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The Level of Concentration at Airports in terms of International Freight and Cargo Transportation in Türkiye

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Abstract

Despite the increase in competition in the aviation sector, which was a monopoly in most parts of the world until the 1980s, the deregulation measures implemented since the 1980s have paved the way for the emergence of oligopolistic structures in the aviation sector in many countries, including Türkiye, in a short period as a result of market dynamics. This study examines the market concentration in international freight and cargo transport in the context of the global development of the airline industry and the liberalization process in Türkiye. Based on data for the periods 2009-2024 and 2013-2024, the analysis using the Herfindahl-Hirschman Index (HHI) shows that Ataturk and Istanbul airports play a dominant role in international freight transport, while this pressure shifts to Istanbul airport after 2019. As a result, it is important to implement strategic policy recommendations such as increasing regional diversity and creating alternative logistics centres, as high market density poses risks in terms of reduced competition, lower service quality, infrastructure and urban planning.

1. Introduction

As part of the global economy, the airline industry now serves most of the world through technological developments. In addition to its direct operational effects, the airline industry is an economic powerhouse with indirect effects on related industries such as aircraft manufacturing, fuel demand and the tourism sector. One of the most important developments in the airline industry has been the use of jet aircraft since the 1950s, while the use of wide-body jets in the 1970s was another important development (Belobaba, 2009, p. 1). Aircraft size increased until 1985, but since then industry growth has been driven by new airline fleets and routes rather than aircraft size (Swan, 2002, p. 349).

The Civil Aeronautics Board was established in the United States in 1938 to regulate the aviation industry to establish an economical, safe and efficient air transport system free from unfair and destructive competitive practices, partly as a result of the Great Depression of 1929. This power remained with the Board for 40 years after its establishment but was terminated in 1978 on the grounds that the Board was preventing competition (Cook, 1996, p. 33). One of the most important steps in the development of civil aviation was the Civil Aviation Conference held in Chicago in 1944. It is considered to be one of the most successful conferences held during the Second World War, as it laid the foundations for the International Civil Aviation Organization, an advisory body to the United Nations. The conference established a standardized form and a final document consisting of a number of technical issues for the safe and orderly development of future aviation agreements (Mackenzie, 1991, p. 287). As it was felt that it would take some time for the 26 governments attending the Conference, which took place between 1 November and 7 December 1944, to ratify the Convention on International Civil Aviation, the Provisional International Civil Aviation Organization (PICAO) was set up and, in addition to the initiatives being taken to establish the International Civil Aviation Organization (ICAO), PICAO discussed how to achieve international agreement on airlines, airports, communications, licensing, meteorology, navigation, search and rescue, airworthiness and aircraft registration. On 4 April 1947, the Convention on International Civil Aviation entered into force after being ratified by 26 countries, establishing the International Civil Aviation Organization (FAA, 2023). Although the concept of "Air Freedom" emerged after this Chicago conference, the vast majority of the world's leading airlines, with the exception of US companies, remained state-owned until the early 1980s. One of the main reasons for this was that the airline industry was seen as a developing "infant industry", and the idea that it should be subsidized by the state prevailed. Even in the US, where there are no state-owned airlines, there were strict regulations to prevent destructive competition until 1978, after which the airline sector, especially in the US, was left to the free market (Odoni, 2009, p. 25). The transition to a free market in state-owned

monopolies or in the government-subsidized sector began slowly around the world. In Australia, as the sector developed, it was not until the 1990s that the tightly regulated local bilateral relationships between the state-owned company and the private company were loosened (Borenstein & Rose, 2014, p. 27). Similarly, in Europe, a three-step deregulation package was implemented in 1987, 1990 and 1993 to open up air transport to the free market over a long period of time (Suau-Sanchez & Burghouwt, 2011, p. 244). With these steps, the monopoly market or state-supported sector began to be replaced by free market conditions. As a result of this deregulation movement, although rival airlines to the existing major airlines emerged in the US, most of the smaller competitors closed down, were acquired or went bankrupt within almost 10 years. As a result, the level of concentration in the industry increased and the major carriers reasserted their dominance (Goetz & Sutton, 1997, p. 239). During this period, the integration of regional airlines through agreements with major carriers or acquisitions by major companies led to rapid growth in the sector, especially in regional air transport (Oktal & Küçükönal, 2007, p. 386). In the early 1990s, the Gulf War, company-related bankruptcies, the economic crisis in Asian countries in 1998, the September 11 attack, and the pandemic that has affected the world since the beginning of 2020 caused a decline in demand in the sector. Despite the impact of all these negative shocks, the entire sector, including air freight, is in a general growth trend (Aydın, 2022, p. 56).

Following the free market moves in the aviation sector in the world, steps have been taken to move to a free market in Türkiye. In the USA, where this step was taken first, there were 234 companies with air transport certificates operating at the beginning of 1987, which decreased to 109 in 1996. Although a similar situation occurred in many countries, the sector continued to grow. This fulfils the first element of the oligopolistic market characteristic of the aviation industry (Wensveen, 2007, p. 177). The oligopoly market, which has a small number of sellers and a large number of buyers, is the most common type of structure in the economic structure between the perfectly competitive market and the monopoly market (Yıldırım & et al., 2016, p. 113). In air transport, which shows the characteristics of an oligopoly market, it is known that there are a few companies that hold a large part of the market share in each country's market and there is concentration in the sector (Yaşar & Gerede, 2018, p. 178).

In the Turkish aviation sector, although delayed, similar processes have emerged with the rest of the world and the market structure has similar characteristics to the rest of the world. In the Turkish aviation sector, it is known that there is market concentration among transportation companies (Kiracı et al., 2017, p. 699), i.e. an oligopoly market (Sarıbaş & Tekiner, 2015, p. 31), as in the global examples. In 1983, the Civil Aviation Law came into force in Turkey as one of the important liberalization steps. With this step, an important step was taken for the Turkish aviation sector, and the first private international airline was established in 1986. The second important step in the Turkish aviation sector was observed in October 2003, when domestic lines were opened to private airlines. (Battal et. al, 2006, p.1).

After the liberalization steps, developments that will be explained in more detail under heading 2 took place. After liberalization, many aviation companies were established, but most of them ended their activities and the market returned to a position close to where it started and took on an oligopolistic structure. In parallel with these developments, the number of airports in Türkiye and both passenger and cargo capacity have increased. During this period, the number of airports in Türkiye, domestic and international passenger and cargo capacities have increased.

Commercial airports around the world are classified as Level 1, 2, or 3 based on an assessment of the risk that demand will significantly exceed the airport's capacity. In recent years, approximately 200 (5%) of all airports serving commercial passengers worldwide have been classified as Level 3. These airports serve nearly half of the world's air passengers, most of whom are in Europe (Milioti and Odoni, 2024, p. 1).

Despite increased waiting times and delays for passengers, the "hub and spoke" model has led to the development of level 3 airports in the aviation sector to increase profitability. In terms of airport traffic network management, determining certain cities or airports as “hub and spoke” is a situation that can cause an oligopoly situation in the aviation market at the airport level (Oum, & Tretheway, 1990, p. 380). Therefore, as in world examples, it is expected that airports in Turkey are concentrated at a certain level in terms of international freight and cargo transportation and that this concentration is in Istanbul. Although various studies have been conducted on the concentration status in Türkiye’s aviation sector, no study has been found on the density levels of airports in international freight and cargo transportation. The level of concentration is attempted to be determined with this study.

This study aims to determine the current situation of concentration in cargo transportation at airports in Türkiye. This study is important because it is one of the first studies to show how concentration in freight transportation has changed after the opening of Istanbul Airport. After analyzing the historical development of Turkish aviation in the second section, the concept of concentration and measurement methods are discussed in the third section. The fourth section summarizes the studies in literature, the fifth section presents the application and results, and the last section presents the conclusion.

2. Historical Development of Turkish Aviation

The first steps towards civil aviation in Türkiye were taken by foreign initiatives, with the Italian civil aviation company being the first to be granted a concession to carry out air transport activities (Yalçınkaya, 2019, p. 407). The first step towards national civil aviation activities in Türkiye was taken with the establishment of the Turkish Aeronautical Society in 1925. The Turkish Machinist School was established to train the personnel needed for Turkish aviation. The Turkish Aeronautical Society became a member of the International Aviation Federation in 1929. The name of the society was changed to Turkish Aeronautical Association in 1935 (THK, 2024).

In parallel with the organisation of economic policy on the basis of statism from the 1930s, the State Airways Administration was established in 1933 to carry out national air transport activities (Gerede & Orhan, 2015, p. 167). In 1933, Turkish Airlines had a total capacity of 28 seats with 5 planes, but in 1980 it managed to increase the number of planes to 26 (Bakırcı, 2012, p. 345).

In parallel with the economic policies implemented by Türkiye and the developments in the world aviation sector, the Turkish aviation sector has abandoned its statist approach since the 1980s. Since then, private companies have been established in air transportation and competition has started in the sector

(Aydın, 2022, p. 57). After the Aviation Law of 1983, the aviation sector was opened to private companies, but restrictive regulations were reintroduced in the following periods. Twenty-two private airlines entered the market between 1983 and 1992, but most of them withdrew from the market within a short period of time (Gerede & Orhan, 2015, p. 173). In 1992, market entry was made relatively more difficult with the changes made in 1992, and in 1996, new regulations were implemented that made market entry more difficult (Gerede, 2010, pp. 69-70). Until 2003, only Turkish Airlines operated domestic flights. The total capacity of 150 wide-body aircraft registered in the Turkish Registry Office was 25,114 seats and 896,865 tons of cargo. After 2003, with the change in aviation policy, private companies were opened to the sector, competition increased, service quality and capacity increased, and significant improvements in prices were experienced in favor of passengers (Çetin & Benk, 2010, p. 202).

In 2003, following the deregulation of the sector, significant developments took place in the sector. While the turnover and employment figures of the sector in 2003 were TL 3.06 billion ($2.2 billion) and 65,000 respectively, these figures will be TL 668.06 billion ($35.7 billion) and 262,000 in 2022. In 2003, 188 thousand tons of cargo were transported on domestic routes and 775 thousand tons on international routes, while these figures will increase to 853 thousand and 3,357 thousand tons in 2023. The number of airports increased from 26 in 2003 to 57 in 2023. The number of countries flown to has increased from 50 to 130 and the number of destinations from 60 to 343 (DGCA, 2023).

3. Concentration and Measurement Methods

According to the intensity of competition in goods and services markets, markets are divided into perfectly competitive markets, oligopoly markets and monopoly markets. Accordingly, markets are shaped as markets with many buyers/sellers and markets with a single buyer/seller. Market concentration is defined as a small number of firms holding all or most of the total market share. Market structures may differ from country to country, depending on government policies and the dynamics of individual sectors. For example, while it is more likely to observe market structures close to perfect competition in road transportation worldwide, it is more likely to observe imperfect competition in air transportation due to different regulations, policies, capital requirements, etc.

Having the ability to accurately measure, monitor, and compare the competitive intensity of an economy or industry provides a holistic perspective and is therefore extremely valuable to policymakers who want to understand how competitive the markets within their economy or industry are (Pike, 2018, p. 4).

Concentration, which indicates the intensity of competition in the market, can be measured by various methods. In particular, the calculation of market concentration indices such as the Herfindahl-Hirschman index (HHI) is considered as a starting point for assessing the state of market competitiveness (Sung, 2014, p. 3037). In the report prepared by the OECD (2018), the HHI method is recommended as an important determinant of concentration level (Pike, 2018). In addition to the HHI, the Concentration Index (CRn) is also frequently used in the literature (Naldi & Flamini, 2014, p. 1). Apart from these two indices, various indices such as Entropy Index, Gini Index, Hall-Tideman Index, Rosenbluth Index, The Hannah-Key Index, Comprehensive Concentration Index, etc. have been developed (Ildırar & Kıral, 2018; Tatlı, 2018, p. 65).

4. Literature Review

There is a rich national and international literature on market concentration. It has been observed that the indices used in a significant number of studies are mostly HHI and CRn methods. On the other hand, although there is a large literature on concentration, studies on air transport are more limited. Since the literature on the airline industry is limited, the literature on concentration in the airline industry is reviewed first, followed by the studies on concentration in other industries.

Barret (2000) examined the impact of privatization, commercialization and market entry of new airports on factors such as the availability of airports in Ireland, the United Kingdom, France, Italy, Sweden, Norway, Belgium and Germany, aiming to stimulate local and regional development. The study found that the gains from airport competition were significant and that lower fares were financed by both more efficient airlines and airports. The relationship between market concentration and ticket prices in the airline industry was analyzed by Hernandez and Wiggins (2008) using HHI and various statistical methods, and it was observed that in markets with increasing concentration, business seats became cheaper, but the price of economy seats increased, while the opposite relationship was observed in markets with decreasing concentration.

Costa et al. (2010) compared two existing methods for calculating the number of hub airports in Brazil. However, due to significant discrepancies between the two methods, they developed a new model based on the Herfindahl–Hirschman Index (HHI) to determine the number of hubs in a given network. The HHI-based analysis revealed an increase in congestion. This concentration, combined with the significant increase in domestic flights in recent years, has put pressure on existing airport infrastructure, particularly at major airports within the country. Johnston and Ozment (2011) used CRn and HHI methods in their study, in which they examined the market concentration of the US airline industry and the corresponding use of scale economies by firms. According to the results obtained for the two indices, it was found that the concentration, size and number of airlines increased, and it was concluded that this situation is an indicator of economies of scale.

Using panel data analysis, Bilotkach and Lakew (2014) examined the effect of airport concentration (as measured by the Herfindahl-Hirschman Index, or HHI) on average airfares from 1993 to 2009. They found that, for the subset of large and medium-sized hub airports, the concentration of routes originating from an airport was the strongest determinant of price levels, while it did not significantly affect prices in the subsample of small hub airports. Pacheco et. al (2015) used the HHI and the Lorenz curve to examine concentration in the Brazilian international air travel market between 1999 and 2012. Although the increase in concentration in Latin America and the Caribbean led to a decrease in the concentration of flights to the European market due to the entry of foreign companies, no significant change was found between 1999 and 2012 when evaluating the market concentration as a whole.

Yaşar and Kiracı (2017) examined the market structure and the level of competition in the world aviation market for the

years 2006-2015, by dividing air transportation into 7 different markets using the CRn and HHI methods. The study concludes that the world market has a highly competitive structure compared to other markets, but market concentration has increased in a significant part of the markets over the 10-year period. A similar study was conducted by Kiracı et al. (2017) to determine the concentration rate in the market of the five largest airports operating in Turkey. In this context, the number of passengers and cargo amounts of the airlines using these airports were examined using the HHI and CRn methods for the period 2012-2015, and it was found that the airports were far from a competitive structure. Grosche et al. (2020) examined the market concentration in the airline industry in Germany using the service quality index (QSI) and HHI method. It was found that market concentration in the German airline market increased as a result of the collapse of Air Berlin and the dominance of the Lufthansa Group in German air transport.

Peng and Lu (2022) calculated the effects of three global airline alliances on airport concentrations in 10 Asian countries separately for round-trip passengers and transfer passengers using the Herfindahl-Hirschman index (HHI) and Entropy Index (EI). The selected airports generally exhibited stronger internal cooperation (higher concentration) in transfer markets, while some airports showed significant internal competition in round-trip traffic. Adrangi and Hamilton (2023) examined the role of market concentration in the U.S. airline industry and found that decreasing market concentration improves competitiveness and increases firm profitability.

Yaşar (2023) used the data from 28 airports in Turkey between 2007 and 2018 to determine the number of airlines at the airport, the factors influencing market demand, and to reveal the market structure and its changes using the HHI method. It was observed that monopoly still persisted, especially at airports where concentration was high, but over time, with the entry of other airlines into the market, access to monopoly and monopolistic markets was achieved, leading to an increasingly permanent structure. Milioti and Odoni (2024) examined the effect of airport size on market concentration. They used a sample of 157 airports that serve 88% of European passengers and categorized the airports into three levels. The researchers then used the HHI index to analyze the data. They found that market concentration was highest in Level 1 and large Level 3 airport clusters. Within Level 3, market concentration was prevalent in the super-large airport sub-cluster.

Ha and Seo (2013) used the HHI method to calculate the concentration of South Korea's maritime transportation sector between 1992 and 2004 and found that the Korean market has become more competitive, but the concentration level of the global maritime market has increased. Sung (2014) measured the concentration in mobile telecommunications markets in 24 OECD countries using the HHI method. The OECD (2018) report measured the concentration in seed markets using the HHI method and the four-firm concentration ratio (CR4) methods and found that the concentration in the market increased.

Önder (2016) used Entropy and Rosenbluth, CRm and HHI methods on the Turkish food sector for the period 1997-2014 and found that there is a high concentration in the sector and that the sector is close to an oligopoly market. Ildırar and Kıral (2018) examined the concentration in Türkiye's automotive sector using CRm and HHI methods and concluded that there is a competitive structure in the imported vehicle sector where domestic firms in the sector are close to monopolistic competition.

Bakhtiari (2021) analyzes the changing structure of market concentration in Australia from 2002 to 2017 using the HHI method. They found that although market concentration has gradually increased, concentration has decreased in some sectors, and there has been strong productivity growth in sectors where concentration has increased. Amiti and Heise (2021) analyze the level of concentration of local firms in the US market between 1992 and 2012. They find that although the level of concentration among local firms has increased, the penetration of foreign firms has reduced overall market concentration and even caused the largest local firms in the US market to lose sales.

Koltay et. al (2023) analyzed concentration in European economies using a dataset of over 17,000 firms in 5 countries representing 80% of European economies between 1998 and 2019 and found that there has been a moderate increase in market concentration over the last two decades, a shift towards oligopolistic structure in highly concentrated sectors and an increase in aggregate firm profitability. Kwon, et. al (2024) analyzed the state of concentration in the US economy using a 100-year data set. As a result, concentration has increased over the last 100 years, and this is consistent with the long-term trend of stronger economies of scale.

5. Method, Data Set and Findings

5.1. Method

This study uses the Herfindahl-Hirschman index, which is the most widely used index in the literature (Ginevičius & Čirba, 2009, p. 192) and is reported to be more successful against measurement errors in the OECD (2018) report. The HHI is preferred both because it takes into account the market shares of all firms and because it is sensitive to firms with high market shares. The HHI takes on values between 0 and 10,000 as the industry moves from perfect competition to a monopolistic structure. The index value approaches zero as the number of firms increases and their market shares converge. HHI is calculated by summing the squares of the sales/market shares of the firms in the market (Naldi & Flamini, 2014, p. 3; Ildırar & Kıral, 2018, p. 98). The HHI is expressed as in Equation 1 (Ginevičius & Čirba, 2009, p. 192; Önder, 2016, p. 196; Špička, 2016, p. 8):

$$HHI = \sum_{i=1}^{n} P_i^2 \quad (1)$$

HHI is the degree of concentration, n is the number of units, and P^2 is the square of the unit's share of the total. If the HHI value is lower than 1000, it is considered an "unconcentrated market", if it is between 1000 and 1800, it is considered a "moderately concentrated market", and if it is higher than 1800, it is considered a "highly concentrated market" (USDOJ, 2025; Ildırar & Kıral, 2018, p. 99; Tatlı, 2018, p. 72). Špička (2016) defined the HHI value as "competitive market" if it is lower than 1000, "unconcentrated market" if it is between 1000 and 1500, "moderately concentrated market" if it is between 1500 and 2500, and "highly concentrated market" if it is higher than 2500.

5.2. Dataset

In this study, the concentration of international freight traffic in Türkiye is calculated using the HHI method for the 18-year period 2007-2024 by using a dataset that includes all

airports in Türkiye where freight (baggage, cargo and mail) is transported on international flights. The dataset was first produced by DHMI (2025) for the year 2008 and is published monthly on their website. In the data published for the years 2007-2012, all cargo was presented under a single heading, but since 2013, cargo loads have been presented under a separate heading. In addition, for the years 2007 and 2008, only the data of the airports belonging to the State Airports Authority were provided, so these years could not be included in the study. Therefore, in this study, the HHI values for all loads for the period 2009-2024 and the HHI values for cargo loads for the period 2013-2024 are calculated separately. In 2009, 46 airports are actively used in Türkiye, while in 2024, 58 airports are used. Although international freight and cargo traffic is reported as 0 for some airports in the relevant years, it is included in the study. Of the 58 airports, 50 are operated by DHMI, 7 are operated by private companies, and 1 is operated by a university (DHMI, 2025).

Table 1. Concentration level of Turkish airports in international freight transport (2009-2024)

	Airports									
Years	**Atatürk**	**İstanbul**	**Sabiha Gökçen**	**Esenboğa**	**Adnan Menderes**	**Antalya**	**Dalaman**	**Milas-Bodrum**	**Adana**	**Total***
2009	3006	0	50	6	6	610	10.9	4.4	0.4	3695
2010	2941	0.0	56	5.9	6.8	634	9.7	3.4	0.6	3659
2011	3116	0.0	48.3	4.8	6.7	637	6.8	2.9	0.4	3824
2012	4193	0.0	40.9	3.5	6.7	293	6.6	2.9	0.4	4547
2013	4355	0.0	54.7	2.7	5.8	246	5.6	2.1	0.2	4673
2014	4581	0.0	66.0	2.2	4.9	209	4.5	1.5	0.2	4871
2015	4843	77.5	0.0	1.9	4.7	166	3.7	1.0	0.3	5099
2016	5880	82.4	0.0	1.4	3.3	56.1	1.3	0.3	0.3	6025
2017	5838	0.0	64.3	1.7	3.6	78.9	1.3	0.2	0.1	5988
2018	5665	0.0	57.6	1.5	2.9	105	1.7	0.4	0.1	5835
2019	1077	1725	54.3	1.5	3.4	125	1.8	0.6	0.2	2988
2020	1732	1903	34.8	1.0	1.4	18.8	0.4	0.1	0.1	3692
2021	937	2533	40.1	0.9	1.9	58.9	0.2	0.2	0.2	3572
2022	3.0	5450	52.8	1.1	3.8	103	1.6	0.5	0.1	5617
2023	0.0	5553	59.0	1.5	3.8	114	1.7	0.4	0.1	5734
2024	0.0	5610	65.0	1.4	3.6	101	1.8	0.4	0.0	5783

*Index data for airports not included in the table are also included in the total.

5.3. Findings

The HHI values for all freight for the period 2009-2024 are shown in Table 1 and the HHI values for freight for the period 2013-2024 are shown in Table 2. In the tables, airports with values greater than 0 for more than 5 periods are included and other airports are not listed.

The concentration levels calculated according to the HHI for international freight transportation at Turkish airports are shown in Table 1. It can be seen that there is a very high level of concentration for all periods analyzed. From 2009 to 2018, the concentration was particularly concentrated on Atatürk Airport. With the active operation of Istanbul Airport and Atatürk Airport in 2019, 2020 and 2021, there was a significant improvement in the level of congestion, but very high levels of congestion continued. From 2019, Atatürk Airport was closed for domestic and international passenger traffic (DHMI, 2025), but cargo traffic continued until 2021.

Table 2. Concentration level of Turkish airports in international cargo transport (2013-2024)

	Airports						
Years	**Atatürk**	**İstanbul**	**Sabiha Gökçen**	**Esenboğa**	**Adnan Menderes**	**Antalya**	**Total***
2013	8610.3	0.0	21.6	0.2	0.1	0.1	8634.1
2014	8578.5	0.0	22.3	0.8	0.1	0.1	8602.9
2015	8646.7	0.0	31.0	0.3	0.2	0.1	8678.2
2016	8664.4	0.0	34.8	0.0	0.1	0.1	8699.5
2017	8680.9	0.0	31.9	0.0	0.5	0.0	8713.4
2018	8934.8	0.0	22.8	0.0	0.1	0.0	8957.8
2019	3144.2	1558.8	12.8	0.1	0.1	0.0	4716.0
2020	3642.6	1306.9	6.8	0.2	0.1	0.0	4956.6
2021	2551.2	2126.0	6.7	0.1	0.0	0.0	4684.1
2022	13.7	8592.5	6.2	0.1	0.1	0.1	8612.7
2023	0.0	9307.1	8.2	0.0	0.0	0.1	9315.4
2024	0.0	9397.7	6.6	0.0	0.0	0.1	9404.4

*Index data for airports not included in the table are also included in the total.

In 2022, there was insignificant cargo traffic and international cargo traffic shifted to Istanbul Airport. In 2009, Antalya Airport was important for international freight transportation, but the level of concentration decreased with a downward trend until 2024. It is understood that low level of transportation is carried out in other airports. From the relevant years, it is observed that the center of international freight transportation is Istanbul, and this concentration was in Atatürk Airport until 2019 and gradually shifted to Istanbul Airport from 2019.

The levels of density calculated according to the HHI for international freight traffic at Turkish airports are shown in Table 2. Very high levels of congestion were observed in all relevant years. As in the case of freight transportation, the density levels decreased relatively in 2019, 2020 and 2021 due to the simultaneous use of Atatürk and Istanbul airports, but the very high-density levels persisted.

6. Conclusion

The liberalization movements implemented in the aviation sector have increased competition. However, in the existing literature, it is frequently reported that although the aviation sector initially entered a highly competitive process with low concentration with liberalization steps, after a certain period of time the sector transitioned towards an oligopolistic market structure. Following the liberalization measures implemented in the Turkish aviation sector since the 1980s, many companies entered the sector but later exited the sector or merged. As a result, the degree of concentration in the Turkish aviation sector has increased in line with global trends.

The fact that strategic alliances between airline companies are common in the airline industry (Chao and Kao, 2015, p. 29), large airports are generally in a competitive position in business relations with their own networks (Choo et al. 2018, p. 67), the proximity of a central airport creates significant structural advantages for the economy from a macro and local perspective (Song and Ma, 2006, 2015), taking advantage of economies of scale, reducing the number of routes, the positive effect of more frequent flights on demand, and attempts to reduce costs by combining personnel, maintenance, and operational activities trigger firms to create a hub-and-spoke system in the aviation sector (Çiftçi &Şevkli, 2015, p. 191). All these situations experienced in the aviation sector bring about an increase in congestion at airports.

This study analyzes the concentration level of airports in the context of international freight and cargo transportation within the Turkish aviation sector. The findings reveal a concentration trend that has emerged similarly across airports at the firm level in the aviation sector. In the context of international freight and cargo transportation, it has been determined that airports in Türkiye have reached a high level of concentration, leading to a market structure that is far from competition and close to monopoly. Initially observed at Ataturk Airport, this concentration transitioned to Istanbul Airport in 2019, which has become the central hub for international air freight and cargo transportation in Türkiye.

Given the nature of the aviation sector, numerous studies worldwide have determined that elevated levels of competition are not viable in the long term. The sector is undergoing a transition towards an oligopoly market structure. The primary factor contributing to this phenomenon is the fact that firms have chosen Istanbul airport as a hub in line with government policy to achieve economies of scale and increase their profitability through this mechanism. Given the applicability of this phenomenon to airports, a certain level of concentration is expected, particularly in the Istanbul region, which accounts for approximately 25% of Türkiye's exports and 50% of its imports.

The inadequacy of the cargo infrastructure at Istanbul Ataturk Airport and the fact that most of the cargo operations in the Turkish air cargo sector are carried out from there have been shown as the main reasons preventing the Turkish air cargo sector from reaching its potential, which could have a higher volume in the market (Tanrıverdi & Lezki, 2021, p. 1).

A notable factor contributing to this concentration is the substantial cargo capacity of Istanbul Airport, which is estimated to be 3 million tons, and its significantly larger terminal area, measuring 1.4 million square meters, in comparison to that of Atatürk Airport. This has led to a notable concentration of cargo and freight transportation activities within Istanbul Airport (K Kılıç & Turgut, 2019, p. 155).

As a trade and transit center with the advantage of its strategic geographical location, Istanbul has managed to gradually strengthen its role in Turkey and the world in terms of passenger and cargo networks. Factors such as its geopolitical location, high infrastructure capacity, access to human resources, and the ability to fly to many commercial points of the world in short periods of time support Istanbul's important position in the Turkish aviation sector (Tanrıverdi & Lezki, 2021, p. 1).

As of 2024, Turkey ranks 6th in Europe with an average daily flights per day, while the Istanbul Airport ranked 7th in the World Passenger Traffic ranking and the 1st with 1401 flights in the European passenger traffic ranking (DHMI, 2025; p. 27-29). Although Istanbul's economy and Istanbul airport have a high potential and capacity in the aviation sector; In addition to creating risks related to market dynamics such as lower competition and high condensation, lower service quality and higher prices, it is thought that this situation may cause serious problems for Istanbul's current infrastructure and urban planning.

This concentration, particularly with regard to Istanbul Airport, has the potential to further exacerbate Istanbul's already substantial traffic congestion by imposing a considerable strain on the city's road network due to the airport's logistics and transportation operations. This has the potential to impede the efficient and timely movement of cargo and freight, as well as exerting a negative impact on urban transportation.

However, a study for a US airport also found that a 10% increase in airport-level HHI resulted in a 1.05–1.3% increase in average airfares for flights departing from an airport (Bilotkach &Lakew, 2014, 295.

Furthermore, given Istanbul's high earthquake risk, the fact that all critical air transportation infrastructure is concentrated in a single geographical area creates the risk of a complete collapse of the logistics system in the event of a major disaster. This predicament engenders a grave vulnerability with respect to the provision of post-disaster emergency aid, the transportation of materials, and the uninterrupted continuity of foreign trade. Considering these concerns, it is imperative that Türkiye adopts strategies aimed at enhancing regional diversity in international air cargo and freight transportation. This will not only ensure the country's continued competitiveness in the global marketplace but also bolster its resilience in the face of crises.

It is also important to evaluate this situation in terms of Turkey's high tourism potential. Because as of 2024, more than

62 million tourists have entered Turkey, including 9 million Turkish citizens living abroad, contributing approximately 60 billion dollars to tourism. Out of around 53 million foreign tourists, 40 million used air transport. According to the border gates where tourists entered, Istanbul hosted 35% of the total tourists, while 30% entered through Antalya (KTB, 2025). When it is taken into account in the international cargo category class in the goods they bring with them, it is possible to say that a city like Antalya is in a more suitable position for transportation from point to point. Indeed, in the study by Çiftçi and Şevkli (2015) aimed at determining an alternative hub center to Istanbul, it was identified that Antalya would be a good choice for a new hub and spoke system in Turkey.

In light of these findings, diversifying airport infrastructure on a regional scale and establishing alternative logistics centers for international freight and cargo transportation are of strategic importance. This is essential to maintain competitiveness and to reduce urban traffic and disaster risks. Future studies and policy recommendations should address the market structure of airports not only from an economic perspective but also considering the vulnerabilities of metropolises like Istanbul, which will play a critical role in the sustainable development of the Turkish aviation sector. Additionally, it is believed that efforts to identify alternative points to Istanbul as a hub and to determine airports suitable for point-to-point transportation should be increased, and new policy proposals should be developed based on the results obtained.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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