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Examination of Airlines and Airports in COVID-19 Pandemic: A Comparative Study of Turkey with European and Global Aviation*

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Abstract

COVID-19 pandemic caused a serious interruption in global aviation and tourism industries. The purpose of this study is to examine the economic and operational effects of COVID-19 on aviation industry including airlines and airports, and how it relates to tourism sector. A descriptive approach is adopted using secondary data and reports of national, regional, international authorities and organizations. The comparison of 2019, 2020, and in some cases, 2021, is made by analyzing and interpreting global, European, and Turkish civil aviation data together with Turkish tourism data. The findings reveal that, in contrast to cargo traffic, passenger and aircraft traffics in world, Europe, and Turkey have massively been hurt by the pandemic in 2020 which caused critical losses in airlines and airports. Since aviation is the locomotive of tourism, it is found that foreign visitors entering Turkey by air dropped significantly affecting tourism revenues in 2020. It is found that there was some recovery in aviation and tourism industries in 2021, but not as much as to the 2019 levels due to the travel restrictions and lockdowns caused by severe third and fourth waves of COVID-19 in Turkey and deferred country-wide crisis response. Lastly, several response and recovery strategies were presented, and recommendations were made that can be followed by decision-makers in aviation and tourism industries to overcome this crisis.

Keywords: Air Transportation, Civil Aviation, COVID-19 Pandemic, Turkish Tourism.

COVID-19 Pandemisinde Havayolları ve Havalimanlarının İncelenmesi: Türkiye'nin Avrupa ve Küresel Havacılık ile Karşılaştırmalı Bir Çalışması

Öz

COVID-19 salgını, küresel havacılık ve turizm sektörlerine ciddi şekilde sekte vurdu. Bu çalışmanın amacı, COVID-19'un havayolları ve havalimanları dahil olmak üzere havacılık endüstrisi üzerindeki ekonomik ve operasyonel etkilerini ve bunun turizm sektörü ile ilişkisini incelemektir. Ulusal, bölgesel, uluslararası otorite ve kuruluşların ikincil verileri ve raporları kullanılarak tanımlayıcı bir yaklaşım benimsenmiştir. Küresel, Avrupa ve Türkiye sivil havacılık verileri ile Türkiye turizm verileri analiz edilmiş ve yorumlanmış olup, 2019, 2020 ve bazı durumlarda da 2021 yıllarının karşılaştırması yapılmıştır. Bulgular, pandeminin 2020 yılında havayolları ve havalimanlarında kritik kayıplara neden olarak, dünyada, Avrupa'da ve Türkiye'deki yolcu ve uçak trafiğinin büyük ölçüde zarar gördüğünü ortaya koymaktadır. Havacılık turizmin lokomotifi olduğu için, 2020 yılında Türkiye'ye hava yoluyla gelen yabancı ziyaretçi sayısının düşmesinin, turizm gelirlerini önemli ölçüde etkilediği tespit edilmiştir. 2021'de havacılık ve turizm sektörlerinde bir miktar toparlanma olduğu, ancak, COVID-19'un Türkiye'de şiddetli geçen üçüncü ve dördüncü dalgalarının neden olduğu seyahat ve sokağa çıkma kısıtlamaları ile ülke genelinde geciken kriz müdahalesi nedeniyle, 2019 seviyelerindeki kadar olmadığı tespit edilmiştir. Son olarak, çeşitli müdahale ve toparlanma stratejileri sunulmuş olup, bu krizi aşmak için havacılık ve turizm sektörlerindeki karar vericilerin izleyebileceği önerilerde bulunulmuştur.

Anahtar Kelimeler: Hava Taşımacılığı, Sivil Havacılık, COVID-19 Pandemisi, Türkiye Turizmi.

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INTRODUCTION

Aviation has always played a crucial role in facilitating tourism and economy, including pre-pandemic, post-pandemic, and pandemic times. Airline passenger transportation and airport traffic have deeply been impacted by the COVID-19 pandemic in 2020 regarding health and safety of passengers and employees, operational and financial results due to border closures, travel restrictions, quarantine requirements, and reduced demand for air travel caused by individuals' concerns of disease transmission on board and at airports. Tourism sector has also been greatly hurt by COVID-19 that discouraged travelers from visiting other countries or other places in their countries, especially by air.

EUROCONTROL (2021a) forecasts for the years 2021-2027 that in the most optimistic scenario European flights will recover to 2019 levels by the end of 2023 at the earliest. According to the pessimistic scenario, full recovery can be deferred until 2027. EUROCONTROL's previous forecast for the optimistic scenario informed that 2019 traffic levels would be caught within 2024 at the soonest. The difference between the two ensuing forecasts shows that there is a positive trend and slight improvement in the traffic forecast that recovery can be earlier than anticipated considering the current condition and course of the disease. However, there are still important downside risks such as slow vaccination rates, failure to introduce new vaccines for variants, inability to contain new waves, and resultant imposition of full or partial lockdowns and travel restrictions.

For Turkey, which was experiencing the third wave during 2021 spring, it could take even more according to worst-case scenario forecasts since only 9% of the population was fully vaccinated (Bloomberg, 2021a) and country was at the second-worst place in the world with 55,791 new cases (Ministry of Health, 2021a) as of 9 April 2021. At that time, when the incidence rate per million was calculated considering the country populations, Turkey was rising to first place in the number of new COVID-19 cases. On 2021 autumn, while the fourth wave was continuing, the fifth wave started in some European countries showing a leap again in new cases forcing the European countries to retighten the measures to control the disease. As of 13 November 2021, % 59.1 of Turkey's population was fully vaccinated with a significant increase, but still far from the target level of % 80, and Turkey's full vaccination rate of population remained lower than EU countries (% 67.3) and UK (68.6) (Bloomberg, 2021b) that makes Turkey vulnerable to possible fifth and sixth waves. As of 20 November 2021, the number of daily new cases was 23,347 (Ministry of Health, 2021b) in Turkey showing a significant decline from April 2021 levels, yet strict measures to protect social distancing needs to be continued during the winter season in order to avoid a new surge in the new COVID-19 cases.

The situation of pandemic in 2021 spring has led countries to take measures against Turkey to restrict air travel and protect their citizens from COVID-19 infection. Hence, airlines based in Turkey would transport fewer passengers and airports would transact with fewer aircraft and passengers which eventually would decrease their revenues because of having high fixed costs. Civil aviation and tourism industries are at risk of prolonged stagnation and cash burn that will further trigger social and economic results such as increased unemployment and business closures.

Recent international studies reveal the negative effects of COVID-19 on civil aviation (Ding et al., 2020; Dube et al., 2021; Gallego & Font, 2020; Maneenop & Kotcharin; 2020; Nhamo et al., 2020a&c; Ru et al., 2021; Sobieralski, 2020; Suau-Sanchez et al., 2020). COVID-19 effects on Turkish air transport (Bakırcı, 2020), economic impact of pandemic on air transport (Adıgüzel, 2020), measures to protect passengers and employees (Kurt, 2020), precautions taken in Turkish civil aviation (Macit & Macit, 2020) are investigated in national studies. Besides, the effects of COVID-19 on tourism sector are studied (Ertaş & Yağcı, 2020; Gössling et al., 2020; Kunt, 2021; Nhamo et al., 2020b). Public nonconfidence is mentioned as one of the most important concerns of aviation and tourism sectors (Bae & Chang, 2020).

This paper aims to understand what economic and operational effects of COVID-19 on aviation (including airlines and airports) are in the medium-term, how they are linked with tourism industry, and what strategies can be followed by practitioners and policy makers to respond and recover from a disaster during a turbulent time. Eliciting knowledge for decision-makers is what makes this study important as also pointed out by Gallego and Font (2020) and Dube et al. (2021). Comparisons are made for global, European, and Turkish aviation, between 2019, 2020, and in some cases, 2021, to comprehend the course of aviation during COVID-19 and its interdependency with tourism. Rest of the paper is organized as follows: Section 2 presents the method of the study. Section 3 presents COVID-19 effects on global air transport in terms of examining economic and operational effects of COVID-19 on global aviation. Section 4 presents COVID-19 effects on European air transport in terms of examining COVID-19 effects on airlines, airports, and states in Europe. Section 5 presents COVID-19

effects on Turkish air transport in terms of examining COVID-19 effects on airlines, airports including travel restrictions in Turkish aviation. Section 6 gives COVID-19 effects on Turkish tourism through civil aviation. Towards the end of the paper, section 7 provides the discussions in the research results, section 8 presents the practical implications of the study, and section 9 shows the limitations and recommendations.

METHOD

This study adopted a descriptive approach using secondary archival data from the websites of several sectoral sources to make comparisons for global, European, and Turkish aviation, between 2019, 2020, and in some cases, 2021, to give a picture of aviation during COVID-19 and its interdependency with tourism. Descriptive summary is accomplished by analyzing and interpreting open access secondary data, to get insight for economic and operational effects of COVID-19 on aviation including airlines and airports and its close link with the tourism industry. Reports of national, regional, and international authorities in aviation and tourism were also investigated for the study period.

Flightradar24 which provides real-time flight traffic data around the globe (Dube et al., 2021) was used to get the daily commercial flight volumes for 2019, 2020, and 2021. Dube et al. (2021) and Maneenop and Kotcharin (2020) used the same data source in their recent studies. International Civil Aviation Organization (ICAO) COVID-19 website provides an interactive data platform called COVID-19 Air Traffic Dashboard to monitor different types of global impacts of COVID-19 on civil aviation. Among these impacts, this study focused on the data for operational impact to see the changes in passenger and cargo traffic, economic impact to uncover the total losses of airlines and airports, and aircraft utilization to make the active fleet comparison by aircraft type for 2019 and 2020. EUROCONTROL data was utilized to look for the effects of COVID-19 on European air transport including the effects on airlines, airports, and states by comparing the years 2019, 2020, and in some cases, 2021. The website of General Directorate of State Airports Authority (GDSAA) provided passenger, aircraft, freight, and cargo traffics of airports in Turkey for 2019, 2020, and in some cases, 2021. Turkish Directorate General of Civil Aviation (TR-DGCA) was used as the information source for the countries where Turkish citizens were banned from traveling by air in 2021. The data of Ministry of Culture and Tourism (MCT) was utilized to understand the change in foreign visitors coming to Turkey by air and the change in the revenues obtained from foreign visitors in 2020 compared to 2019. This research is among those that do not require an ethics committee approval.

COVID-19 EFFECTS ON GLOBAL AIR TRANSPORT

Economic Effects

Global economic effects of COVID-19 on revenues of airlines and airports are tremendous. For airlines, almost empty flights, labor costs, aircraft leasing fees, parking expenses, maintenance costs, and losses of fuel hedging were the major causes of cash burn together with the lost revenues resulted from canceling scheduled flights due to the pandemic. According to data from ICAO (2021a), the total loss of air carriers is found to be -372,485,980,931 USD in 2020 compared to 2019. In terms of the losses in percentages by region of air carriers for both international and domestic operations, the greatest loss was found to be in Asia/Pacific region with 33%, followed by Europe with 29% and North America with 22%. The least loss was in Africa with 3%.

Airports had a total loss of -114,578,325,649 USD in 2020 compared to 2019 (ICAO, 2021b). In terms of the losses in percentages by region of airports for both international and domestic routes, the greatest loss was found to be in Europe with 35% followed by Asia/Pacific with 27% and North America with 22%. The least loss was in Africa with 1%. Disproportionate losses by regions of air carriers and airports can be attributed to disproportionate measures taken by countries such as border closures, travel restrictions, quarantine and isolation requirements, PCR test applications to be protected against the spread of COVID-19.

Operational Effects

Operational effects of COVID-19 on airlines and airports concerning passenger and cargo flights for international and domestic air transportation are revealed by comparing 2019 and 2020. For airlines, operational influence of pandemic involves monthly changes in passenger and cargo traffic and aircraft utilization. The difference in global flights including passenger and cargo in both international and domestic operations between 2019 and 2020 is given in Figure 1(A). In January and February 2020, there were slight increases in the number of flights compared to 2019. However, in March 2020, the flights were suddenly dropped by 25.3% when the coronavirus outbreak is announced as being a pandemic. After March, flights continued to drop for the rest of 2020 compared to 2019. In April and May 2020, flight drops were at the highest levels by 69.4% and 70.7%.

When passenger and cargo flights were examined separately, different results were seen for the comparison of 2019 and 2020 in Figure 1(B) and Figure 1(C). Passenger flights were severely impacted in 2020 by 34.6% fall starting from March to December and the highest fall was in May by 71.8%, mostly because of the increased travel restrictions of countries and public fear of infection resulted from the rapid spread of disease across borders by air travel. However, cargo flights were neck and neck in 2019 and 2020, only by 2.7% increase in 2020. 19.2% drop happened in cargo flights in May 2020 that can be related to damaged international trade caused by industrial interruptions due to pandemic closures. But, in the rest of 2020, cargo flights were generally increased especially in September and December by more than 10% which can be attributed to increased logistics and distribution of medical supplies, vaccines, and personal protective equipment together with raw materials and finished goods due to increased production and trade across world to ensure the sustainability of business sectors and industries in the 'new normal'.

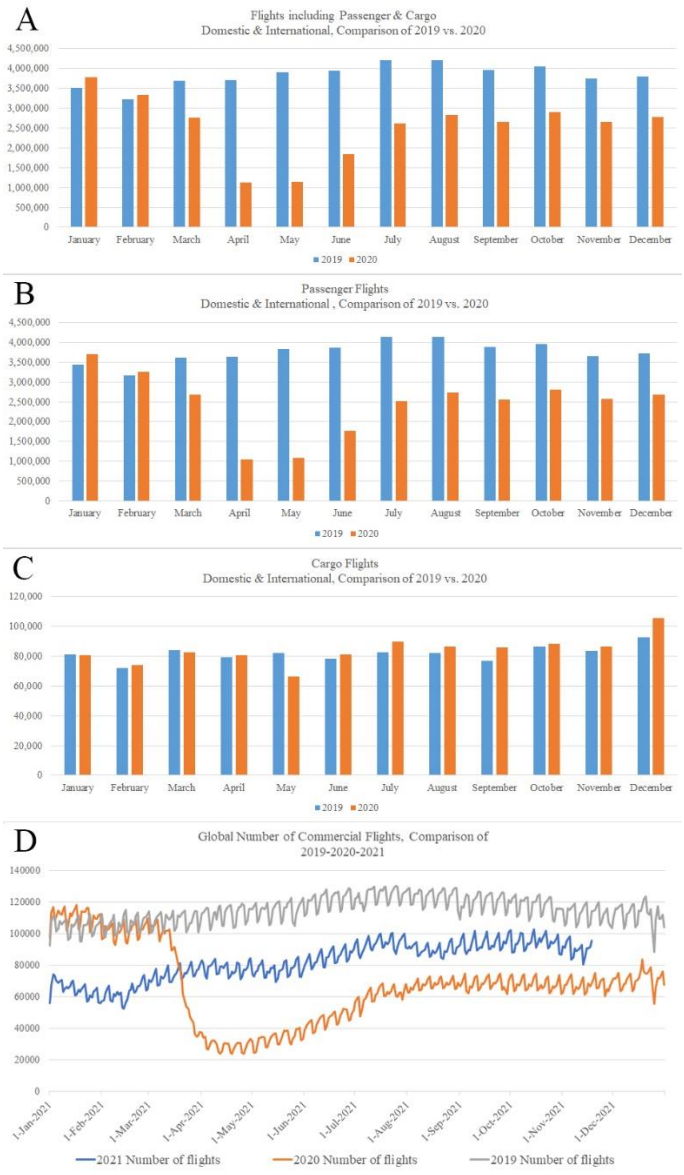

Figure 1. (A) Flights including Passenger & Cargo, Domestic & International, Comparison of 2019 vs. 2020. (B) Passenger Flights, Domestic & International, Comparison of 2019 vs. 2020. (C) Cargo Flights, Domestic & International, Comparison of 2019 vs. 2020. (D) Global Number of Commercial Flights, Comparison of 2019-2020-2021

Source: Authors, Data from ICAO (2021c) for (A), (B), (C), Data from Flightradar24 (2021) for (D)

Global number of daily commercial flights (passenger, cargo, charter, and some business jet flights) between 1 January and 31 December followed by Flightradar24 (2021) is given in Figure 1(D) to compare flight trends between 2019, 2020, and 2021 (up to 12 April 2021). In 2020, the highest number of commercial flights was seen on 17 January with 118,166 flights (8.4% higher than 2019 levels). On 28 February 2020, the number of commercial flights was 109,732, and on 6 March 2020, 109,212 flights were recorded as the highest flows within each month. However, after the global declaration of the COVID-19 pandemic on 11 March 2020 (with 101,682 commercial flights observed on the same day), the amount of daily commercial flights fell steeply within 3 days most probably because of the travel restrictions imposed by countries as an immediate response strategy to avoid the spread of pandemic in their territories. On 12 April 2020, the lowest daily commercial traffic is seen for the whole year that was only 23,926 flights (-79.7%).

A slight improvement was seen during May and on 29 May 2020, 40,570 flights were tracked. On the 2020 summer, flights were increased continuously up to a peak point on 28 August 2020 with 73,389 flights (-42.5%). On the 2020 autumn, flight levels were between 60,000 and 80,000 with steady ups and downs. On 18 December 2020, flights reached up to 83,670 (-29.1%). Increased flights in the second half of 2020 can be associated with the new vaccine discoveries, public trust in health and safety measures taken against coronavirus transmission, and Christmas vacation (Dube et al., 2021).

In January and February 2021, flight numbers continued to slightly fall between 50,000 and 75,000 levels, probably as a result of reimposed travel restrictions, lockdowns, public fear of infection due to second and third waves, and new coronavirus mutations (Dube et al., 2021) that were more infectious than the original one. Starting from mid-February towards the beginning of summer flight numbers were observed to be between 70,000 and 85,000 levels. During the summer season flight traffic continued to rise and pass over 100,000-limit,but stabled during autumn between 85,000 and 105,000 levels because of the lifted or alleviated restrictions caused by decreasing new COVID-19 cases and increased inoculations done simultaneously in many countries around the world. However, from the beginning of November 2021, there was a negative trend in flight traffic most probably, due to the introduction of new Delta variant and increase in new cases through fourth and fifth waves with the cooling of the weather and the global tightening of the measures again.

Based on ICAO (2021c), it was possible to make comparisons of 2019 and 2020 flights according to region of origin. Middle East, Africa, and Europe flight declines are higher than 50%. North America flights are the least affected by only 17%, perhaps because of the unlimited and wide domestic air transportation during pandemic. In 2020, the total decline in the number of global passenger and cargo flights was 33.8%.

Although there are slight improvements in the number of cargo flights and enhancements in air transportation, short-term and rapid recovery of commercial flights back to 2019 levels seems far away. But, in the medium- term, full recovery seems more possible for the passenger and commercial aircraft traffics. Nevertheless, this puts a heavy financial burden on civil aviation that will eventually interrupt global travel, tourism, business, trade, employment, and economy with a domino effect. Therefore, government intervention seems inevitable to support civil aviation to facilitate both passenger and cargo transportation in domestic and international routes and recover economic activities in their countries.

As the demand for air travel is sharply reduced during the pandemic, many airlines grounded their aircraft in bulk. According to the data of ICAO (2021d), changes in aircraft utilization by aircraft categories gave information about the percentage of grounded aircraft in fleets of airlines in 2020 compared to in 2019. Cargo aircraft was the only aircraft category that showed increased utilization in 2020 with 4% which is compatible with the total increase in the number of cargo flights. The utilization of other aircraft categories was significantly less in 2020 than 2019. Twin aisle jet was the least utilized aircraft category with 57.8% grounding rate, followed by single-aisle jet with 49.7% and regional jet with 45.5% grounding rates. This result shows that more than 50% of large aircraft used in long-haul flights were grounded during pandemic probably because of low load factors (seat occupancy rates) and high fuel consumption causing inefficiencies for the airlines. Totally, 49.3% of the aircraft in fleets of airlines are grounded that increased their costs further in addition to lost revenues from dropped demand for air travel.

Monthly changes in aircraft utilization in percentage by aircraft category are provided in the data of ICAO (2021d) to compare 2019 and 2020. Cargo aircraft were grounded only in February 2020 by 4.1%, and for the rest of the year changes in aircraft utilization were positive with the highest increase in June by 10.1% probably because of alleviated travel restrictions and opening of industries that facilitated trade and distribution by air transport. For twin-aisle, single-aisle, and regional

jets, most groundings were seen from April to June by more than 70%. The highest grounding rate was 85.9% in April that belonged to twin-aisle jets, followed by single-aisle jets with 82.1% in April, and regional jets with 77.6% in May.

COVID-19 EFFECTS ON EUROPEAN AIR TRANSPORT

European aviation was severely impacted by COVID-19 like every part of global aviation. According to EUROCONTROL (2021b), the massive financial impact happened on every ring of the European aviation value chain including airlines with €22.2 billion net losses, airports with €33.6 billion revenue losses, and air navigation service providers with €4.8 billion in-year revenue losses. There were 1.7 billion fewer travelers and 6.1 million fewer flights (55% down) in 2020 compared to 2019. 4,118 of 8,048 aircraft (51%) were grounded, 191,000 direct job losses were reported in 2020.

COVID-19 Effects on Airlines

According to EUROCONTROL (2021b), daily average flights of the top ten airlines in Europe dropped by between 45% and 67% as given in Table 1. Ryanair was at the top in both 2019 and 2020, but by 59% drop in 2020. Two airlines dropped from the 2020 list were Eurowings and Norwegian Air Shuttle. Eurowings was downsized by conglomerate Lufthansa Group, Norwegian Air Shuttle entered bankruptcy protection. Their blanks were filled by Wizz Air and Pegasus Airlines. Turkish Airlines (THY) moved up from fourth place in 2019 to second in 2020. Relatively less fall in flights of Turkish Airlines and Pegasus can be attributed to large domestic demand.

Negative effects of steep fall in flight numbers of airlines intensified with very low load factors in quarter two and three of 2020 compared to the same period in 2019. Figure 2 shows that load factors were varied between 42% and 76% in 2020 compared to between 79% and 96% in 2019. Pegasus Airlines moved up to first place in load factor by 76% and THY fourth place by 67% in 2020 exhibiting relatively better performances.

According to EUROCONTROL (2021c), the impact of the COVID-19 pandemic on airline schedules in European network was severe in terms of the ratio of actually flown flights to scheduled flights from 2019 to 2020. From January 2019 to March 2020 the ratio was generally greater than 90%. However, after mid-March, the ratio was started to fall steeply, and on 29 March 2020, it had the least value of 23.6%. The volatility between March and July 2020 shows that published airline schedules were a weak guide to actually flown flights as a result of the pandemic.

According to EUROCONTROL (2021d), before the declaration of pandemic, there were many daily flights between 12 and 20, 20 and 30, and more than 30 in short- and medium-haul routes in February 2020. In contrast, there were only a few short- and medium-haul routes and daily flights between 12 and 20, 20 and 30, and no flights more than 30 in February 2021. Similarly, before the pandemic, long-haul operations were much more than post-pandemic (EUROCONTROL, 2021e). In February 2021, South America and Africa routes were eliminated together with flights more than 16 a day, and other long-haul routes that had 6-12 and 12-16 daily flights have become sparse.

An enormous decline in flight volumes has resulted in the grounding of large parts of airline fleets, either temporarily or permanently. According to EUROCONTROL (2021f), groundings started in mid-March and more than six thousand aircraft were grounded in Europe during April and May with

Table 1. Top 10 Airlines in Europe, 2019 vs. 2020, Average Daily Flights (departures/arrivals)

No.	Airlines	2019	Airlines	2020	Change (%)
1	Ryanair	2,323	Ryanair	951	-59%
2	easyJet	1,671	Turkish Airlines	626	-53%
3	Lufthansa	1,470	easyJet	547	-67%
4	Turkish Airlines	1,331	Lufthansa	513	-65%
5	Air France	1,074	Air France	457	-57%
6	British Airways	911	KLM	341	-51%
7	SAS	812	SAS	332	-59%
8	KLM	690	British Airways	320	-65%
9	Eurowings	655	Wizz Air	312	-47%
10	Norwegian AS	605	Pegasus	261	-45%

Source: Authors, Data from EUROCONTROL (2021b)

more than 80% of fleets pointing out a different view on the damage of pandemic on airlines. An obvious recovery was observed from June to September 2020 by an increase in active aircraft, but complete recovery to pre-pandemic levels seems to take time in 2021 and beyond. Groundings brought additional parking and maintenance costs to airlines (Dube et al., 2021) when the revenues have already been interrupted, airports struggled in finding parking areas for grounded aircraft (Nhamo et al., 2020c).

trend is generally similar to that of global commercial flights in which a rapid decline observed in March 2020 because of the travel restrictions caused by the rapid spread of COVID-19 among European countries reaching the lowest level in April, and then a slight improvement happened in May. Domestic flights began in mid-June, followed by regional passenger flights in July by lifting restrictions. From July to October, there was a clear recovery with a peak of 795,041

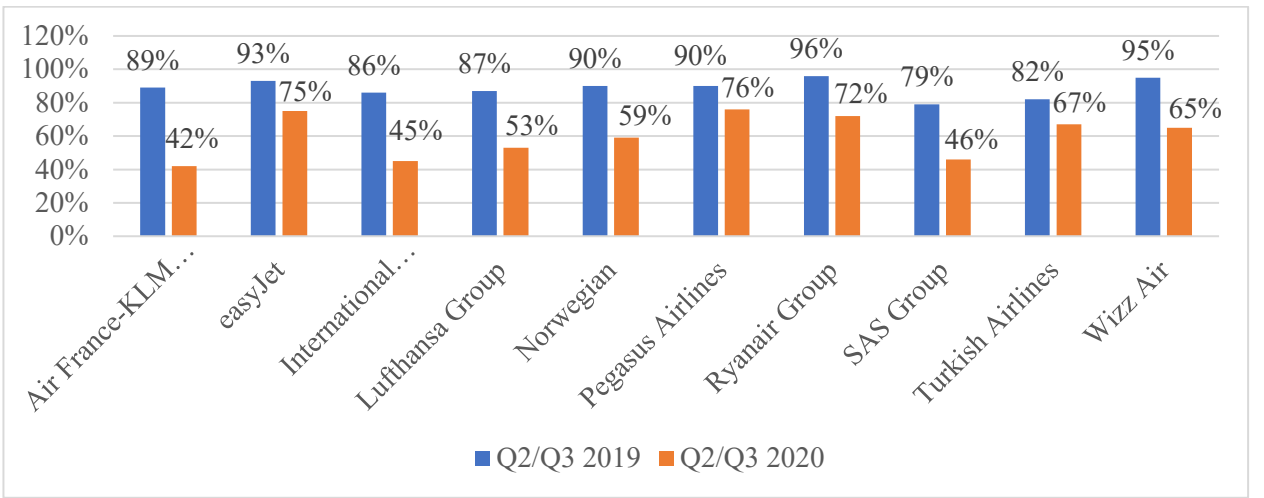

Figure 2. Load Factors of Leading Groups in Europe

Source: Authors, Data from EUROCONTROL (2021b)

EUROCONTROL (2021f) listed the top twenty airlines by grounded and active aircraft in EUROCONTROL area in terms of the average of 12-18 April 2021 week. Lufthansa had 195 grounded aircraft with the highest score, followed by Ryanair with 172, and British Airways with 159 aircraft. THY was in sixth place with 100 grounded aircraft. Contrarily, Ryanair had 322 active aircraft as the highest, followed by 214 of THY, and 165 of Lufthansa.

COVID-19 Effects on Airports

The top ten airports in Europe are given in Table 2 for 2019 and 2020 as average daily movements. In 2020, average movements fell by between 44% and 65%, and there were some changes in the list due to COVID-19. Frankfurt Airport went down to third place in 2020 from first in 2019, whereas Amsterdam went up to first place in 2020 from second in 2019. IGA Istanbul Airport moved up to fifth place in 2020, from eighth in 2019. Rome Fiumicino and London Gatwick were displaced by Oslo Gardermoen and Istanbul Sabiha Gokcen because of serving more to domestic operations.

Figure 3 shows airport traffic comparison for 2019, 2020, 2021 in EUROCONTROL (2021g) area. The

movements in August 2020, followed by a slight decline from November 2020 to February 2021 when new COVID-19 cases soared, except a little increase in December 2020 due to the Christmas holiday.

In spring 2021, flights were slightly ascended passing 500,000 in May 2021 and climbed more during summer season passing 1,000,000 levels in July, and reaching 1,150,868 movements in August 2021, because of the easing up of restrictions and increase in public trust due to fast inoculations and disease control by lowering the number of new cases in Europe. Total movements in September and October 2021 were stable above 1,000,000 levels, however, there may be a negative trend during November and December 2021 because of the surge in new COVID-19 cases in Europe with fourth and fifth waves of new variants such as the Delta variant, and probable travel restrictions, although a slight increase may be observed in Christmas holiday. It seems that full recovery of the European aviation will be faster than anticipated in the near future, given that the societies, businesses, and individuals learn to live with the coronavirus at least a few more years and take strict measures to control the risks of new variants.

Table 2. Top 10 Airports in Europe (2019 vs. 2020) in Average Daily Movements (Departures/Arrivals)

No.	Airports	2019	Airports	2020	Change (%)
1	Frankfurt	1,408	Amsterdam	644	-54%
2	Amsterdam	1,395	Paris CDG	603	-56%
3	Paris CDG	1,383	Frankfurt	580	-59%
4	London Heathrow	1,310	London Heathrow	559	-57%
5	Madrid Barajas	1,168	IGA Istanbul	504	-44%
6	Munich	1,135	Madrid Barajas	453	-61%
7	Barcelona	944	Munich	394	-65%
8	IGA Istanbul	893	Istanbul Sabiha Gokcen	339	-46%
9	Rome Fiumicino	849	Barcelona	335	-65%
10	London Gatwick	781	Oslo Gardermoen	335	-51%

Source: Authors, Data from EUROCONTROL (2021b)

Covid-19 Effects on States

According to EUROCONTROL (2021b), the change in 2020 flights was between 40% and 73% in the countries of EUROCONTOL area. In terms of numbers, UK, Germany, and Spain had the highest losses with more than 1 million flights. In terms of percentage, Georgia, Israel, and Morocco had the highest falls with 73%, 68%, and 65%. The least influenced country was Norway owing to its serious dependence on the aviation network. Turkey was the least affected eighth country in Europe as percentage of flight loss by 54% with 553,000 less flights.

COVID-19 EFFECTS ON TURKISH AIR TRANSPORT

COVID-19 Effects on Airlines

The data of GDSAA (2021a) provided comparative information for 2019 and 2020 on passenger, aircraft, freight (cargo, mail, baggage), cargo traffics of 56 airports in Turkey for both international and domestic routes. Total passenger traffic fell by 60.8%, international passenger traffic by 70.6%, domestic passenger traffic by 50.2% in 2020. Total aircraft traffic dropped by 45.1%, international aircraft traffic by 60.8%, domestic aircraft traffic by 31.8% in 2020. The greater fall of

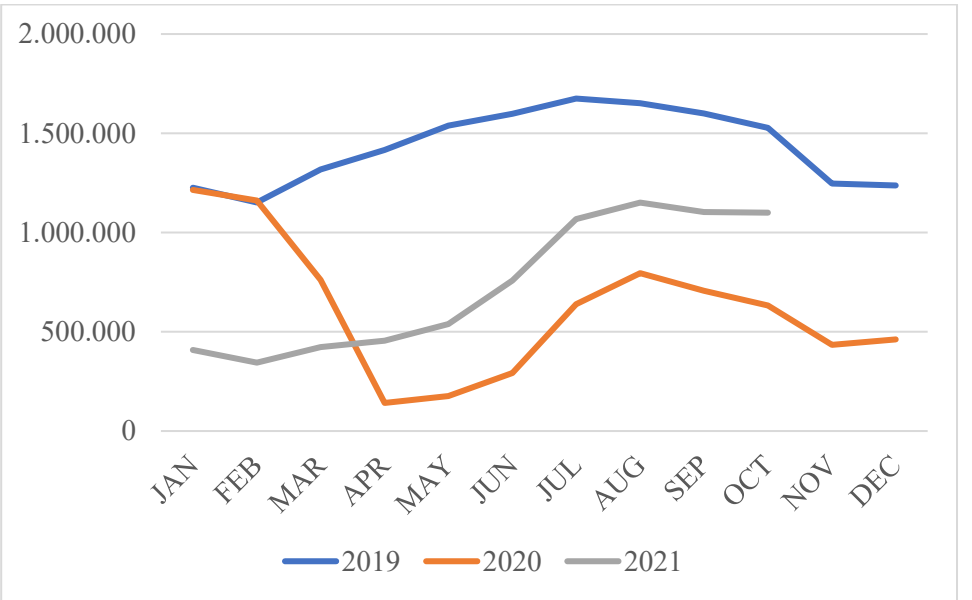

Figure 3. Airport Traffic in EUROCONTROL Area (Total Number of Arrivals and Departures), Comparison of 2019-2020-2021

Source: Authors, Data from EUROCONTROL (2021g)

international passenger and aircraft traffics than domestic ones are caused by counter measures taken by countries by restricting travel to halt the spread of pandemic. The fall in passenger traffic was much lower than that of aircraft traffic, because of low load factors of airlines. The drop in Turkey's passenger and aircraft traffics is compatible with global drop in number of passenger flights.

Total freight traffic fell by 39.1%, international freight traffic by 38.9%, domestic freight traffic by 40%. The drops probably caused by the falls in number of passenger baggage. Total cargo traffic fell by 10.1%, international cargo traffic by 9.6%, domestic cargo traffic by 22.3%. As tonnage, international cargo traffic was nearly ten times less than domestic cargo traffic revealing relative dependence on international trade and its influence on aviation during pandemic. The drop in Turkey's cargo traffic in 2020 was not in accord with the global increase in cargo flights. This can be attributed to further damage in Turkish international and domestic trade, distribution of medical supplies, food, other goods compared to the world.

According to data of GDSAA (2021a), monthly passenger, commercial aircraft, freight traffics of Turkey for 2019, 2020, 2021 (up to October) are

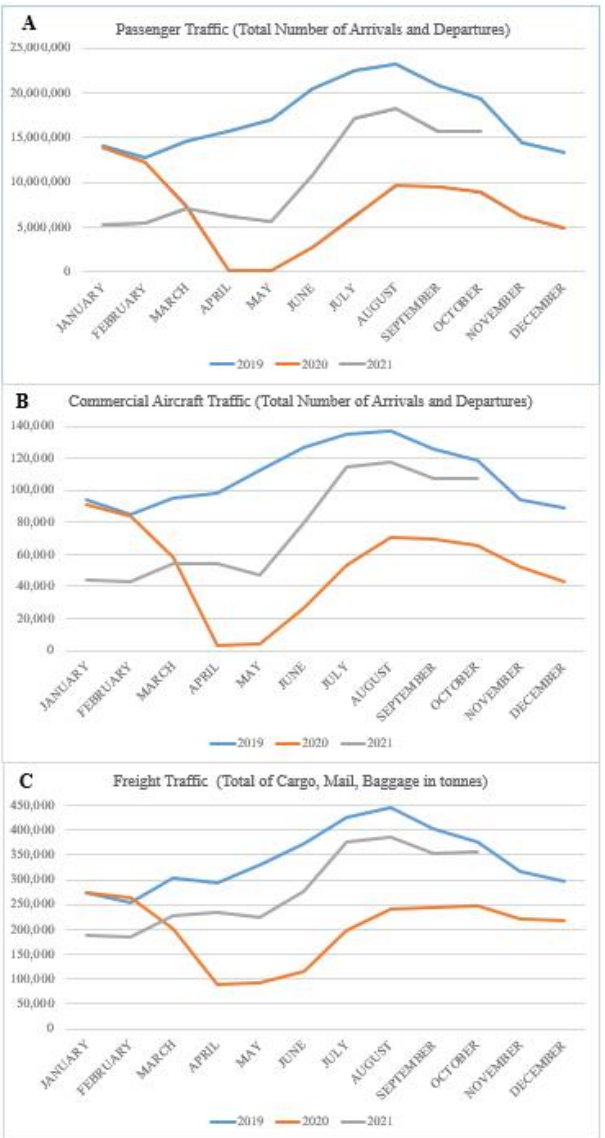

Figure 4. (A) Passenger Traffic (Total Number of Arrivals and Departures). (B) Commercial Aircraft Traffic (Total Number of Arrivals and Departures) (C) Freight Traffic (Total of Cargo, Mail, Baggage in tonnes)

Source: Authors, Data from GDSAA (2021a)

shown in Figure 4. In all graphs in 2020, although a considerable fall started in March, April and May had the greatest falls. From June to August, fast recovery was observed in all graphs due to decreased daily new cases, increased confidence in air travel caused by fast adoption of health and safety protocols. Slight falls

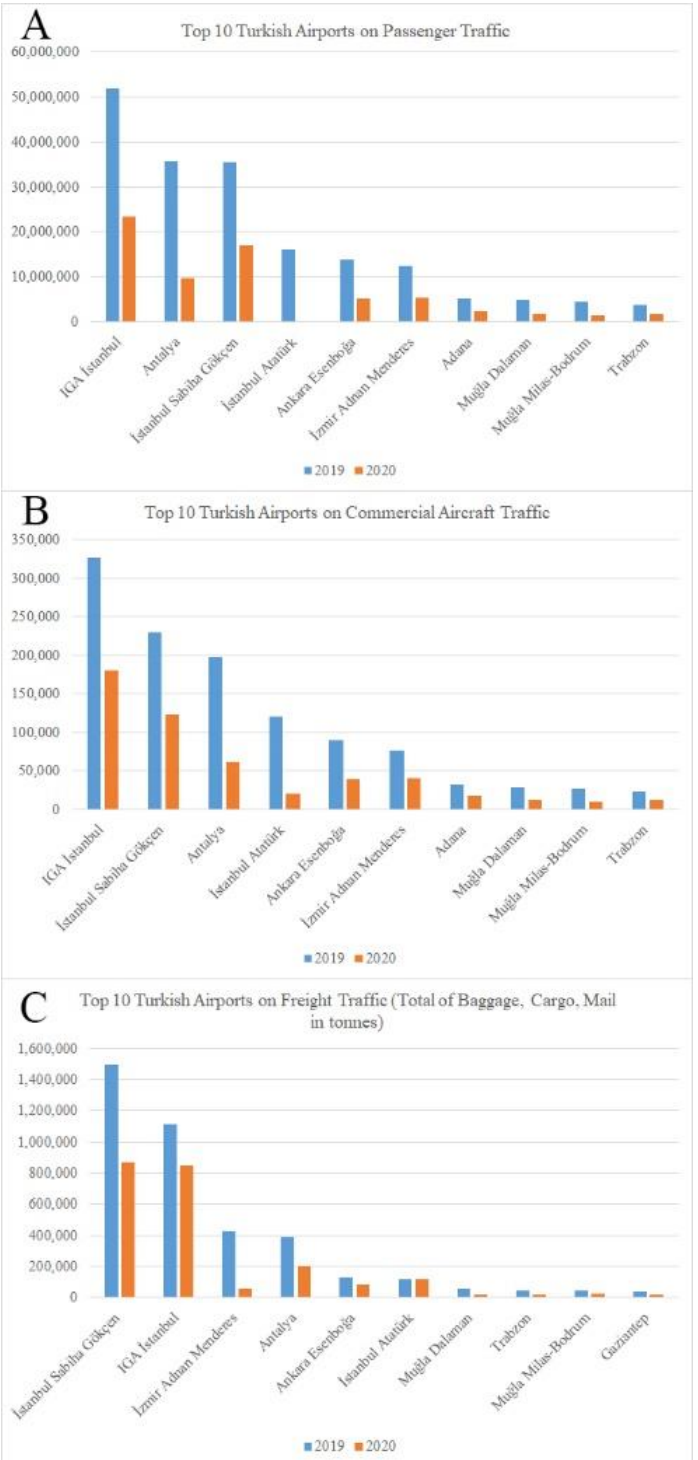

Figure 5. (A) Top 10 Turkish Airports on Passenger Traffic. (B) Top 10 Turkish Airports on Commercial Aircraft Traffic. (C) Top 10 Turkish Airports on Freight Traffic (Total of Baggage, Cargo, Mail in tonnes).

Source: Authors, Data from GDSAA (2021b)

at decreasing rates were observed in September and October for passenger and commercial aircraft traffic, in contrast to a slight increase in freight traffic. In November and December, although freight traffic had a minor drop, passenger and commercial aircraft traffics fell in an increasing rate, probably due to the surge in COVID-19 cases and reimposed travel restrictions.

At the end of 2020, improvements in traffic were recorded compared to April and May, but still quite less than 2019 levels. In January and February 2021, passenger, commercial aircraft, freight traffics were stagnant, but with the start of March, a considerable increase occurred in all three traffics. However, in March 2021, passenger traffic was at 48.5%, commercial aircraft traffic was at 57.5%, freight traffic was at 74.8% capacity levels of March 2019. Traffic increase continued in the coming months, especially in the summer season, reaching a peak in August 2021 for all the passenger, commercial aircraft, and freight traffics with 18,253,128 passengers, 117,191 commercial aircraft, and 386,218 tonnes freight. There were slight declines in September 2021 and stabilities in October 2021 in all three traffics, that were much higher than the 2020 levels, but a little lower than the 2019 levels. It is expected that there will be declines in all traffics in November and December 2021 due to the likely increase in new COVID-19 cases due to more infectious new variants, slow vaccination, and loosening of measures. Full recovery of Turkish aviation back to 2019 levels seems possible in the medium-term as the case for the global and European aviation.

According to EUROCONTROL (2020), Turkish Airlines ranked first with 625 daily flights operating at 50% capacity because of being a flag carrier serving in many domestic and international routes, followed by Pegasus as a low-cost carrier with 333 flights operating at 70% capacity during 26 October - 1 November 2020 compared to the same week of 2019.

EUROCONTROL (2020) shows the top ten country pairs of Turkey in average daily flights during 26 October - 1 November 2020 and percentage changes compared to the same week of 2019. Although there was a 29% drop, Turkey mainly operated in domestic routes with 628 flights, because of increased restrictions and public concerns for the revival of pandemic all around the world with second and third waves. Other countries that had more than 40 average daily flights from/to Turkey were Russia, Germany, Ukraine, UK whose flight numbers fell by between 31% and 63%, except flights from/to Ukraine by a 2% increase.

COVID-19 Effects on Airports

According to data of GDSAA (2021b), top ten Turkish airports on passenger, commercial aircraft, freight traffics are given in Figure 5 for comparing 2019 and 2020. IGA Istanbul was the top airport in passenger (-55% with -28,600,088 passengers compared to 2019) and commercial aircraft (-44.7% with -145,906 movements) traffics, followed by Istanbul Sabiha Gokcen (-52.3% with -18,594,038 passengers, -46.6% with -107,237 commercial aircraft), and Antalya (-72.6% with -25,907,793 passengers, -68.5% with -135,222 commercial aircraft) in 2020.

Istanbul Sabiha Gokcen overtook Antalya in passenger traffic and rose to second place in 2020 due to less international travel to touristic places during the pandemic. In April 2019, passenger flights of Istanbul Atatürk moved to IGA Istanbul, so, no passenger traffic was observed, but commercial aircraft traffic (-83% with -99,694 movements) was continued because of business aviation together with freight traffic (-3% with -3,633 tonnage) in 2020.

Istanbul Sabiha Gokcen was the top airport in freight traffic (-41.8% with -623,619 tonnage), followed by IGA Istanbul (-23.7% with -263,289 tonnage), and Antalya (-47.2% with -184,088 tonnage) in 2020. Izmir Adnan Menderes dropped to fifth place in freight traffic (-87.1% with -369,594 tonnage) in 2020 from third in 2019. In all three graphs, critical places of two airports, IGA Istanbul and Istanbul Sabiha Gokcen, and the city of Istanbul are revealed as the main lever of aviation because of being at the center of economic, business, cultural, social activities both before and during the pandemic.

EUROCONTROL (2021g) provided the average daily departures of IGA Istanbul Airport as having the highest traffic and being the largest airport in Turkey. IGA Istanbul started full capacity operations on 6 April 2019, before this date there were no departures. Average daily departures passed 600 marks in June 2019 and finished the year with 508 departures. However, after the declaration of the pandemic in March 2020, departures suddenly dropped below 100 starting from the end of March to the end of May. In June 2020, departures started to increase, became approximately between 200 and 300 from July towards year-end.

The same trend continued in the first three months of 2021 and a peak of 342 departures was observed on 26 March 2021. The departures started to increase in the second half of March passing the 300-level towards the middle of April 2021 and decrease again to 200 levels in the first half of May 2021. It is most probably caused by the full lockdown between 29 April-17 May

2021 before the start of summer tourism in Turkey. The departures started to rise speedily in the second half of May and during the summer season up to a peak of 532 departures on 27 August 2021. This number was a significant improvement compared to the previous year, but still nearly 100 departures less than 2019 levels. During September and October 2021, the number of departures were between 450 and 530, however, in the same period of 2019 the departures were between 590 and 650.

COVID-19 Effects as Travel Restrictions

The imposition of travel restrictions due to the pandemic in the world critically hurt the service value chain including aviation and tourism industries in 2020. However, Turkey confronts a bigger challenge in 2021 because of increased new COVID-19 cases during the time when Europe has already started to normalize by controlling the pandemic. European and some other countries where Turkish citizens were banned from traveling by air in 2021 are given in Table 3 (Turkish Directorate General of Civil Aviation (TR-DGCA), 2021).

Nationals of UK, Denmark, Brazil, South Africa are banned from traveling to Turkey by air in 2021 (TR-DGCA, 2021), although UK and Denmark lifted their bans later. Russia which sent the highest number of visitors to Turkey by air both in 2019 and 2020 (6,837,752 and 2,084,604 visitors by 69.5% drop) (MCT, 2021a), suspended all flights to and from Turkey between 15 April and 01 June 2021. Germany changed Turkey's risk level to 'high incidence area' since 11 April 2021 (Robert Koch Institute, 2021), warned its citizens to refrain from non-compulsory touristic travel to Turkey. U.S. Centers for Disease Control and Prevention (2021) announced that Turkey's COVID-19 level was 'very high', travelers should avoid trips to Turkey. The number of countries imposing travel bans and restrictions against Turkey may increase in the coming months unless new cases are mitigated and the spread of disease is controlled.

COVID-19 EFFECTS ON TURKISH TOURISM THROUGH CIVIL AVIATION

Based on data from MCT (2021a), the proportion of foreign visitors entering Turkey by air was 76.7% with 34,545,875 visitors in 2019, 75.2% with 9,580,478 visitors in 2020. There was a significant drop in foreign visitors coming by air by 72.3% with 24,965,397 fewer visitors in 2020. The revenues obtained from foreign visitors dropped by 68.3% with -19.6 billion USD (MCT, 2021b). This shows that the aviation sector is the locomotive of the tourism industry by having the greatest share in transportation of foreign visitors. COVID-19 pandemic didn't only undermine civil aviation, but also tourism since both sectors are critically interdependent.

Figure 6(A) shows the monthly number of foreign visitors entering Turkey by air in 2019 and 2020 according to data of MCT (2021a). After the announcement of the pandemic in March 2020, foreign visitors dropped by 67% with more than 1 million fewer visitors. Foreign visitors entering by air changed by between -57.4% in September and -99.9% in May as of percentage, between -910,132 in November and -4,464,946 in July as of number. From April to October, each month more than 2 million (in June and July more than 4 million) foreign visitors going to Turkey by air were lost.

Table 3. Countries Where Turkish Citizens Are Banned From Traveling by Air In 2021

EU Countries		Some Other Countries
Germany	Sweden	Switzerland
Austria	Italy	Iceland
Belgium	Latvia	Norway
Denmark	Lithuania	Canada
Estonia	Luxemburg	Azerbaijan
Czech Republic	Hungary	Israel
Finland	Poland	Turkmenistan
France	Portugal	Japan
Croatia	Romania	China
Netherlands	Slovakia	
Spain	Greece	

Source: Authors, Data from TR-DGCA (2021)

The numbers of the top ten foreign visitors entering Turkey by air in 2019 and 2020 are given in Figure 6(B) based on data from (MCT, 2021a). Accordingly, Russia, Germany, Ukraine, UK had the highest number of visitors in 2019 and 2020. However, these visitors dropped by 69.5% with -4,753,148 visitors, 77.8% with -3,574,638 visitors, 32.3% with -437,428 visitors, 66.9% with -1,608,263 visitors in 2020 respectively. Russia had the greatest fall among these countries followed by Germany and UK as the number of visitors traveling by air due to the alarming course of the pandemic which caused a devastating effect on Turkish tourism and economy that is heavily reliant on tourism revenues. In January and February of 2021, the number of foreigners visiting Turkey decreased by 70.24% compared to the same period of the previous year (MCT, 2021c) showing that the impact of COVID-19 on tourism revenues will continue and may be much worsened unless an immediate measure is taken.

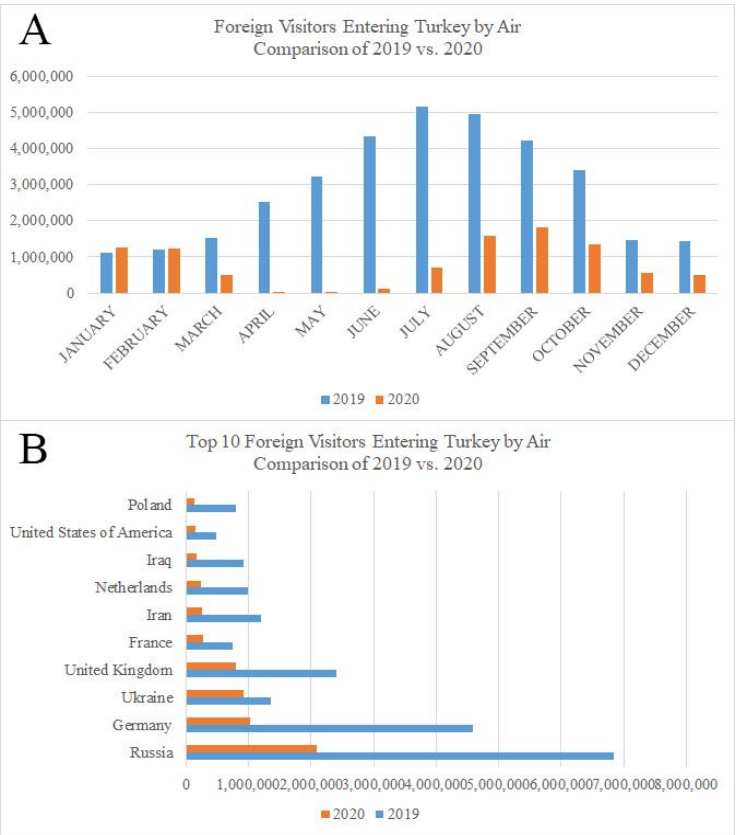

Figure 6. (A) Monthly Number of Foreign Visitors Entering Turkey by Air, Comparison of 2019 vs. 2020. (B) Top 10 Foreign Visitors Entering Turkey by Air, Comparison of 2019 vs. 2020.

Source: Authors, Data from MCT (2021a)

DISCUSSIONS

The impact of COVID-19 on global civil aviation (Dube et al., 2021; Maneenop & Kotcharin; 2020) or Turkish air transportation (Bakırcı, 2020; Adıgüzel, 2020) has been discussed in the recent literature. However, the comparison of the operational and economic effects of the pandemic on Turkish air transportation with those on global and European civil aviation hasn't been made before. In addition, studies that incorporate data from both airlines and airports at the same time are limited. So, this study tries to fill this gap by giving the relative position of airlines and airports based in Turkey as a developing country against Europe and world in terms of the operational and economic effects of recent coronavirus crisis. In addition, although the influence of the pandemic on tourism industry (Ertaş & Yağcı, 2020; Nhamo et al., 2020b) and the relationship between decreased passenger demand and tourism policy (Gallego & Font, 2020) has been previously studied, the domino effect between civil aviation and tourism as a result of COVID-19 has not been shown clearly. In this regard, this study contributes to literature by examining the effects of COVID-19 on Turkish tourism through civil aviation.

In contrast to Dube et al. (2021), the recovery in European air travel market seems faster than anticipated

based on current reports (EUROCONTROL, 2021a) through the realization of the optimistic scenario in the short-term. However, this recovery process in civil aviation and tourism industries may significantly differ to region to region, country to country, and business to business. It shows that global, regional, and local recovery depends on the duration and breadth of the pandemic; taking fast and effective measures to control the disease such as imposing lockdowns and travel restrictions, crowd prevention, social distancing, remote working, requiring vaccination passport from passengers for international and local air travel, and introducing digital vaccination card or certificate applications for indoor entrance. Other measures include speedy vaccination by promoting vaccination campaigns within public while struggling against anti-vaccine movements; imposing sanctions against those who are not vaccinated; increasing public confidence against air travel; and enhancing the transparency, economic level, and financial reserves of both the states and the businesses.

As for the policy implications, this study agrees with the insights given in the literature in terms of the government support and assistance needed for both aviation and tourism sectors as bailout packages including workforce protection, wage subsidy, cash injection, loan opportunity with low-interest rates, loan guarantee, rental amnesty, tax reductions in corporate income, airport usage, tickets, and fuel to bounce back from the ongoing crisis and keep the businesses afloat. However, as advocated by Amankwah-Amoah et al. (2021), full government intervention should be avoided not to lose the continuous search for the efficiencies, innovations, and cost-savings by private entities through optimization and digitalization activities in everchanging competitive business environment.

2020 passed with massive losses in global aviation and tourism sectors compared to 2019 due to the COVID-19 pandemic with resultant border closures and travel restrictions. Turkey was caught unprepared for this disaster with huge effects on passengers, aircraft, freight, cargo traffics. Unfortunately, 2021 seems far from full recovery, although some improvement has been observed. In the first quarter of 2021, partial curfews are applied in Turkey considering the risk level of each city in the COVID-19 risk map. However, partial curfews were not sufficient to contain the spread of disease, because, in April 2021, daily new COVID-19 infections soared above 50,000 marks with a peak of 63,082 on 17 April 2021. Turkey's underwhelming situation on incidence rates of new COVID-19 cases and slow vaccination seem to decelerate improvement in the number of international flights relative to Europe due to new travel restrictions imposed by countries against Turkey just before the start of tourism season. This situation would further impede the recovery of the Turkish aviation, tourism sector, and economy with a knock-on effect.

The full lockdown period was started between 29 April-17 May 2021 as a late response since tourism season in Turkey generally comes alive in spring and intensifies in summer. During the full lockdown, intercity travel was disallowed except in mandatory conditions, and passengers were required to get a travel permit to be able to travel if their HES codes were not related to COVID-19. This would halt domestic travel that would further damage already troubled Turkish aviation and tourism industries in 2021. Although passenger, commercial aircraft, and freight traffics were climbed up in 2021 summer season, it is expected that these traffics will decline with the cooling of weather in autumn and winter and possible increase in new COVID-19 cases with new variants. In this case, embracing abovementioned local recovery strategies in compliance with the regional and global ones, is at upmost importance to minimize the risks of new waves and their corresponding impacts on aviation and tourism since the humanity may need to live with the coronavirus for a few more years.

PRACTICAL IMPLICATIONS

Given that the magnitude of financial losses is quite large for both air operators and airports, efficiency and innovation in operations by using the state-of-art technologies and agility in responding to pandemic by taking effective measures are the only ways to overcome the devastating effects of pandemic within aviation. To minimize the economic and operational effects of COVID-19 in the Turkish aviation industry as the main driving force of the tourism sector, managers of airlines, airports, and tourism facilities can implement few response and recovery strategies that proved effective. The first and most significant is the application of risk management, crisis management, health and safety management in an integrated manner by all entities in aviation and tourism value chains.

Crisis or disaster planning based on various scenarios need to be done to respond to and recover from pandemics and other natural disasters as these are expected to repeat in the future. Similarly, developing knowledge management and learning from past experiences are needed to enhance dynamic capabilities in order to adapt to and transform after environmental shocks such as the ongoing COVID-19 pandemic. Organizations may reschedule debts with vendors and loan providers, halt capital investments, decrease employee numbers and downsize when workforce protection is ended, although the last option

isn't preferred since it may increase unemployment and lead to unwanted social consequences. Alternative strategies can be paid /unpaid leave, furlough, and wage-cutting.

Airlines may reconsider their business models to use passenger aircraft for cargo transportation, renegotiate airport charges, decrease the fleet size, suspend delivery of new planes, withdraw old, wide-body, inefficient aircraft from service to increase load factors and minimize costs. Eliminating unprofitable long-haul routes, composing fleets with less variety of aircraft types to minimize maintenance, storage (for components and spare parts), and crew costs, outsourcing ancillary services, and focusing on core business functions are other strategies that can be followed.

Airports may increase efficiency and reduce costs through optimization and innovation in operations since their revenue stream was interrupted by the pandemic. Minimizing contact in check-in, boarding, security, and immigration checkpoints by using advanced technologies, fast screening and testing of travelers at arrivals, smooth passenger processing and flow, safe baggage and cargo handling, speedy aircraft turnaround operations are some strategies that can be used.

Since recovery in traveler volume is much slower than flight volume, increasing public confidence is vital for aviation and tourism industries. This can be achieved by establishing effective communication with the public, coordination with public health and all relevant stakeholders, taking health and safety measures in aircraft, airports, hotels such as using medical masks, providing contactless services, using shields and barriers at interaction points, limiting close social interaction by redesigning cabin interiors, airport spaces, shared areas in hotels, improving physical distancing that eliminates close queuing and crowded groupings, enhancing cleaning and disinfection, effective ventilation, and using high-efficiency particulate absorbing (HEPA) filters.

LIMITATIONS AND RECOMMENDATIONS

Descriptive approach is used in this study. In further studies, in addition to qualitative methods, more quantitative approaches can be utilized to discover the relationships between variables in terms of measuring the effects of COVID-19 on specific constructs for aviation and tourism sectors. Our study relied on secondary data which has limitations to uncover the operational and economic effects of the pandemic on civil aviation and tourism industries. Future research might involve primary data to get deep insights and understanding on the topic. This study concentrated on medium-term effects of COVID-19 particularly for the years 2020 and 2021, however, long-term effects may also be investigated in the future to reveal the negative or positive consequences of the pandemic.

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Informed Consent Form: All parties are involved in the study voluntarily.

Ethics Committee Approval: This research is among those that do not require an ethics committee approval.

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1st author contribution rate: 35%

2nd author contribution rate: 65%