobeda, Smartavia and NordStar. URL: https://www.aeroflot.ru/sb/app/ru-ru#/search?_k=9emdt5; https://www.nordstar.ru/; https://flysmartavia.com/; https://pobeda.aero/ (accessed on 09.11.2022).

vs 28.1%. Pobeda, contrary to the main characteristics of low-cost carriers of having high flight punctuality, had almost half of flight departures delayed — 49.4%, with an average flight delay time of 104.5 minutes (*Table 4*).

In terms of operational indicators, we can conclude that the fastest growing business model is the low-cost model. Both Pobeda and Smartavia have grown faster than the market average, even during the years of the COVID-19 pandemic. Aeroflot still holds strong positions, though it suffered the most during the COVID-19 pandemic as a large portion of its route network was closed. NordStar had mixed results: the growth of the airline's volumes has been no more than 2%. These results in many ways will help interpret the results of assessing the financial stability of these airlines before, during and after the COVID-19 pandemic.

Bankruptcy models, such as Altman's Z-score for developing markets [8], Chow's et al. AIRSCORE model [9] and Pilarski's and Dinh's P-score model [10] have been used to calculate the likelihood of financial failure of these airlines for three years: 2019, 2020 and 2021. *Table 5* shows the calculation results of Altman's Z-score: before the COVID-19 pandemic, Aeroflot had a high Z-score of 3.75, indicating a close to zero chance of becoming bankrupt. This rapidly changed in 2020, when the airline's Z-score was equal to 0.72, which is lower than 1.1, indicating serious financial difficulties. In 2021, the value had grown to 1.77, which is characterized as a state of uncertainty. The 2020 decrease was a result of the 3 of 4 parameters of Altman's model decreasing, especially the EBIT/Assets indicator. In 2021, the Z-score recovered due to EBIT/Assets improving (this indicator has the highest weight in the Z-score model), the Equity/Liabilities ratio kept the total score down, as it had become almost equal to 0.

On the other hand, Pobeda had high levels of financial stability throughout all the years assessed: the Z-score values were always higher than 2.6–6.81, 5.59 and 8.61 in 2019–2021, accordingly. This is a result of lower liability values and a good volume of retained earnings. The same can be said for Smartavia: the Z-scores were usually higher than 2.6–8.51, 2.44 and 4.20 in 2019–2021, accordingly.

NordStar was stable at the start, having a Z-score of 2.70, then had a similar trajectory to Aeroflot's. NordStar's issues include a low share of working capital in the overall assets structure, virtually no retained earnings and a negative EBIT/Assets ratio.

So, Altman's model indicates a higher level of financial stability of low-cost carriers, in particular Pobeda and Smartavia. Aeroflot, as the flag carrier of the Russian Federation, had gradually recovered in 2021.

The results of calculating the AIRSCORE model slightly differ: for example, Aeroflot did not enter the zone of high financial instability in 2020. However, it did reach the uncertainty zone in 2021 (again because of a decrease of equity — by almost 86%). Pobeda indicated strong financial stability throughout, also reaching a peak AIRSCORE in 2021, as equity values in 2021 were almost twice the values of 2019. NordStar showed much better results with the AIRSCORE: in 2019 and 2021 the airline had values indicating strong financial stability, while in 2020 it was in the "grey" zone of uncertainty. Such differing

Table 4

Share of Delayed Flights and Average Flight Delay of Aeroflot, Smartavia, NordStar and Pobeda in October 2022, % and minutes

Airline / Indicator	Share of delayed flights, %	Average flight delay (minutes)
Aeroflot	13.0	36.2
Smartavia	28.1	40.0
NordStar	47.0	39.3
Pobeda	49.4	104.5

Source: Compiled by the authors using data from flightradar24. URL: https://www.flightradar24.com/data/airports/russia (accessed on 07.11.2022).

Table 5

Calculation Results of Altman's Z-score Model for Emerging Markets for Aeroflot, Pobeda, NordStar and Smartavia in 2019–2021

Parameter	Aeroflot			Pobeda			NordStar			Smartavia		
	2019	2020	2021	2019	2020	2021	2019	2020	2021	2019	2020	2021
X1	0.02	0.12	0.18	0.15	0.23	0.45	0.06	–0.54	–0.03	0.93	0.94	0.89
X2	0.34	–0.10	–0.28	0.29	0.33	0.40	0.01	–0.25	–0.35	0.41	0.15	0.11
X3	–0.18	–0.48	–0.26	0.16	–0.14	0.03	–0.27	–0.33	–0.17	0.10	–0.50	0.00
X4	0.54	0.24	0.03	0.54	0.63	0.80	0.83	0.03	0.74	0.76	0.22	0.15
Z-score	3.75	0.72	1.77	6.81	5.59	8.61	2.70	–3.26	1.54	8.51	2.44	4.20

Source: Compiled by the authors using data from Aeroflot's, Pobeda's, NordStar's and Smartavia's balance sheets and income statements for the years 2019–2021, formed according to the Russian accounting standards.

results for NordStar are to do with the AIRSCORE models, including the interest expenses to liabilities ratio: in 2010–2021, the airline had 0 interest expenses. Smartavia once again demonstrated high financial stability, though the AIRSCORE dropped year to year because of equity decreasing by 59.5% (*Table 6*).

Lastly, we will calculate Pilarski's and Dinh's P-score, which will give us the exact probability of bankruptcy for each airline in 2019–2021. The model includes many indicators, like Altman's Z-score but uses non-linear methods to create a model that can indicate the percentage chance of bankruptcy. In the pre-COVID-19 years, all 4 airlines had a 0% chance of going bankrupt. In 2020, Pobeda and Smartavia saved this probability, having P-scores of 0.2% and 0.1%, accordingly. The chance of becoming bankrupt drastically increased for both Aeroflot and NordStar — their P-scores totaled to a 35.9% and 19.8% chance, accordingly. Although much higher than in 2019, it is important to note that this chance is still considered low for the airline industry. In 2021, both Pobeda and Smartavia went back to a 0% of becoming bankrupt, while Aeroflot and NordStar had better results at 19.7% and 2.1% chance, accordingly (*Table 7*). According to the model, the main issues for Aeroflot in 2020 included a 60% revenue drop, negative values of retained earnings and a decrease in equity. The only strong aspect of Aeroflot's financial state was the growth in current liquidity. NordStar also struggled with a sharp drop in equity and negative retained earnings.

As a result of analyzing the financial stability of airlines with different business models before, during and after the COVID-19 pandemic, we can note that before the pandemic, all 4 airlines showed above average financial performance: liquidity values lied within the industry norms; profitability, though low for some air carriers, was present. However, issues with the capital structure of airlines were present even then. During the COVID-19 pandemic, this issue strengthened as airlines such as Aeroflot and

Table 6

Calculation Results of Chow's AIRSCORE Model for Aeroflot, Pobeda, NordStar and Smartavia in 2019–2021

Parameter	Aeroflot			Pobeda			NordStar			Smartavia		
	2019	2020	2021	2019	2020	2021	2019	2020	2021	2019	2020	2021
X1	0.00	0.02	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
X2	5.43	6.49	7.33	2.83	2.39	2.81	4.68	5.74	6.07	3.88	3.56	3.39
X3	0.54	0.24	0.03	0.54	0.63	0.80	0.83	0.03	0.74	0.76	0.22	0.15
AIRSCORE	0.19	0.08	0.00	0.20	0.23	0.29	0.30	0.01	0.27	0.28	0.08	0.05

Source: Compiled by the authors using data from Aeroflot's, Pobeda's, NordStar's and Smartavia's balance sheets and income statements for the years 2019–2021, formed according to the Russian accounting standards.

Table 7

Calculation Results of Pilarski's and Dinh's P-score del for Aeroflot, NordStar and Smartavia in 2019–2021

Parameter	Aeroflot			Pobeda			NordStar			Smartavia		
	2019	2020	2021	2019	2020	2021	2019	2020	2021	2019	2020	2021
X1	2.77	0.85	1.44	2.54	1.65	2.21	3.33	1.46	2.07	3.92	2.98	4.37
X2	0.34	–0.10	–0.28	0.29	0.33	0.40	0.01	–0.25	–0.35	0.41	0.15	0.11
X3	0.54	0.24	0.03	0.54	0.63	0.80	0.83	0.03	0.74	0.76	0.22	0.15
X4	1.04	1.23	1.38	1.26	1.47	2.55	1.11	0.45	0.93	1.68	1.41	1.08
X5	0.00	–0.52	–0.13	0.12	0.05	0.09	–0.04	–0.16	–0.05	0.01	–0.10	0.01
w	–8.41	–0.58	–1.40	–8.01	–6.49	–8.52	–8.34	–1.40	–3.83	–11.55	–7.03	–9.67
P–score	0.0%	35.9%	19.7%	0.0%	0.2%	0.0%	0.0%	19.8%	2.1%	0.0%	0.1%	0.0%

Source: Compiled by the authors using data from Aeroflot's, Pobeda's, NordStar's and Smartavia's balance sheets and income statements for the years 2019–2021, formed according to the Russian accounting standards.

NordStar sharply decreased their own resources. In 2021, we can see an improvement for all airlines, so it is highly unlikely that any of these air carriers will become bankrupt soon. We can also highlight that in the battle between full-service airlines and low-cost carriers, the latter show much higher financial results.

At the moment, there is not much research that assesses the financial stability of airlines before, during and after the COVID-19 pandemic. On the one hand, many western airs transport markets started recovering from the crisis much later than the Russian air transport market; on the other hand, many of them highlight the degree to which the aviation market has suffered because of the COVID-19 pandemic. Furthermore, the relevance of this research is highlighted by the fact that there is almost no research on this topic for the Russian airlines. Some recent research has shown that the Russian airlines are always faced with risks: be it changes in fuel prices, exchange rate fluctuations, or other external factors — all of which seriously affect the financial stability of air carriers and their ability to meet their obligations [11].

Similar research used both Altman's Z-score and Pilarski's P-score models and two other bankruptcy prediction models to analyse the financial stability of the 4 Indian airlines. The results indicated a high level of financial stability for Indigo (a low-cost carrier), which coincides with our results: the low-cost Russian airlines also show a higher degree of financial stability. However, Spice Jet, another Indian low-cost carrier, was defined as an airline under financial distress, so it is difficult to say certainly that a low-cost business model guarantees financial stability [12].

Research on the impacts of the COVID-19 pandemic on the US domestic air transport market gives a more defined answer: low-cost models are more successful than full-service network carriers in facing the consequences of an unexpected crisis [13]. The authors also note that such differences in the financial stability of airlines with different business models have become evident only during the crisis, as in the years before the COVID-19, a steady growth in demand allowed all air carriers to receive profit and hold a normal degree of financial stability. A similar study of the financial performance of the U.S. airlines conducted for the period before the COVID-19 pandemic (2015–2019) also concluded that airlines that follow the low-cost business model show higher efficiency not only financially, but operationally as well [14].

A contradictory answer is shown for European airlines: research suggests that during crises, low-cost airlines perform worse than full-service air carries [15]. The authors connect this to airlines with low-cost business models receiving less financial aid than national air carriers, leading the latter to become "too big to fail". Such differences in results highlight the relevance of diving into this topic further to receive a more concrete answer.

CONCLUSION

Before the Russian aviation industry was yet again hit with a new economic and sanction crisis in 2022, it proved to be one of the strongest markets in terms of traffic recovery post the COVID-19 pandemic in 2021. The analysis of the key operational indicators has shown that even considering the years of the pandemic crisis, the market still shows growth rates at an average of 3.2%, with low-cost carriers staying the absolute leaders of such growth. Amongst the analysed airlines, Aeroflot experienced the sharpest decline, which is mainly a result of its large share of international routes.

Bankruptcy likelihood prediction models show similar results in terms of who has proven to be more effective: low-cost air carriers, though also experiencing financial distress, were much more financially stable than full-service airlines; all calculations amongst the three models indicate that the chance of bankruptcy for air carriers that follow this business model is always close to zero. On the other hand, full-service airlines during the pandemic had values that indicated serious financial risk, though they started to recover during 2021. These results coincide with numerous previous studies that have proven the strength of the low-cost model during economic uncertainty (two studies based on data of the U.S. airlines, one study based on data of the Indian airlines), however, there are also studies that have shown the opposite (study on the European airlines).

This study is limited to the number of airlines included for analysis, as well as the number of years for which bankruptcy model scores were calculated. Further research will be aimed at broadening both the time series and the number of airlines included. This will form a more complete picture and potentially identify important dynamics and relationships necessary to build the author's model.

REFERENCES

1. Chen P. Analysis on the reasons of delta bankruptcy. In: Proc. 3rd Int. conf. on economic management and cultural industry (ICEMCI 2021). Dordrecht: Atlantis Press; 2021:1123–1128. (Advances in Economics, Business and Management Research. Vol. 203). DOI: 10.2991/assehr.k.211209.182
2. Gritta R.D., Adrangi B., Davalos S., Bridght D. A review of the history of air carrier bankruptcy forecasting and the application of various models to the US airline industry: 1980–2005. In: Gratzer K., Stiefel D., eds. History of insolvency and bankruptcy from an international perspective. Huddinge: Södertörns högskola; 2008:193–214. (Södertörn Academic Studies. No. 38). URL: https://www.diva-portal.org/smash/get/diva2:213027/fulltext01.pdf
3. Diaconu L. Coronavirus pandemic and airline industry: Between facts in prospects. In: Tacu Hârșan G.-D., Haller A.-P., Ungureanu D., eds. Romanian rural tourism in international context: Present and prospects. Iași: Performantica; 2021;47:81–92. URL: https://zenodo.org/records/5726331

4. Shi Y., Li X. Determinants of financial distress in the European air transport industry: The moderating effect of being a flag-carrier. *PLoS One*. 2021;16(11): e0259149. DOI: 10.1371/journal.pone.0259149
5. Bachwich A.R., Wittman M.D. The emergence and effects of the ultra-low-cost carrier (ULCC) business models in the U.S. airline industry. *Journal of Air Transport Management*. 2017;62:155–164. DOI: 10.1016/j.jairtraman.2017.03.012
6. Savchina O.V., Pavlinov D.A., Bobkov A.L., Konovalova N. Comparative analysis of the financial stability of renewable-based electricity companies: The case for hydroelectric organizations. *International Journal of Energy Economics and Policy*. 2022;12(5):392–408. DOI: 10.32479/ijeep.13575
7. Savchina O.V., Pavlinov D.A., Savchina O.V. Financial stability of electricity companies in the context of macroeconomic instability and the COVID-19 pandemic. *International Journal of Energy Economics and Policy*. 2021;11(5):85–98. DOI: 10.32479/ijeep.11575
8. Altman E.I. An emerging market credit scoring system for corporate bonds. *Emerging Markets Review*. 2005;6(4):311–323. DOI: 10.1016/j.ememar.2005.09.007
9. Chow G., Gritta R.D., Leung E. A multiple discriminant analysis approach to gauging air carrier bankruptcy propensities: The Airscore model. *Journal of the Transportation Research Forum*. 1991;31(2):371–377. DOI: 10.22004/ag.econ.317357
10. Pilarski A., Dinh T. Numerical scoring approach to credit risk analysis. In: Butler G.F., Keller M.L., eds. Handbook of airline finance. New York, NY: McGraw-Hill Book Co.; 1999:329–342.
11. Koptseva E.P., Paristova L.P., Sycheva E.G. Model for determining the probability of airline bankruptcy. *Transport Research Procedia*. 2022;61:164–170. DOI: 10.1016/j.trpro.2022.01.026
12. Shome S., Verma S. Financial distress in Indian aviation Industry: Investigation using bankruptcy prediction models. *Eurasian Journal of Business and Economics*. 2020;13(25):91–109. DOI: 10.17015/ejbe.2020.025.06
13. Fontanent-Pérez P., Vázquez X.H., Carou D. 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? *Case Studies on Transport Policy*. 2022;10(1):647–656. DOI: 10.1016/j.cstp.2022.01.025
14. Huang C.C., Hsu C.C., Collar E. An evaluation of the operational performance and profitability of the U.S. airlines. *International Journal of Global Business and Competitiveness*. 2021;16(2):73–85. DOI: 10.1007/s42943–021–00031-x
15. Kökény L., Kenesei Z., Neszveda G. Impact of COVID-19 on different business models of European airlines. *Current Issues in Tourism*. 2022;25(3):458–474. DOI: 10.1080/13683500.2021.1960284

ABOUT THE AUTHORS

Oksana V. Savchina — Cand. Sci. (Econ.), Assoc. Prof., Department of Finance and Credit, RUDN University, Moscow, Russia
https://orcid.org/0000-0003-3568-576X
savchina-ovl@rudn.ru

Dmitriy A. Pavlinov — Postgraduate student, Department of Finance and Credit, RUDN University, Moscow, Russia
Corresponding author:
1042210198@pfur.ru

Conflicts of Interest Statement: The authors have no conflicts of interest to declare.

The article was submitted on 10.02.2023; revised on 10.03.2023 and accepted for publication on 27.03.2023. The authors read and approved the final version of the manuscript.