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THE IMPACT OF THE COVID-19 PANDEMIC ON THE ECONOMIC PERFORMANCE OF THE EUROPEAN AIR CARRIERS

Michaela Mikulášiková
Air Transport Department
University of Žilina
Univerzitná 8215/1
010 26 Žilina

Abstract

The outbreak of the COVID-19 pandemic which was officially declared in March 2020 as a whole new global risk, has negatively affected operations in all industries around the world. Air transport was one of the first sectors to be affected the most by this event as the disease has been easily transmittable among people. As a measure to prevent the spread of the disease, governments around the world have severely restricted international commercial air traffic. These travel measures have significantly reduced the market value of airlines operating scheduled passenger air services worldwide, where operations have had to be largely limited or even canceled by air carriers. These facts motivate to research the impact of the COVID-19 pandemic on the performance of air carriers, which is also the main aim of this paper. This paper examines the impact of the COVID-19 outbreak on 15 European airlines using economic analysis of the influence of the determining factors.

Keywords

air carrier, COVID-19 pandemic, Determining Factors, Economic analysis

1. INTRODUCTION

Only four months after the first case of COVID-19 was reported in China, the disease has spread around the world infecting more than two million people. Many countries have adopted strict measures including border closures to prevent the virus from spreading. At the beginning of April 2020 up to 91% of the world's population lived in countries where pandemic measures included strict restrictions or even bans on the entry of foreigners. However, the pandemic has been gradually devastating the global economy in addition to human lives. Almost every industry has been currently hit by the pandemic, but no other industry has been hit as hard as the air transport and tourism. It is these sectors that are most vulnerable because they are very sensitive to sudden market changes. Aviation business has always been hit hard in previous crises, such as the terrorist attack in 2001 in the USA, the outbreak of the SARS epidemic or the global economic crisis in 2008. All of these crises had a negative impact on the aviation sector, which was reflected in particular in the decline in demand for air transport services.

The COVID-19 pandemic has caused the largest decline in airlines' seat capacity in early April 2020. This decline of more than 80 % forced some airlines to suspend their operations. The enormous decline in seat capacity was caused by the mass grounding of airline aircraft, at the beginning of April 2020 it was almost 60% of the global fleet.

Most airlines which were forced to ground their aircrafts and temporarily suspend commercial flights, provided assistance to individual states in the fight against coronavirus. The aircraft, which were originally intended for passenger transport, were adapted for the transport of cargo, including medical supplies and vaccines used in the fight against COVID-19. Some airlines have also provided free flights to transport paramedics to hard-hit regions of the world.

However in addition to the operational impact, the pandemic has also had a significant impact on the air transport market and airline costs. By closing countries' borders as well as some airports, airlines have been forced to dramatically disrupt international flights what has caused a significant reduction in passenger revenues and also a significant increase of the cost of pandemic measures and aircraft grounding, leading to mass redundancies to reduce employees costs.

2. LITERATURE OVERVIEW

The COVID-19 pandemic and the ongoing global political and economic crisis are currently the main topic of various research studies. Various studies and articles are currently examining the correlation between the COVID-19 pandemic and the economic performance of airlines.

2.1. THE IMPACT OF THE COVID-19 PANDEMIC ON AIRLINES

Authors Q. Aman et al. (2020) claim that "COVID-19 has had a significant impact on revenue in the airline industry. The passenger revenue average decreased to $237.25 billion. In contrast, the cargo revenue increase was $23.73125 billion. Thus, COVID-19 had no impact on the industry's cargo revenue." Then they claim that „regional airlines will clearly benefit from increasing their activity as hub feeders during the recovery period. This would, indeed, take the regional airline business model in Europe closer to the US model." Furthermore authors S.M. Iacus et al. (2020) assume that „a reduction of direct revenues passengers may impact the entire aviation sector proportionally, we can roughly estimate the expected number of job losses and impact on GDP at global scale." Also „the large employment reductions is seen by the major carriers. One explanation is that low-cost and regional airlines are built

around low fares driven by low costs of operation. The already lean nature of these airlines may make them more able at allocate personnel in a cost-effective manner." what claims author Sobieralski (2020). On the other hand, S. Maneenop, S. Kotcharin (2020) say in their article that „the administrative measures should allow the airlines to change their business plans and establish alternative. Besides, they should be able to operate irregular flight schedules reflecting market demand."

P. Ozili et al. (2020) state that „the travel restrictions imposed by governments subsequently led to the reduction in the demand for all forms of travel which forced some airlines to temporarily suspend operations" Operational costs are also mentioned by authors T. Thepchalerm and P.Ho (2021) in their article where they claim that „the increasing costs of operation amplifies the damage to airlines. The infection preventive measures that airlines need to implement are costly." Authors Kokény et al. (2021) deal with the issue of the different business model of the airlines and claim that „smaller airlines, possibly including LCCs, might be more vulnerable to a serious crisis than FSCs. When the crisis reaches a higher magnitude, then smaller airlines (including LCCs) decline sharply." Authors H. Troyer et al. (2021) in their article indicate that „the "new normal" moving forward in the aviation industry and, specifically, airline travel will include social distancing measures and other public health safety measures."

An analysis of the articles shows that the COVID-19 pandemic has caused a significant damage to airlines, which have been forced to radically reduce their operations in order to reduce operating costs and thus maintain the necessary liquidity to overcome the crisis. However, the authors differ in the position of low-cost and traditional airlines and their vulnerability in times of crisis.

2.2. FUTURE OF THE AIRLINES

According to A. Curley et al. (2020) article, „airlines will experience a gradual and uneven return to operations that requires an unprecedented logistical effort. Done poorly, their strategy may be as costly as the crisis itself." The future of the airline in post-covid era is also mentioned by the authors D. Tay et al. (2020). They say that „Looking forward, airlines need to first and foremost look to strategically rebuild demand levels while reassuring passengers on the safety of air travel. In order to do this, airline carriers should understand the changes in passengers' sentiment and behaviour caused by the COVID-19 pandemic through analysing the market as a whole and by passenger segments." Data and digitalization are also considered as the future of airlines what is claimed authors D. Molenaar et.al (2020)„Companies that take a data-driven, action oriented, and digitally supported approach will have the best chance to emerge stronger from the COVID-19 crisis." The issue of the new revenue management is mentioned by author B. Vinod (2021) in his research article who says that „with the COVID-19 pandemic in our midst, historical booking data may not represent the future. What is required is an adaptive robust revenue management approach that does not rely on demand forecasts based on historical data but relies on monitoring key performance indicators in real time to take corrective action." Also authors L.B. Bauer et al. (2020) claim that „hub and Spoke model, on the premise that heavily scaled international feeder networks, as seen in Europe for example, will become impractical, more expensive to operate and face significantly lower Seat Load Factors. Simultaneously, the alternative concept of Point-to-Point travel looks set to become more attractive, with airlines and customers alike being afforded a unique array of advantages provided by direct flights in a post COVID-19 era."

The authors of the analysed articles agree that in order to overcome the crisis with the least possible losses and to successfully return to unlimited operations, airlines must focus on planning a successful strategy now and also sufficiently monitor current changes in demand, which will allow for a faster return to service.

2.3. AIRLINES'S REACTION TO PANDEMIC

„Keeping a proportion of the fleet in active mode is not without its costs in terms of labour, maintenance and fuel, but it does mean airlines that do can respond to changes in restrictions or an upturn in passenger demand before their competitors and so potentially gain market share and enjoy first mover advantage." say N. Adrienne et al. in their research article. Y.H. Akbar et al. (2020) claim that „the airlines response depends on the size of the health impacts on society of a particular policy measure proposed by a government as well as on economic impacts of a given measure on airlines." On the other hand S. Albers et al. (2020) argue that „some airlines have engaged in tactical moves with immediate effect: they have converted passenger aircraft into cargo transporters to benefit from the more stable cargo demand in the crisis, which has even seen a short-term "boom" due to the urgent delivery of medical protection gear." According to the article by two Slovakian authors M. Mrázová and A. Kazda (2021) „some airlines will bankrupt, some of them will be forced to change their core airline business and divert it to a more efficient way."

The authors of the articles furthermore state that the most frequent reactions of airlines to the COVID-19 pandemic and the resulting travel restrictions were flight cancelation, aircraft grounding and mass redundancies. They also agree that despite timely and sufficient measures to reduce operating costs, in the absence of State aid, some airlines will be forced to suspend or even to close down.

2.4. STATE AID TO THE AIRLINES

Authors M. Abate et al. (2020) claim that „the need for support and the actual support to airlines provided by governments vary significantly in each country. Analysis suggests that most governments give a high priority to maintaining air transport connectivity in order to protect economic activity and jobs, in aviation itself and in related sectors such as tourism. This often means that the support is primarily given to, at best, a handful of national operators in each country." Also „some airlines and related aviation sectors, such as airports and air traffic control providers, have signalled to their respective national governments the need for financial support in the form of loans, grants, other cash or fee waivers." According to J. Macilree's et al. (2020) article.

Although the authors of both articles focus on state aid to airlines from different perspectives, they clearly agree that the role of government not only in the form of state aid but also in the implementation of pandemic measures plays a key role in the future of the aviation.

3. METHODOLOGY

Based on the analysis of the research articles, differences in opinions have been discovered about the performance of low-cost nad traditional airlines, on which basis the goal of this analysis was determined.

This part deals with the economic analysis of selected European airlines based on the method of quantification of the influence of determining factors.

3.1. FUNCIONAL METHOD

The functional method allows quantification of the influence of factors in multiplicative links and is based on the coefficients of change of individual factors.

The principle of the functional method is to determine the overall change of the peak indicator X through the change of individual factors and to quantify the impact of these factors. The method allows quantification even in the case of a simple share, if X = a / b, without the need to convert the share into a product, as in the case of this analysis, which may make it difficult to interpret the indicators thus generated.

The analysis is based on three designed models where analysed peak indicators represent:

- Load factor
- Work productivity
- Aircraft productivity

These models use following equations:

Table 1: Equations used in three designed models of determining factors [Source: Author]

I. *MODEL OF DETERMINING FACTORS INFLUENCING LOAD FACTOR OF THE AIRLINES*
$LF_0 = \frac{RPKM_0}{ASKM_0}, \quad LF_1 = \frac{RPKM_1}{ASKM_1}$ $A = \frac{RPKM_1}{RPKM_0} - 1, \quad B = \frac{ASKM_0}{ASKM_1} - 1$ $\Delta LF_{RPKM} = LF_0 \; x \; A \left[1 + \frac{B}{2}\right]$ $\Delta LF_{ASKM} = LF_0 \; x \; B \left[1 + \frac{A}{2}\right]$
II. MODEL OF DETERMINING FACTORS INFLUENCING AIRLINES WORK PRODUCTIVITY
$WP_0 \frac{number\ of\ PAX_0}{number\ of\ employees_0}$, $WP_1 = \frac{number\ of\ PAX_1}{number\ of\ employees_1}$ $A = \frac{number\ of\ employees_1}{number\ of\ PAX_0} - 1,$ $B = \frac{number\ of\ PAX_0}{number\ of\ employees_1} - 1$ $\Delta WP_{pax} = PP_0 \; x \; A \left[1 + \frac{B}{2}\right]$ $\Delta WP_{employees} = PP_0 \; x \; B \left[1 + \frac{A}{2}\right]$
III. MODEL OF DETERMINING FACTORS INFLUENCING AIRLINES AIRCRAFT PRODUCTIVITY
$AP_0 = \frac{number\ of\ flights_0}{number\ of\ aircraft_0}$, $AP_1 = \frac{number\ of\ flights_1}{number\ of\ aircraft_1}$ $A = \frac{number\ of\ aircraft_1}{number\ of\ flights_0} -$ $B = \frac{number\ of\ flights_0}{number\ of\ aircraft_1} - 1$ $\Delta AP_{number\ of\ flights} = AP_0 \; x \; A \left[1 + \frac{B}{2}\right]$ $\Delta AP_{number\ of\ aircraft} = PP_0 \; x \; B \left[1 + \frac{A}{2}\right]$

By applying these equations, it is possible to find out which relative part of the determining factors affect the total value of three peak indicators. The pre-covid and covid periods are analyzed and compared.

3.2. AIRLINES SELECTION

15 air carriers were selected for the economic analysis. The analysis is focused on European carriers, so each of the analyzed carrier has its headquarters in Europe. However, it is important to note that the analysis includes carriers based in European countries, but not exclusively in the European Union. Turkish Airlines is also included in the selection of carriers. Although Turkey is only partially part of Europe, it is a member of the European Common Aviation Area (ECAA) and has therefore been selected for this analysis as one of the most important air carriers.

However, the selection of carriers was limited and had to be adapted to the availability of information for those carriers for which the required data were available. As many European airlines now tend to operate as a group, the choice of carriers had to be adapted to those carriers whose necessary data were available for the company itself and not for the group as a whole.

Table 2: Airline selection for the analysis [Source: Author]

Airline	***Established***	***Headquarter***	***Business model***
KLM	1919	Netherlands	Traditional
Turkish Airlines	1933	Turkey	Traditional

Lufthansa	1953	Germany	Traditional
Swiss Airlines	2002	Switzerland	Traditional
Austrian Airlines	1957	Austria	Traditional
Tap Portugal	1945	Portugal	Traditional
British Airways	1919	Great Britain	Traditional
Finnair	1923	Finland	Traditional
SAS	1946	Sweden	Traditional
Aer Lingus	1936	Ireland	Traditional
Eurowings	1990	Germany	Low-cost
Easyjet	1995	Great Britain	Low-cost
Vueling	2004	Spain	Low-cost
Norwegian	1993	Norway	Low-cost
Wizzair	2003	Hungary	Low-cost

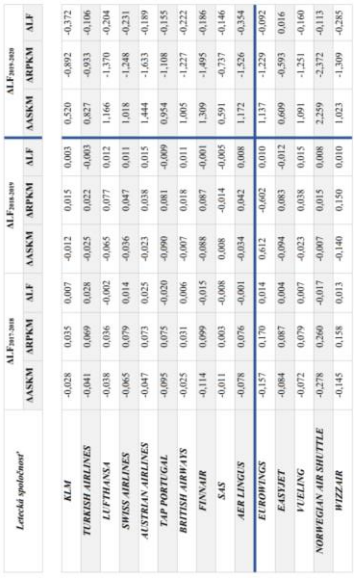
Selected air carriers represent a diverse group. It includes both large and small companies, companies with many years of operation at the market for scheduled passenger air transport, as well as younger companies. However, this analysis considers the difference in the business model of selected carriers to be the most important. Airlines with either a traditional or low-cost business model are analyzed.

Information of selected airlines were obtained from annual reports which airlines publish annually on their official website.

4. RESULTS OF THE ANALYSIS

4.1. MODEL 1

Table 3: Results of the analysis of the model 1 [Source: Author]



Letecká společnost	ALF2017-2018 ASKM	ALF2017-2018 ARPKM	ALF2017-2018 ALF	ALF2018-2019 ASKM	ALF2018-2019 ARPKM	ALF2018-2019 ALF	ALF2019-2020 ASKM	ALF2019-2020 ARPKM	ALF2019-2020 ALF
KLM	-0,028	0,035	0,007	-0,012	0,015	0,003	0,520	-0,892	-0,372
TURKISH AIRLINES	-0,041	0,069	0,028	-0,025	0,022	-0,003	0,827	-0,933	-0,106
LUFTHANSA	-0,038	0,036	-0,002	-0,065	0,077	0,012	1,166	-1,370	-0,204
SWISS AIRLINES	-0,065	0,079	0,014	-0,036	0,047	0,011	1,018	-1,248	-0,231
AUSTRIAN AIRLINES	-0,047	0,073	0,025	-0,023	0,038	0,015	1,444	-1,633	-0,189
TAP PORTUGAL	-0,095	0,075	-0,020	-0,090	0,081	-0,009	0,954	-1,108	-0,155
BRITISH AIRWAYS	-0,025	0,031	0,006	-0,007	0,018	0,011	1,005	-1,227	-0,222
FINNAIR	-0,114	0,099	-0,015	-0,088	0,087	-0,001	1,309	-1,495	-0,186
SAS	-0,011	0,003	-0,008	0,008	-0,014	-0,005	0,591	-0,737	-0,146
AER LINGUS	-0,078	0,076	-0,001	-0,034	0,042	0,008	1,172	-1,526	-0,354
EUROWINGS	-0,157	0,170	0,014	0,612	-0,602	0,010	1,137	-1,229	-0,092
EASYJET	-0,084	0,087	0,004	-0,094	0,083	-0,012	0,609	-0,593	0,016
VUELING	-0,072	0,079	0,007	-0,023	0,038	0,015	1,091	-1,251	-0,160
NORWEGIAN AIR SHUTTLE	-0,278	0,260	-0,017	-0,007	0,015	0,008	2,259	-2,372	-0,113
WIZZAIR	-0,145	0,158	0,013	-0,140	0,150	0,010	1,023	-1,309	-0,285

The calculated data in Table 3 show that in the analysed period 2017-2018, most airlines recorded a year-on-year increase in the total LF. The highest increase in LF was recorded by the Turkish carrier Turkish Airlines, by 2.8 percentage points. The exceptions in this case are Lufthansa, TAP Portugal, Finnair, SAS, Aer Lingus and Norwegian, which recorded a decrease in LF but this decrease did not represent a significant operational changes which did not represent significant operational changes. On the contrary, an increase in ASKM is recorded by all carriers, which can also be interpreted as an increasing demand in scheduled air transport services in this period to which air carriers responded with an increased offer. However, in order to achieve an increase in LF it is necessary that these offered seats are also used by customers, which is expressed by the RPKM indicator. For all carriers for which a year-on-year increase was recorded in the LF, the factor of used RPKM achieved a higher influencing value.

Also, in the period 2018-2019 most of the analyzed carriers recorded an increase in the total value of LF. The only exceptions are Turkish Airlines, TAP Portugal, Finnair, SAS and Easyjet. However, the recorded declines in LF are only slight. Other figures for other carriers, which show positive values again point to a growing year-on-year demand in scheduled passenger air transport services.

The analysed period 2019-2020 already represents the covid period where significant declines in the operation of analysed airlines are recorded. Since mid-March 2020, due to the outbreak of the COVID-19 pandemic, air carriers have been forced to significantly reduce their operations, as evidenced by the results in Table 3. All analyzed carriers recorded significant declines in LF during this period, which ranged from about -10 to -37 percentage points. The largest decrease in LF among the examined carriers was recorded by the Dutch flag carrier KLM together with the Irish flag carrier Aer Lingus, by as much as -37.2 percentage points for KLM and by 35.4 percentage points for the Irish carrier. By contrast, German low-cost carrier Eurowings saw the lowest decline of -9.2 percentage points, followed by Turkish Airlines with the second lowest decline in LF, by -10.6 percentage points.

All analyzed carriers responded to the outbreak of the pandemic by reducing the number of seats offered, which is clearly indicated by significant decreases in the ASKM. We can say that the decrease in the ASKM has a positive effect on the final value of LF. Norwegian low-cost carrier and Austrian flag carrier cut the offer the most. On the other hand, the carrier KLM reduced the offer the least, which also recorded the highest decrease in the total of LF. Despite the fact that carriers significantly reduced supply, interest in passenger air transport services fell so sharply at the time of the pandemic that all analyzed carriers recorded a higher decrease in RPKM than in ASKM, which had a significant impact on the resulting value of LF. This value decreased due to the higher influencing weight of the RPKM factor, which showed high negative values. On the other hand, the significant decrease in ASKM airlines' passenger kilometers offered partially offset the decrease in LF, as if the seat offer was not reduced, the LF drops in the analyzed carriers would be much higher, which would be very disadvantageous for carriers. The only exception for the analyzed carriers is the British low-cost carrier Easyjet, which as the only carrier did not record a decrease in LF during the covid period, but on the contrary its increase. This fact can be explained by the fact that as the only

carrier, during the outbreak of the COVID-19 crisis estimated and reduced the supply of ASKM so well that the decrease in RPKM did not exceed the decrease in ASKM, thus not reducing LF.

4.2. MODEL 2

Table 4: Results of the analysis of the model 2 [Source: Author]

Letecká společnost'	ΔPP2017-2018			ΔPP2018-2019			ΔPP2019-2020		
	Δzam.	Áčest.	ΔPP	Δzam.	Áčest.	ΔPP	Δzam.	Áčest.	ΔPP
KLM	-24,098	46,227	22,129	-19,864	28,182	8,318	52,153	-749,356	-697,202
TURKISH AIRLINES	-211,449	118,817	-92,631	-95,797	-14,295	-110,092	51,564	-736,075	-684,511
LUFTHANSA	-56,448	124,987	68,539	-250,200	63,818	-186,381	55,744	-1409,797	-1354,053
SWISS AIRLINES	-91,857	182,007	90,149	-118,202	109,020	-9,182	61,154	-1541,094	-1479,940
AUSTRIAN AIRLINES	-46,217	155,342	109,125	27,105	96,224	123,329	107,472	-1715,014	-1607,542
TAP PORTUGAL	68,993	140,264	209,257	-85,149	121,031	35,882	126,684	-1203,586	-1076,903
BRITISH AIRWAYS	4,559	46,741	51,300	-0,907	19,835	18,927	100,271	-985,921	-885,651
FINNAIR	-179,137	222,724	43,587	-103,794	206,827	103,033	149,456	-1736,728	-1587,272
SAS	48,787	16,513	65,300	-325,422	-31,857	-357,279	725,906	-1694,251	-968,345
AER LINGUS	6,291	183,083	189,373	19,640	105,204	124,844	1676,406	-4764,797	-3088,391
EUROWINGS	-898,252	709,373	-188,879	6000,430	-2300,688	3699,742	555,145	-6070,887	-5515,743
EASYJET	-947,517	629,278	-318,238	-531,535	511,637	-19,898	396,799	-3225,265	-2828,466
VUELING	-1316,767	956,587	-360,180	-1573,55	475,290	-1098,26	394,214	-4075,312	-5681,098
NORWEGIAN AIR SHUTTLE	-223,429	424,490	201,060	316,921	-112,428	204,493	1089,461	-3866,107	-2776,646
WIZZAIR	-1943,942	1307,433	-636,509	-352,887	1255,841	902,954	685,422	-7128,476	-6443,054

The results of this model also indicate an increasing demand in scheduled passenger air transport services in the pre-covid period which in this case indicates in particular a year-on-year increase in the number of passengers carried for all analyzed carriers. According to the data in Table 12, it can also be argued that the increasing number of passengers carried motivates air carriers to hire new staff, an increase of which is recorded for most of the air carriers analyzed in the pre-covid period. As for the work productivity indicator, it is clear from the obtained data that higher values of total work productivity are achieved by low-cost carriers. This argument can be explained in particular by the fact that carriers with a traditional business model place great emphasis on the quality of the services offered, which ensures a higher number of crew during the flight than low-cost carriers that comply with minimum mandatory crew numbers. Therefore, the number of passengers carried per one employee is lower for traditional carriers, which in this case reduces the work productivity of traditional carriers compared to the low-cost ones.

In the analyzed covid period, all carriers recorded a significant decrease in the number of transported passengers, which was also reflected in a significant decrease in the work productivity indicator. The highest decrease in the number of passengers carried was recorded by the carrier Wizzair and on the other hand the lowest decrease was recorded by the carrier Turkish Airlines. The carriers responded to these declines in operation by reducing the number of employees, thus at least partly trying to reduce their operating costs during the peak of the crisis and partly to compensate for the declines in the work productivity indicator. The Irish carrier Aer Lingus cut its workforce the most, by almost half. On the contrary the lowest decrease in the workforce was again recorded for the Turkish carrier. However, despite the significant reduction in the workforce recorded by all carriers analyzed, the negative development of the work productivity indicator towards the reduction, which caused a rapid decline in the number of passengers carried, failed to reverse. The lowest declines in work productivity were recorded by low-cost carriers Wizzair, Vueling and Easyjet, and conversely, the lowest declines were recorded by Turkish Airlines and KLM.

4.3. MODEL 3

Table 5: Results of the analysis of the model 3 [Source: Author]

Letecká společnost'	ΔPL2017-2018			ΔPL2018-2019			ΔPL2019-2020		
	Ausk.lety	Ateriadla	ΔPL	Ausk.lety	Ateriadla	ΔPL	Ausk.lety	Ateriadla	ΔPL
TURKISH AIRLINES	83,950	-13,656	70,295	-11,005	-78,876	-89,881	-749,127	-38,251	-787,378
LUFTHANSA	112,988	26,942	139,930	-47,456	-58,423	-105,879	-956,603	-140,956	-1097,559
SWISS AIRLINES	85,323	-245,258	-159,935	-41,787	-30,144	-71,931	-1039,756	-19,031	-1058,786
AUSTRIAN AIRLINES	83,904	0,00	83,904	-142,223	21,319	-120,904	-1204,393	42,036	-1162,357
SAS	-39,315	11,892	-27,422	-25,010	-11,688	-36,698	-950,299	235,918	-714,381
EUROWINGS	274,072	-742,992	468,920	-456,146	99,227	-356,918	-1365,014	993,224	-371,791
EASYJET	145,102	-220,538	-75,436	142,632	-89,446	53,187	-875,188	-44,571	-919,759
WIZZAIR	214,614	-326,722	-112,108	207,950	-134,224	73,725	-1038,000	-142,379	-1180,379

In the analyzed period 2017-2018, most of the analyzed carriers increased the number of their aircraft in the fleet which can also be explained in response to the growing demand of scheduled passenger air transport services. However, the increase in the influencing value of the factor of the number of aircraft in the fleet has led to a decrease in the overall productivity of aircraft for most carriers. This could be meaning that increasing the number of aircraft in the fleet, while other variables remain unchanged, will have a negative effect on overall aircraft productivity. On the contrary, the reduction in the number of aircraft in the fleet has a positive effect on the overall change in the aircraft productivity indicator.

Not so significant declines in aircraft productivity were also recorded for most of the analyzed carriers in the period 2018-2019. Turkish Airlines, Lufthansa, Swiss Airlines and SAS increased the amount of aircraft, but there was a decrease in the number of flights performed, which caused a decrease in the productivity of these carriers' aircraft. A decrease in aircraft productivity was also recorded for Austrian Airlines, which, although it reduced the amount of aircraft in the fleet, also saw a more significant decrease in the number of flights performed, which was reflected in a decrease in aircraft productivity. Out of the carriers analyzed, the low-cost carrier Eurowings recorded the highest decrease in aircraft productivity during this period, while the low-cost carriers Easyjet and Wizzair increased the amount of aircraft in the fleet but also recorded a significant increase in aircraft productivity.

However, the recorded declines in aircraft productivity for the analyzed carriers in the pre-covid period are only slight compared to the decreases of this indicator in the covid period. At that time, there was a significant decrease in the aircraft productivity indicator for all carriers analyzed. The lowest decrease was recorded by the low-cost carrier Wizzair and the lowest decrease was also recorded by the low-cost carrier Eurowings. The significant decrease in this indicator was mainly influenced by a high drop of the number of flights performed by all analyzed carriers. However, a reduction o the amounts of aircraft in the fleet, which has a positive effect on the growth of the aircraft productivity indicator, was recorded for only 3 carriers (Austrian Airlines, SAS, Eurowings). The carrier Eurowings reduced its fleet the most, but it also recorded the highest decrease in the number of flights performed. For other carriers, there was an increase in the number of aircraft even during the crisis, which was reflected in significant declines in aircraft productivity

4.4. SUMMARY

The analysis of the designed quantification models of determining factors shows that in the case of the first model, which examined changes in the aircraft Load Factor, carriers with a low-cost business model recorded better results in the covid period. On the other hand, in the second model which examined changes in the work productivity indicator and its influencing factors, carriers with the traditional business model applied performed better in the covid period, with the exception of Aer Lingus. Regarding the results of the third model, which examined changes in the aircraft productivity indicator and its influencing factors, in this case it is not possible to clearly determine which applied business model achieved better results in times of crisis.

5. CONCLUSION

The aviation industry together with other transport industries and tourism is one of the most sensitive industries to external factors. Since the beginning of the new millennium, the aviation has gone through many serious crises, but the COVID-19 pandemic can be considered the most serious crisis to hit the aviation industry worldwide. Strict travel restrictions imposed by national governments have led to enormous restrictions on air carriers' operations, which has also been reflected in a significant drop in their market values. However, in general, only the strongest will overcome the crisis, so it is important to find out which applied model of air carriers' business is easier to overcome the crisis and is stronger - traditional or low-cost.

Based on the economic analysis and the results achieved from the three quantification models, it is not possible to clearly determine which business model of the analyzed carriers achieves better results in times of crisis. The first model showed better performance of low-cost carriers. On the contrary the second model showed better results of traditional carriers and the third model showed mixed results, as it was reduced to only 8 carriers due to the unavailability of data. However, the ambiguous results of the analysis can also be explained by the fact that nowadays there is no longer a purely traditional or purely low-cost business model, because there is a mutual hybridization, they take over the characteristics and the boundaries between individual business models gradually disappear. Therefore, in order to achieve clear results, a more comprehensive analysis of a larger number of air carriers is needed, focusing not only on operational indicators but also on financial ones that would provide comprehensive results on the performance of air carriers in times of crisis. Such an analysis should also work with the individual attributes of the air carriers' business models, which would be a more comprehensive approach compared to the chosen procedure in this work, where the examined air carriers were strictly divided into only two groups.

It should also be noted that the paper was written during the ongoing pandemic, so the results achieved in this thesis are not final and full research will require future research after the end of the pandemic.

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