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Instytut Organizacji i Zarządzania  
Wydział Bezpieczeństwa, Logistyki i Zarządzania  
Wojskowa Akademia Techniczna  
w Warszawie

Institute of Organization and Management  
Faculty of Security, Logistics and Management  
Military University of Technology  
in Warsaw

## Multidimensional comparative analysis of passenger air transport in terms of the recovery from the impact of COVID-19 pandemic and economic security

### Wielowymiarowa analiza porównawcza pasażerskiego transportu lotniczego w kontekście wyjścia z oddziaływania pandemii COVID-19 i utrzymania bezpieczeństwa ekonomicznego

**Bartosz Kozicki**

Military University of Technology, Warsaw, Poland  
bartosz.kozicki@wat.edu.pl; ORCID: 0000-0001-6089-952X

#### **Abstract.**

##### *Research objectives and hypothesis/research questions*

The aim of the article is to analyze and evaluate data on the number of passengers transported by air transport in 28 European countries between 2019-2024. For the research problem and aim of the study, a research hypothesis was outlined: it is assumed that in the 28 European countries considered, most of them will see an increase in the number of passengers transported by air in 2023 compared to 2019.

##### *Research methods*

Research methods used in the study were: analysis, comparison, abstraction.

##### *Main results*

The research shows that from 2012 to 2019, there was a strong increasing trend in the number of passengers transported by air in the 28 analyzed European countries. The number of passengers increased during this period from 941 283 897 to 1 360 391 372 people. In 2020, due to the COVID-19 pandemic, the number of passengers decreased to 360 853 482, and from 2021 to 2023 there are increases that are still lower than the level noted in 2019. It was also observed that in each of the 28 European countries considered, there was an increase in the number of passengers transported in 2023 compared to 2022. Comparing data on the number of passengers between 2019 and 2023, increases were observed in 15 of the 28 European countries considered. The most visible one was seen in Spain: 7 764 194 people. The biggest declines were in Germany: 41 484 618 people. The price of an airline ticket certainly influences the number of passengers. The largest part of it, 56.54%, is the price of fuel. Despite the increase in fuel prices, a substantial increase in the number of passengers transported is noted between 2021-2022; due to the process of recovery from the economic crisis caused by the COVID-19 pandemic.

### *Implications for theory and practice*

Development directions indicate that air transport in Europe for 2025-2030 will have to meet new challenges, while adapting to passengers' expectations and global ecological and technological trends. The modernization of airports and the development of new connections will be crucial to cope with the growing passenger traffic. Many airports are planning to expand terminals and improve traffic management systems. A significant challenge is to integrate air transport with other forms of transport such as railways, buses and ridesharing services to ensure seamless and convenient connections for passengers.

**Keywords:** security, air transport, price, COVID-19, war between Russia and Ukraine

### **Abstrakt.**

#### *Cel badań i hipotezy/pytania badawcze*

Celem artykułu jest analiza i ocena danych dotyczących liczby pasażerów przewiezionych pasażerskim transportem lotniczym w 28 państwach Europy w latach 2019-2024. Dla tak przyjętego problemu badawczego i celu pracy postawiono hipotezę badawczą: przypuszcza się, że w większości państw z 28 rozpatrywanych państw europejskich w roku 2023 zaewidencjonowano wzrost liczby pasażerów przewiezionych transportem lotniczym w porównaniu do 2019 r.

#### *Metody badawcze*

W opracowaniu zastosowano metody badawcze: analizę, porównanie, abstrahowanie.

#### *Główne wyniki*

Z przeprowadzonych badań wynika, że w latach 2012-2019 widoczny był silny trend rosnący liczby pasażerów przewożonych pasażerskim transportem lotniczym w 28 analizowanych państwach Europy. W tym okresie nastąpił wzrost liczby pasażerów z 941 283 897 do 1 360 391 372 osób. W roku 2020 z powodu pandemii COVID-19 doszło do spadku liczby pasażerów do poziomu 360 853 482, a w latach 2021-2023 zanotowano wzrosty, które nadal są niższe od poziomu obserwowanego w 2019 r. Zauważono również, że w każdym z 28 rozpatrywanych państw Europy w 2023 r. w porównaniu do 2022 r. nastąpił przyrost liczby przewożonych pasażerów. Porównując dane dotyczące liczby pasażerów pomiędzy rokiem 2019 i rokiem 2023 w 15 na 28 rozpatrywanych państw europejskich zaobserwowano wzrosty. Największy zauważono w Hiszpanii: 7 764 194 osób. Największe spadki odnotowano zaś w Niemczech: 41 484 618 osób. Wpływ na liczbę pasażerów z pewnością ma cena biletu lotniczego. Największą jej część, 56,54%, stanowi cena paliwa. Pomimo wzrostu cen paliw w latach 2021-2022 obserwuje się duży wzrost liczby przewożonych pasażerów. Spowodowane jest to procesem wyjścia z kryzysu gospodarczego wywołanego pandemią COVID-19.

#### *Implikacje dla teorii i praktyki*

Kierunki rozwoju wskazują, że transport lotniczy w Europie w latach 2025-2030 będzie musiał sprostać nowym wyzwaniom, dostosowując się jednocześnie do oczekiwań pasażerów oraz globalnych trendów ekologicznych i technologicznych. Kluczowa będzie kwestia modernizacji lotnisk oraz rozwój nowych połączeń, aby sprostać rosnącemu ruchowi pasażerskiemu. Wiele lotnisk planuje rozszerzenie terminali oraz ulepszenie systemów zarządzania ruchem. Istotnym wyzwaniem jest integracja transportu lotniczego z innymi formami transportu, takimi jak koleje, autobusy i usługi ridesharingowe, aby zapewnić pasażerom płynne i wygodne połączenia.

**Słowa kluczowe:** bezpieczeństwo, transport lotniczy, cena, COVID-19, wojna Rosji z Ukrainą

## **Introduction**

In 2024, dynamic changes in the passenger air transport sector are still continuing, as a result of several key trends and challenges. They result, among other things, from the impact of the COVID-19 pandemic, thanks to which the aviation industry suffered huge losses and is currently trying to rebuild passenger traffic. New route connections, offers and reopening of air routes are key activities to attract tourists and businessmen. The study outlines a research problem: which and how

many countries out of the 28 European countries considered recorded an increase in the number of passengers in 2023 compared to 2019? The aim of the article is to analyze and evaluate data on the number of passengers transported by air transport in 28 European countries between 2019-2024. For the research problem and aim of the study, a research hypothesis was outlined: it is assumed that in the 28 European countries considered, most of them will see an increase in the number of passengers transported by air in 2023 compared to 2019. Research methods used in the study were: analysis, comparison, abstraction.

## **1. Analysis of the literature on the subject of research**

The period between 2012-2024 has been characterized by enormous changes in European air passenger transport, which were caused by an attempt to adapt quickly to the new reality put forward by various random factors.

The concept of “transport” is interpreted differently in the literature. It is a set of activities involving the movement of material goods in time and space using appropriate technical means (Woźniak, Kukiełka, 2011, p. 439). Transport (DAABS, 2019; Transporteca, 2022) is related to the movement of people and material goods using appropriate means, it includes both the movement from one place to another as well as all activities necessary to achieve that goal, i.e. loading activities (Encyklopedia PWN, 2024). It is an essential element of logistics and plays a significant role in the movement of goods and people (Encyklopedia zarządzania, 2024). One of the types of transport, the youngest one, is the passenger air transport. Considered to be by far the fastest type of transport (Bednarek, 2024), it allows one to reach from an airport to another airport at a distance of up to several dozen thousand kilometers, while guaranteeing high security level (JASFBG, 2018). In the literature, security is considered to be the certainty of existence and survival, the state of possession and functioning and the development of the entity (Zięba, 2018, p. 18; Mitkow, Tomaszewski, Kozicki, 2021, pp. 11-29; Mizura, Mitkow, Kozicki, 2023, pp. 13-56). One type of security is the economic security. In the literature, it is interpreted as a process encompassing various activities in the field of national security, the main task of which is to ensure the economic conditions necessary for survival, as well as the state obtained as a result of opposing external and internal destructive factors that may lead to development disorders (Kitler, 2011, p. 49). The economic security (Kozicki, 2022b, pp. 13-18) of the countries of the world was weakened in 2020, especially in the passenger air transport sector.

The discussed global transport was influenced by the COVID-19 pandemic (Kozicki, 2022a, pp. 134-138). One of its effects was a lockdown that grounded planes, cut off airlines from revenues, and consequently also airports, ground crew agents, suppliers, and commercial, service and catering companies operating at airports,

resulting in mass layoffs (Walków, 2022; Jurgilewicz, Malec, Piwowarski, Kozicki, 2021; Kozicki, Kalwasiński, 2021). It can be said that that was a consequence of the shutdown of the passenger air transport sector and then, after a certain period, its gradual reactivation. This, as a result, first led to huge financial losses and then a gradual increase in revenues, but still lower than those in 2019, i.e. before the impact of the pandemic. In 2023, in respective European countries, carriers providing air passenger transport services recorded net profits that were on average 5.3 percent lower compared to 2019 (Dybiński, 2024). Conducting air operations in Europe since 2021 had become more and more expensive every year. In 2023, specialized air navigation authorities received a total of EUR 9,5 billion from airlines in route fees, EUR 1,5 billion more than in the same period of the previous year, while in 2019 airlines paid EUR 7,0 billion in route fees, EUR 9 billion (Kieruzal, 2024). The price of crude oil has the greatest impact on the price of an airline ticket (Sipiński, 2012).

The air passenger transport sector is slowly recovering after the pandemic crisis, but must cope with rising operating costs and changing consumer preferences. The pandemic has also influenced the development of digital technologies, which results in the need to improve the comfort of travelers in terms of implementing an automatic check-in system, digital boarding passes, baggage tracking and advanced reservation systems. The importance of remote work has also increased, reducing the demand for business travel. High energy prices between 2022-2024 affected the profitability of carriers, and airlines had to increase ticket prices, including low-cost ones, which had a negative impact on the phenomenon of competition between entities providing passenger air transport services. During the pandemic, many airlines were on the verge of bankruptcy, and some of them, such as Flybe, went bankrupt (Zmarzły, 2020). Governments of countries such as Poland, France, Germany and others provided financial support for the above-mentioned economic sector.

The war in Ukraine (Wilk, Domańska, 2022) was one of the causes of the increase in aviation fuel prices, as well as inflation, which led to an increase in the operating costs of airlines. This resulted in an increase in ticket prices and weakening the demand – reducing the number of people ready to use transport services.

## **2. Multidimensional analysis of data on passenger air transport in Europe between 2012-2023**

The research began by compiling data on the number of passengers transported by air in a total of 28 European countries in 2012-2023.

The data presented in Figure 1 indicate an increasing trend in the number of passengers transported in a total of 28 European countries from 2012 to 2019. In 2012, 941 283 897 passengers were transported by air, and in 2019 this number increased to 1 360 391 372 passengers. Due to the COVID-19 pandemic,

in 2020 the number of passengers transported by air decreased to 360 853 482, and from 2021 to 2023 there is a strong increasing trend. It was also observed that in 2023, despite strong increases, the level of 2019 was not reached. Then, it was noted that in each of the 28 European countries considered, there was an increase in the number of passengers transported by air in 2023 compared to 2022.

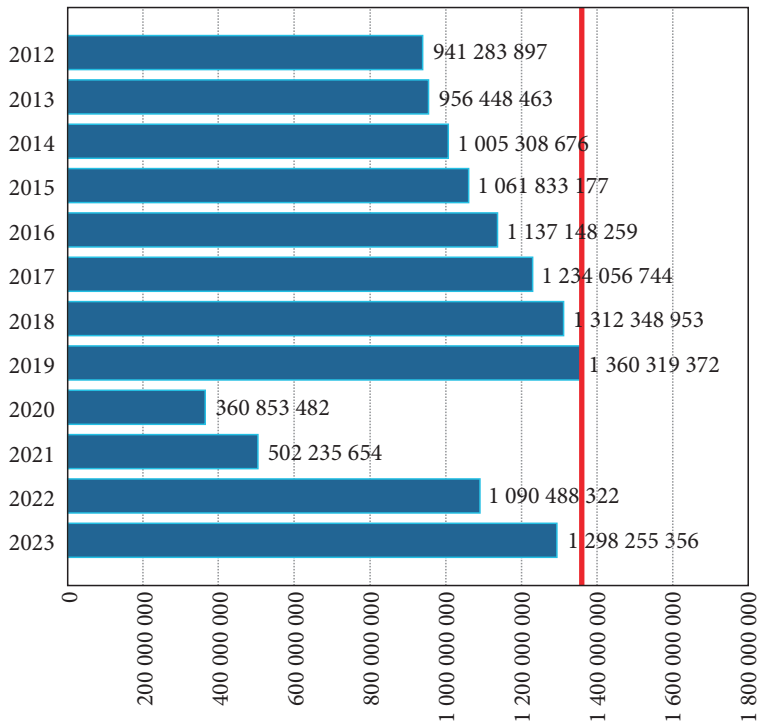


Fig. 1. Bar chart of the number of people transported by air in total in 28 European countries between 2012-2023

Source: own study based on: Eurostat, 2024

The research shows that in each of the 28 European countries considered, there was an increase in the number of passengers transported by air in 2023 compared to 2022. The largest increase was recorded in Spain: 35 311 623 people, then in Germany: 29 976 825 people, and in the third place in Italy: 30 434 659 people. The lowest increase was recorded in Estonia: 215 010 passengers. The increase in the number of passengers in 2023 may forecast further development of the aviation industry in 2024.

The next stage of the research is the compilation of data on the number of passengers transported by air in 28 respective European countries in 2019 and 2023.

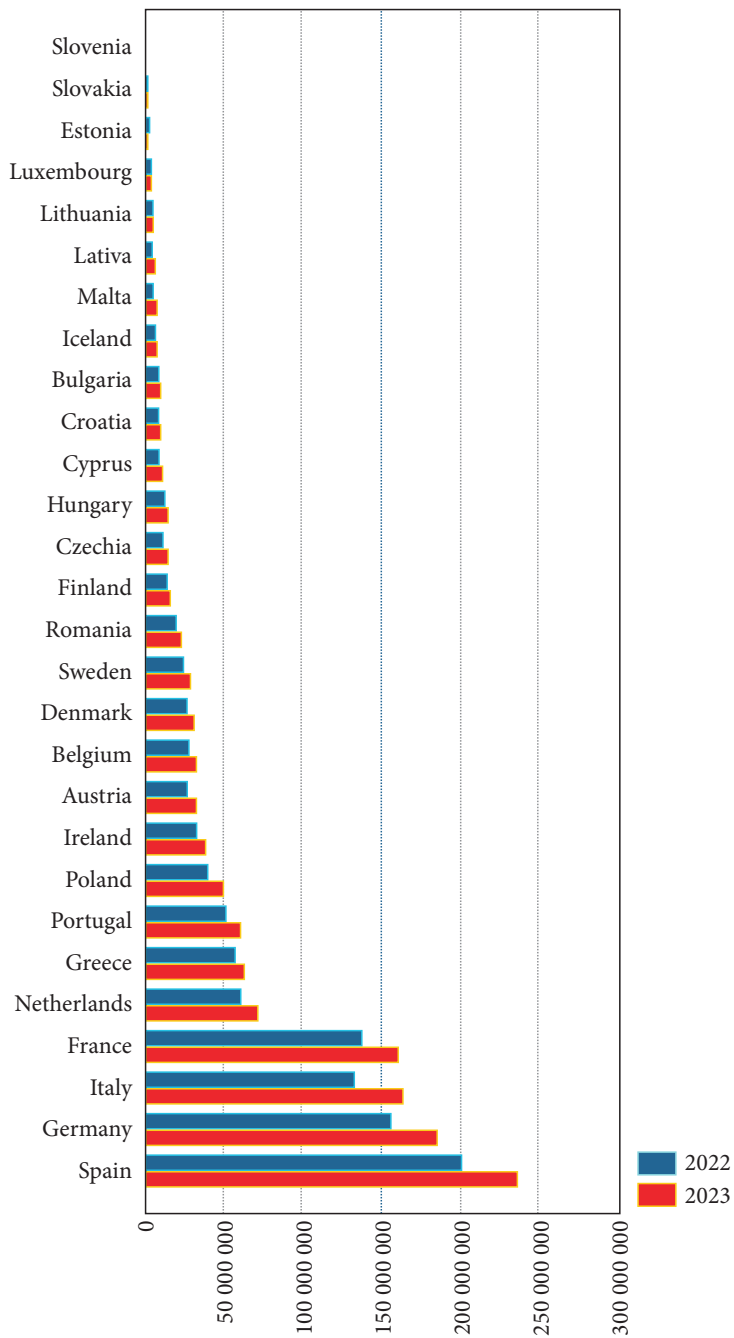


Fig. 2. Pyramid chart of data on the number of people transported by air in 28 European countries between 2022-2023

Source: own study based on: Eurostat, 2024

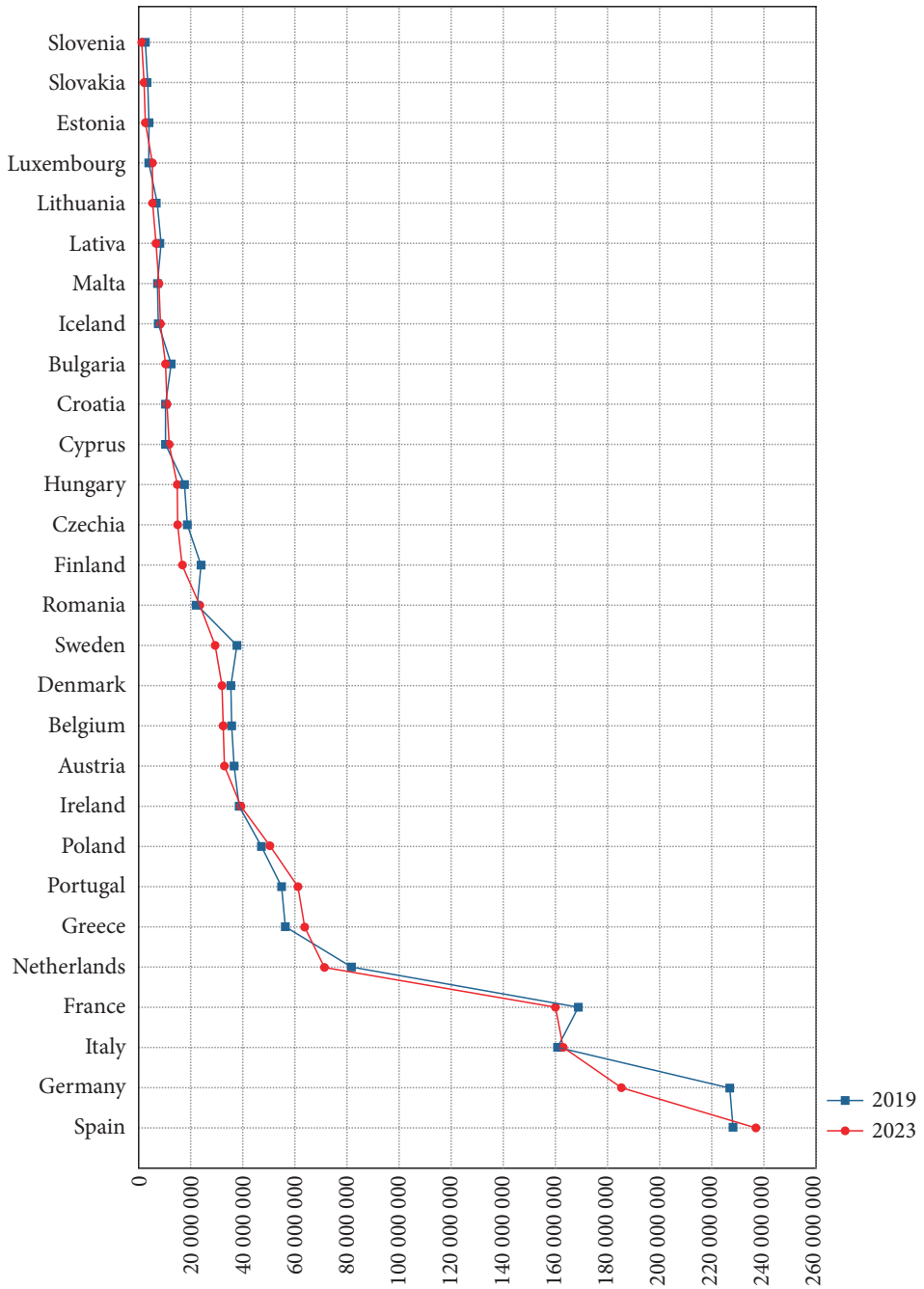


Fig. 3. Categorized line chart of data on the number of people transported by air in 28 European countries in 2019 and 2023

Source: own study based on: Eurostat, 2024

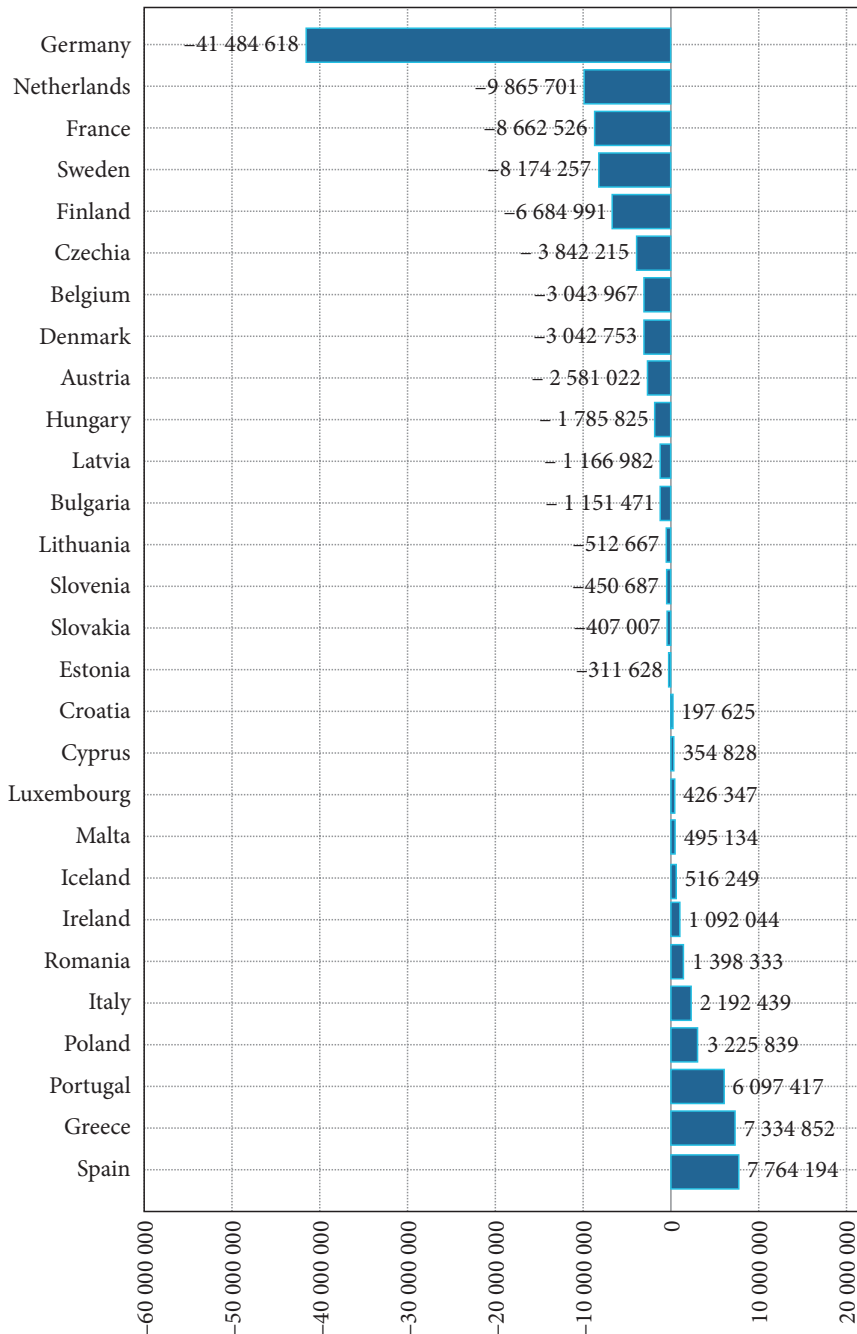


Fig. 4. Bar chart of the difference in the number of people transported by air in 28 European countries between 2019 and 2023

Source: own study based on: Eurostat, 2024



Observations show that the data on the number of passengers transported in 28 European countries in 2019 and 2023 are not balanced. It can be observed that there are countries where significantly more people were transported in 2023 compared to 2019, e.g. Italy, and conversely – Germany.

For research purposes, Figure 4 presents the difference in the number of people transported by air in 28 respective European countries between 2019 and 2023, ranking the results from the largest to the lowest.

The largest increase in the number of passengers transported by air between 2019 and 2023 was observed in Spain: 7 764 194. In the second place there was Greece with an increase of 7 334 852 people. Then, Portugal was third, with an increase of 6 097 417 passengers. Poland was ranked fourth with an increase of 3 225 839 people. The largest decrease in the period considered is visible in Germany and amounts to 41 484 618 people. Decreases were recorded in 13 out of 28 European countries considered. The increase in the number of passengers in 15 European countries may most likely result from a change in the strategy of air carriers related to the increase in the number of connections and perhaps the introduction of attractive travel offers.

Undoubtedly, the number of passengers using air transport will be influenced by the ticket price. The figure below shows the components that influence the price of an airline ticket.

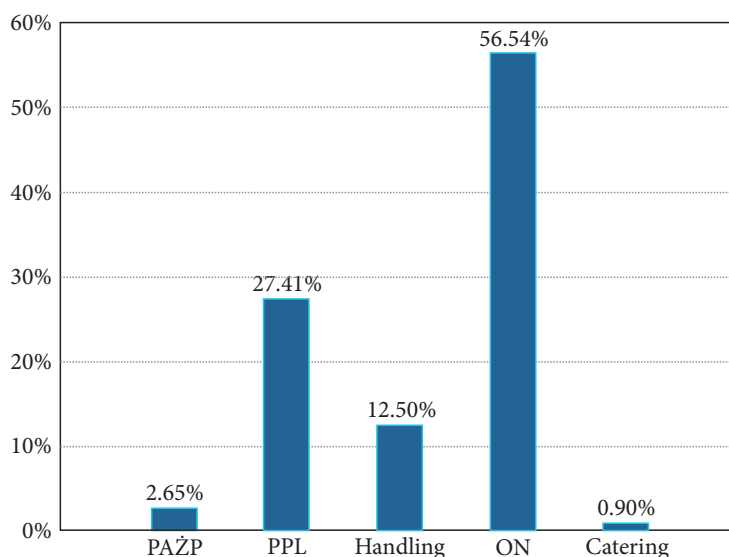


Fig. 5. Bar chart of factors influencing the price of an airline ticket

Source: own study based on: Sipiński, 2012

The research shows that the price of crude oil has the greatest impact on the price of an airline ticket, which accounts for approximately 56.54% of the total ticket purchase value. PPL also has a significant impact, accounting for 27.41%, and 'handling – ground crew' accounting for 12.50%. Then, it was decided to examine the relationship between the arithmetic mean of oil prices and the number of passengers transported by air in 28 European countries considered between 2019-2023. The relationship between the price of oil and passenger numbers may also indicate the flexibility of demand. As oil prices rise, changes in consumer behavior may occur, leading to a decline in air travel, especially in the tourism segment. To sum up, the analysis of the impact of oil prices on air transport in Europe allows for a better understanding of market dynamics and facilitates strategic decisions by carriers, as well as market regulations.

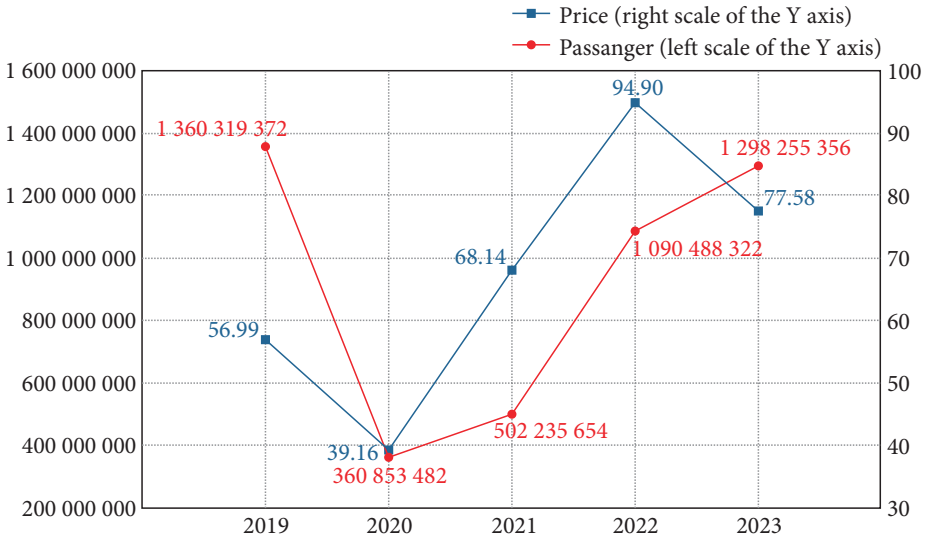


Fig. 6. Line chart of the number of people transported by air in a total of 28 European countries between 2019-2023 and the arithmetic mean of oil prices between 2019-2023

Source: own study based on: Eurostat, 2024; Federal Reserve Bank of St. Louis, 2024

Research indicates that the increase in the number of passengers transported by air in the 28 European countries considered in total between 2021-2023 resulted from the recovery of that economic sector from the crisis caused by the COVID-19 infectious disease pandemic. Similarly, the decline in the arithmetic mean of crude oil prices in 2020 was caused by the COVID-19 pandemic, and the increases between 2021-2022 were the reaction of the market to such low prices of this raw material. Economic crises and the period of recovery from their effects create situations in which interdependent variables may lose this relationship or it may be significantly limited.

To sum up, the analysis indicates that the increase in the number of passengers between 2021-2023 in the considered European countries is a direct result of the reconstruction of the sector after the economic crisis caused by the COVID-19 pandemic. Changes on the fuel market, including the decline in crude oil prices in 2020 and their increases between 2021-2022, illustrate the reaction of the market to extraordinary circumstances and low prices of the raw material. In terms of economic crises, it is important to realize that the relationships between variables, such as the number of passengers and fuel prices, may be distorted and their dependence may be weakened or changed as a result of complex economic interactions. Therefore, it is necessary to take into account those dynamic correlations and the macroeconomic context in further research.

## Conclusions

The research shows that from 2012 to 2019, there was a strong increasing trend in the number of passengers transported by air in the 28 analyzed European countries. The number of passengers increased during this period from 941 283 897 to 1 360 391 372 people. In 2020, due to the COVID-19 pandemic, the number of passengers decreased to 360 853 482, and from 2021 to 2023 there are increases that are still lower than the level observed in 2019.

It was also observed that in each of the 28 European countries considered, there was an increase in the number of passengers transported in 2023 compared to 2022.

Comparing data on the number of passengers between 2019 and 2023, increases were observed in 15 of the 28 considered. The most visible one was seen in Spain: 7 764 194 people. The biggest declines were in Germany: 41 484 618 people.

The price of an airline ticket certainly influences the number of passengers. The largest part of it, 56.54%, is the price of fuel. Despite the increase in fuel prices, a substantial increase in the number of passengers transported is observed between 2021-2022, due to the process of recovery from the economic crisis caused by the COVID-19 pandemic.

The passenger aviation market in Europe and Asia will undoubtedly be influenced by the war between Russia and Ukraine in terms of geopolitical and economic factors. This war will permanently lengthen flights (by 2-3 hours on average) between Europe and Asia, which are already more expensive and less profitable than before. The conflict also contributes to an increased role of air hubs such as Istanbul or Doha, which may result in European ports and airlines losing and Chinese operators gaining (Ciesielski, 2024). These and other previously mentioned factors will cause air traffic to grow at an average annual rate of three percent in the coming years, i.e. half the rate before the COVID-19 pandemic.

Development directions indicate that air transport in Europe for 2025-2030 will have to meet new challenges, while adapting to passengers' expectations and global ecological and technological trends. The modernization of airports and the development of new connections will be crucial to cope with the growing passenger traffic. Many airports are planning to expand terminals and improve traffic management systems. A significant challenge is to integrate air transport with other forms of transport such as railways, buses and ridesharing services to ensure seamless and convenient connections for passengers.

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