

COVID-19 And Declines in The Number of Passengers Transported by Air in Europe*

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Abstract

In this study the research was related to the declines in the number of passengers transported by air in 29 European countries under consideration in 2020. The research is based on secondary data taken from the Eurostat website. The research used the Holt-Winters method to forecast data on the number of passengers transported by air in 29 respective European countries between 2011-2019 for 2020. The declines were examined on the basis of a comparative analysis and calculated indices as dynamics indices with a fixed and non-fixed basis.

Keywords: Transport, Forecasting, Economic Security, COVID-19.

Introduction

Passenger air transport is one of the factors influencing the economic growth of respective countries. The COVID-19 pandemic has led to the long-term collapse of this sector and it had a negative impact on the economic security of world countries, including Europe.

The research problem of the article focuses on the number of passengers transported by air in 29 European countries under consideration and the impact of the COVID-19 pandemic in terms of economic security maintenance.

The aim of the study is to examine the declines in the number of passengers transported by air in 29 European countries under consideration in 2020. A research hypothesis was formulated:

What percentage of declines in the number of passengers transported by air was observed in 2020 compared to 2019 in the 29 European countries considered?

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The subject of the research is 29 European countries while the object of the research is the number of passengers transported by air from 2011 to 2020 within the subject of the research.

Research methods used in the article were forecasting and comparative analysis. The research shows that in 2020, compared to 2019, there was a decrease in the number of passengers transported by air in the 29 European countries under consideration by 74%.

Analysis of the literature on the research object

The study is a continuation of the research presented in the article 'Air passenger transport in Europe before and during the COVID-19 pandemic versus economic security' in the journal "International Business Information Management" (Kozicki, Stajniak, 2021). The study covered new data on the number of people transported by air in 29 European countries during the COVID-19 pandemic throughout 2020. The considered data was juxtaposed with the same data from previous years to observe changes in the decreases in the number of people transported by air caused by the COVID-19 pandemic.

The analysis of the literature shows that transport can be considered in terms of a system - understood as an activity related to the movement of passengers and cargo, determined by the type, number and features of the objects being moved, routes and parameters of their implementation (Jacyna, 2009, p. 14). There is also an interpretation that it is an activity that results from the need to move people and things in time and space (Stajniak, et al., 2008, p. 41). One of the types of transport is air, which means the transport of people and cargo in the air space (Murzyńska, 2016, p. 63).

When it comes to planning of the number of passengers transported by air, the forecasting of it for the future, preceded by an analysis and evaluation of past data, is very important. The study used a multidimensional data analysis (Panek, Zwierzchowski 2013, p. 15), including their grouping (Łuniewska, Tarczyński, 2006, p. 20). The following indices were calculated: arithmetic mean, standard deviation, which were analyzed, evaluated and compared (Bąk, et al., 2020, pp. 185-194; Leśkow, Lenart, 2005, pp. 8-10; Sobczyk, 2010, p. 75-78; Parlińska, Parliński, 2018, pp. 31-58; Puławska-Turyna, 2011, pp. 46-80; Bielecka, 2017, pp. 107-153).

The calculated indices and observation of the outlined data obtained from the secondary sources made it possible to detect regularities like trends and seasonality.

This, in turn, became the premise for the selection of the method for the forecasting of the future data on the number of passengers transported by air for 2020 in 29 European countries under consideration in the form of Holt-Winters exponential smoothing, multiplicative version. In the Holt-Winters method, time series with seasonal fluctuations may overlap the trend in an additive or multiplicative way (Zeliaś, Pawełek, Wanat, pp. 149-150). In a situation where the amplitude of fluctuations will be higher in the case of a higher value of the series, and lower when the variable takes lower values, then the multiplicative model will be the appropriate one (Dittmann and other, 2016, p. 111). The obtained forecast was used to conduct a comparative analysis of the declines in the number of passengers transported by air in 29 European countries in 2020 compared to the forecast obtained. Forecasting (Kozicki, Mizura, 2020, pp. 65-78) in literature means predicting future events (Dittmann, et al., 2016, p. 17).

On 11 March, 2020, the COVID-19 was announced a worldwide pandemic (Satomi, et al., 2020). The disease has led to large declines in the number of passengers transported by air (<https://www.schengenvisainfo.com/news/passenger-demand-decreased-by-67-2-in-march-2021-compared-to-2019-iata-figures-reveal/>; <https://www.iata.org/en/pressroom/pr/2021-02-03-02/>). Passenger numbers in Europe dropped to the lowest level in 25 years (<https://www.euronews.com/2021/02/12/europe-s-air-passenger-numbers-at-lowest-level-since-1995-last-year>). Even in 2019, large increases in the number of passengers transported by air were visible (<https://www.aci-europe.org/media-room/235-european-airports-report-slower-passenger-growth-declining-freight-in-2019.html>). This type of transport remains one of the industries most affected by the crisis (<https://aci.aero/news/2021/03/25/the-impact-of-covid-19-on-the-airport-business-and-the-path-to-recovery/>). In Germany, 31 million fewer passengers were transported by air in 2020 compared to 2019 (<https://www.destatis.de/Europa/EN/Topic/Transport/airtransportpassengers.html>). A global \$ 370 billion drop in airline gross revenues meant a loss of \$ 100 billion in Europe (<https://www.icao.int/Newsroom/Pages/2020-passenger-totals-drop-60-percent-as-COVID19-assault-on-international-mobility-continues.aspx>). This was caused, inter alia, by the movement prohibition and the uncertainty related to the new form of the disease, large numbers of infected people and deaths in dynamic terms. Many other restrictions were introduced, such as: requirements to wear face masks, especially as far as transport means are concerned, disinfection of hands, keeping distances between passengers. From 2021, vaccinations against COVID-19 are recommended. The first case of COVID-19 was observed in December 2019 in China (N. Zhu, et al., 2020).

The infectious disease COVID-19 has had an impact on the economic security of countries around the world, including 29 analyzed European countries. In the literature, economic security is considered to be a kind of national security, a process

that includes various activities, the main goal of which is to ensure the economic conditions necessary for the survival, prosperity and sustainable development of the society, as well as the efficient operation of the state and its institutions (Kitler, 2011, p. 49). Ensuring economic security by the respective countries of the world under consideration is extremely important. It allows for economic development and it influences the demeanour and mental attitude of citizens of these countries in terms of the impact of COVID-19.

The research began with the analysis of data obtained from Eurostat in order to discover the regularities governing them.

Multidimensional data analysis and forecasting

The first stage of the research was to outline the sum of the number of passengers transported by air in 29 respective European countries under consideration between 2011-2019 in Figure 1.

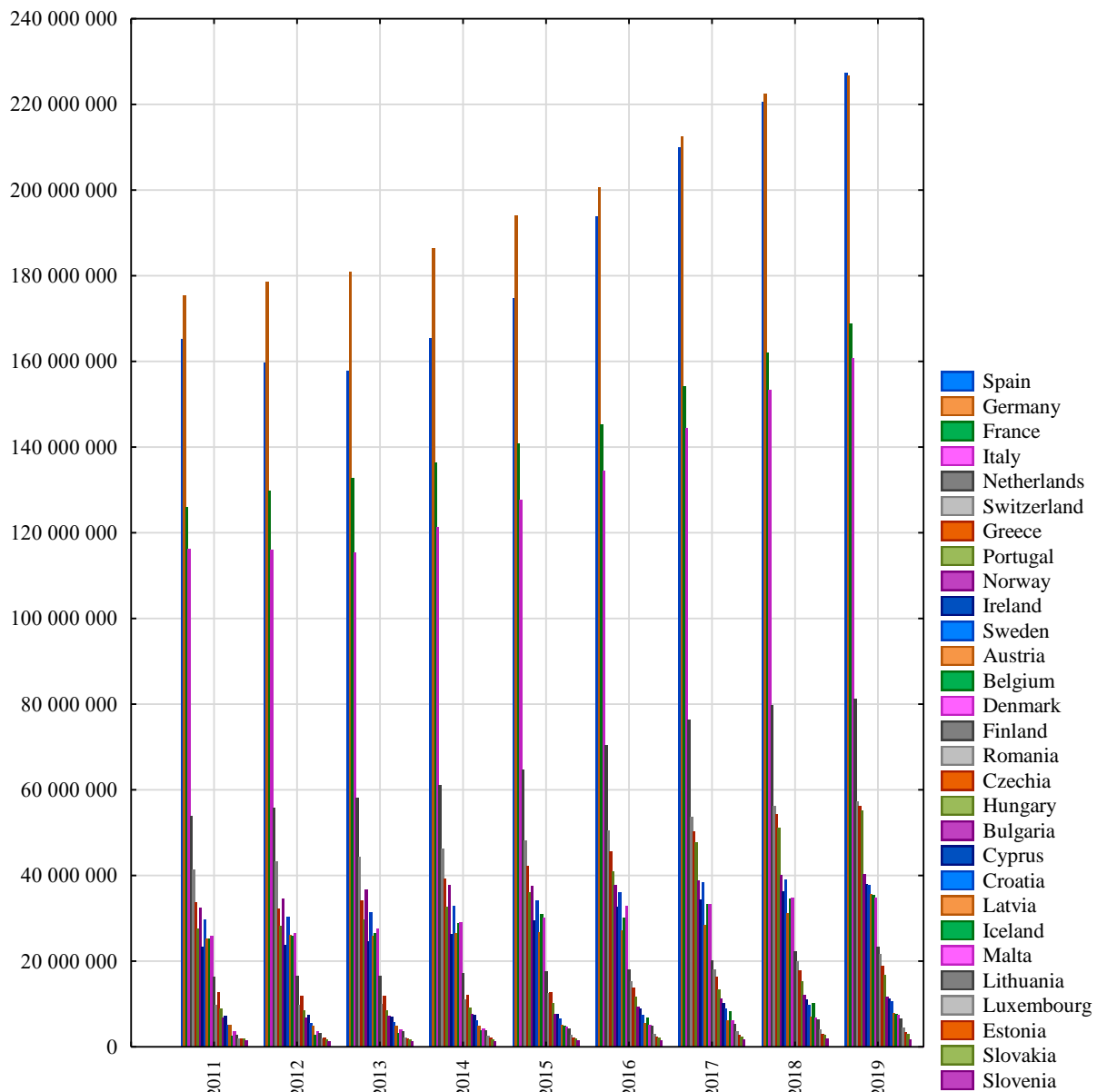


Figure 1: Analysis of the total number of passengers transported by air in 29 respective European countries between 2011-2019

Source: own study based on data obtained from the website: <https://ec.europa.eu/>; (20.07.2021)

The observation of the data in Figure 1 allows us to conclude that from 2011 to 2019, in each of the 29 European countries under consideration, a growing trend in the number of passengers transported by air is visible. From 2011 to 2018, Germany

was the leader among the 29 analyzed European countries in terms of the number of passengers transported, with the total number of passengers transported within the period under consideration at the level of 1 777 335 694 people. In 2019, the first place in terms of the number of passengers transported by air in 29 analyzed European countries was taken by Spain with a result of 227 189 012 transported passengers. The second place in the ranking in 2019 was Germany with the total number of passengers transported 226 764 086. The third place was taken by France, where in 2019 a total of 168 729 932 people were transported by air. Italy took the fourth place in 2019 in terms of the number of passengers transported with a result of 160,667,939 people. In each of the remaining 25 analyzed European countries, the number of passengers transported by air was lower than 82,000,000.

The next stage of the research was a comparative analysis of the sum of the number of passengers transported by air in respective 29 European countries between 2019-2020 (Fig. 2).

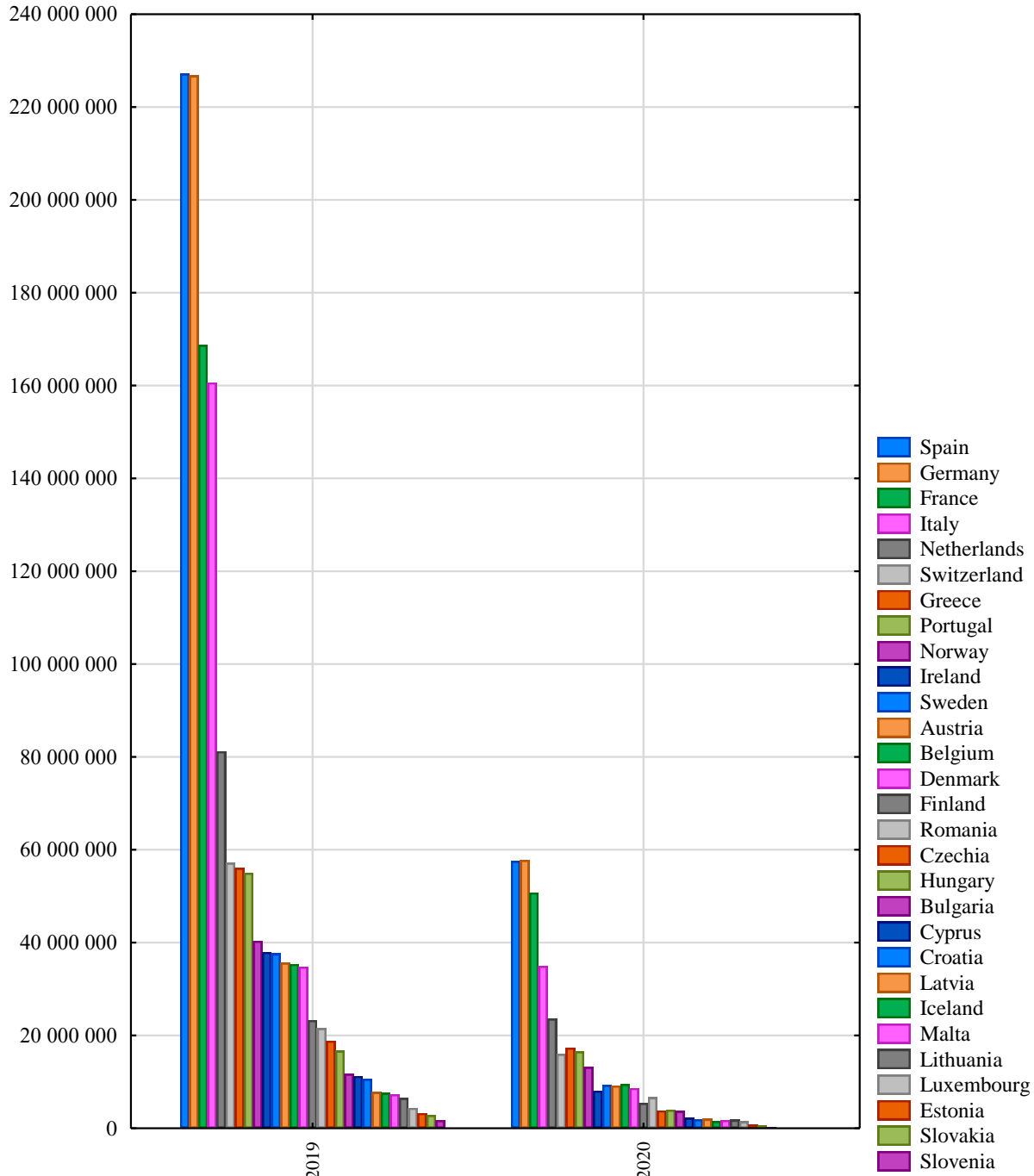


Figure 2: Comparative analysis of the sum of the number of passengers transported by air in respective 29 European countries between 2019-2020

Source: own study based on data obtained from the website: <https://ec.europa.eu/> (20.07.2021)

In 2019, 1 409 894 593 passengers were transported in total in the 29 European countries under consideration. However, in 2020, due to the COVID-19 pandemic, the number decreased to 370 470 634, i.e. 1 039 423 959 passengers less. The arithmetic mean of the sum of the number of transported people in 29 European countries amounted to 48 617 055 passengers while in 2019 it reached the level of 12 774 849 passengers. The median of the analyzed data amounted to 23 287 929 passengers in 2019 and in 2020 it decreased to the level of 6 650 110 passengers. The standard deviation of the number of passengers transported by air in the 29 analyzed European countries amounted to 64 169 946 people and in 2020 it reached the level of 16 722 837 passengers.

The next stage of the research is the ranking of declines in the total number of passengers transported by air in 29 respective European countries between 2019 and 2020.

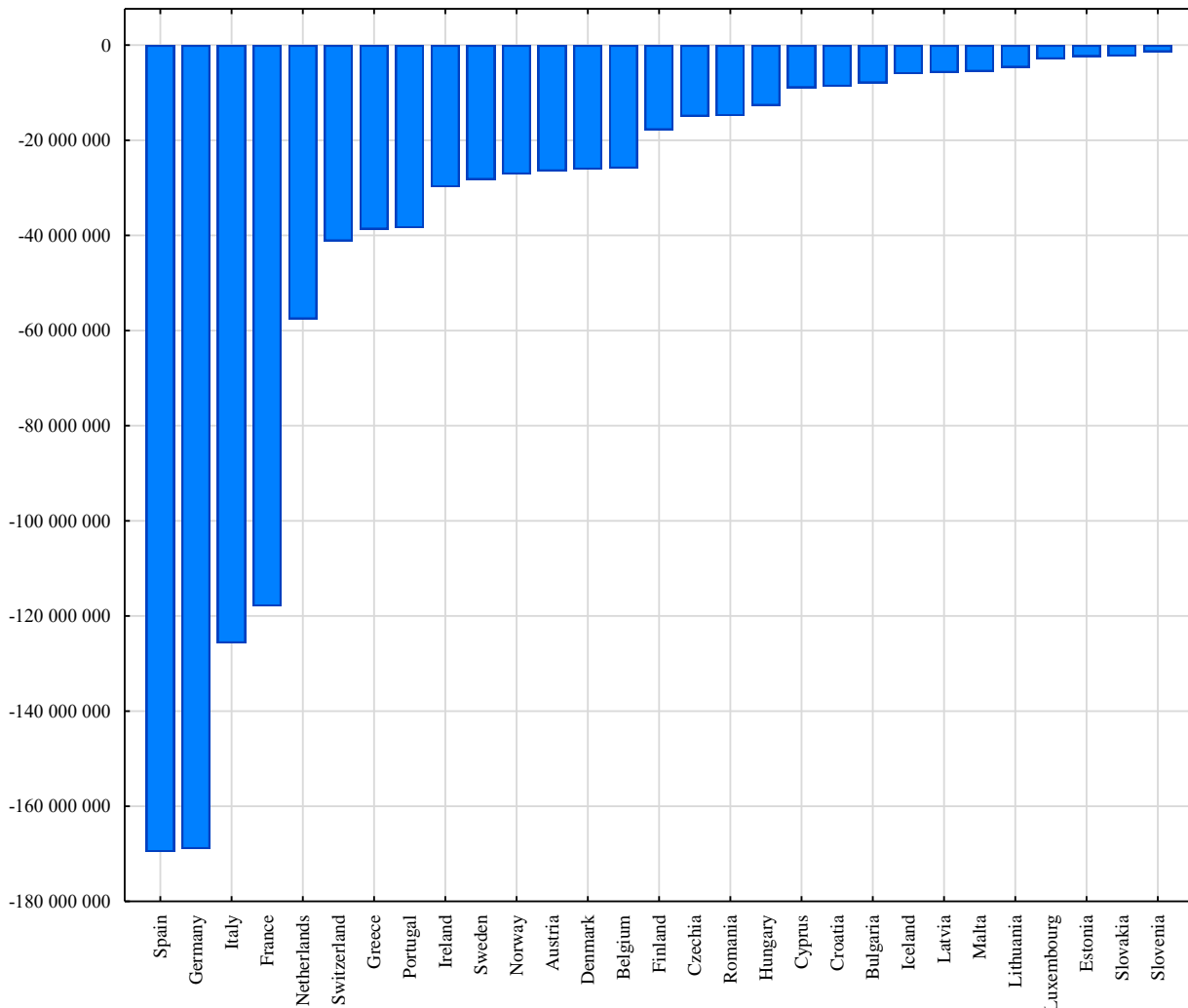


Figure 3: Rankings of declines in the total number of passengers transported by air transport in 29 European countries between 2019 and 2020

Source: own study based on data obtained from the website: <https://ec.europa.eu/> (20.07.2021)

The ranking of declines in the total number of passengers transported by air in 29 respective European countries between 2019 and 2020, from the largest to the smallest, is as follows:

1. Spain – 169 595 604;
2. Germany – 168 968 108;
3. Italy – 125 705 799;
4. France – 117 959 160;
5. Netherlands – 57 597 724;
6. Switzerland – 41 194 669;
7. Greece – 38 747 348;

8. Portugal – 38 458 901;
9. Ireland – 29 856 042;
10. Sweden – 28 283 669;
11. Norway – 27 131 554;
12. Austria – 26 475 757;
13. Denmark – 26 123 141;
14. Belgium – 25 919 360;
15. Finland – 17 859 307;
16. Czechia – 15 011 324;
17. Romania – 14 896 094;
18. Hungary – 12 738 063;
19. Cyprus – 8 990 833;
20. Croatia – 8 704 139;
21. Bulgaria – 7 984 051;
22. Iceland – 6 056 728;
23. Latvia – 5 790 593;
24. Malta – 5 565 912;
25. Lithuania – 4 700 185;
26. Luxembourg – 2 939 259;
27. Estonia – 2 400 200;
28. Slovakia – 2 339 183;
29. Slovenia – 1 431 252.

The total decline in the number of transported passengers in 2020 compared to 2019 is 1 039 423 959 people. The arithmetic mean of drops in the 29 analyzed European countries was 35 842 205. The median was 17 859 307 passengers. In each of the 29 European countries considered, there were drops in the number of passengers transported by air in 2020 compared to 2019.

The next stage of the research was the ranking of % concerning the declines in the number of passengers transported by air in 29 respective European countries between 2019 and 2020.

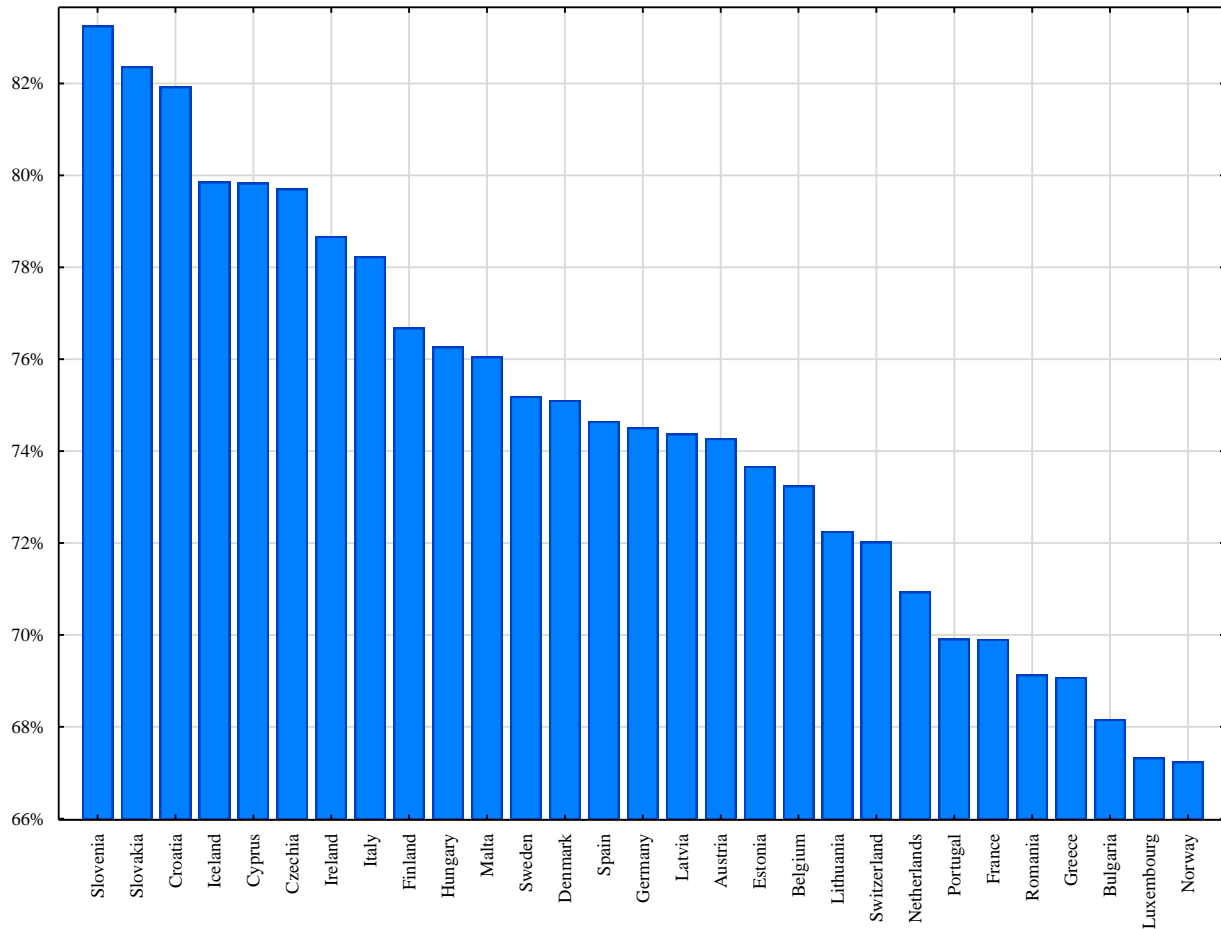


Figure 4: Ranking of % concerning the declines in the number of passengers transported by air in 29 respective European countries between 2019 and 2020

Source: own study based on data obtained from the website: <https://ec.europa.eu/>; (20.07.2021)

The ranking of % concerning the declines in the number of passengers transported by air in 29 respective European countries between 2019 and 2020 was as follows:

1. Slovenia 83,26%;
2. Slovakia 82,37%;
3. Croatia 81,93%;
4. Iceland 79,86%;
5. Cyprus 79,84%;
6. Czechia 79,71%;
7. Ireland 78,68%;
8. Italy 78,24%;
9. Finland 76,69%;
10. Hungary 76,27%;
11. Malta 76,05%;
12. Sweden 75,19%;
13. Denmark 75,11%;
14. Spain 74,65%;
15. Germany 74,51%;
16. Latvia 74,37%;
17. Austria 74,28%;
18. Estonia 73,67%;
19. Belgium 73,25%;
20. Lithuania 72,26%;
21. Switzerland 72,03%;
22. Netherlands 70,94%;

- 23. Portugal 69,92%;
- 24. France 69,91%;
- 25. Romania 69,14%;
- 26. Greece 69,08%;
- 27. Bulgaria 68,16%;
- 28. Luxembourg 67,33%;
- 29. Norway 67,24%.

The arithmetic mean in the 29 analyzed European countries of the declines in % of the number of passengers transported by air between 2019 and 2020 was 74,62% and it was close to the median of 74,51%. The standard deviation from the arithmetic mean was 4,59%.

Then, for illustrative purposes, the forecasting of the total number of passengers transported by air in 29 respective European countries for 2020 was conducted in order to investigate the drops related to the transport of passengers by air caused by the COVID-19 pandemic.

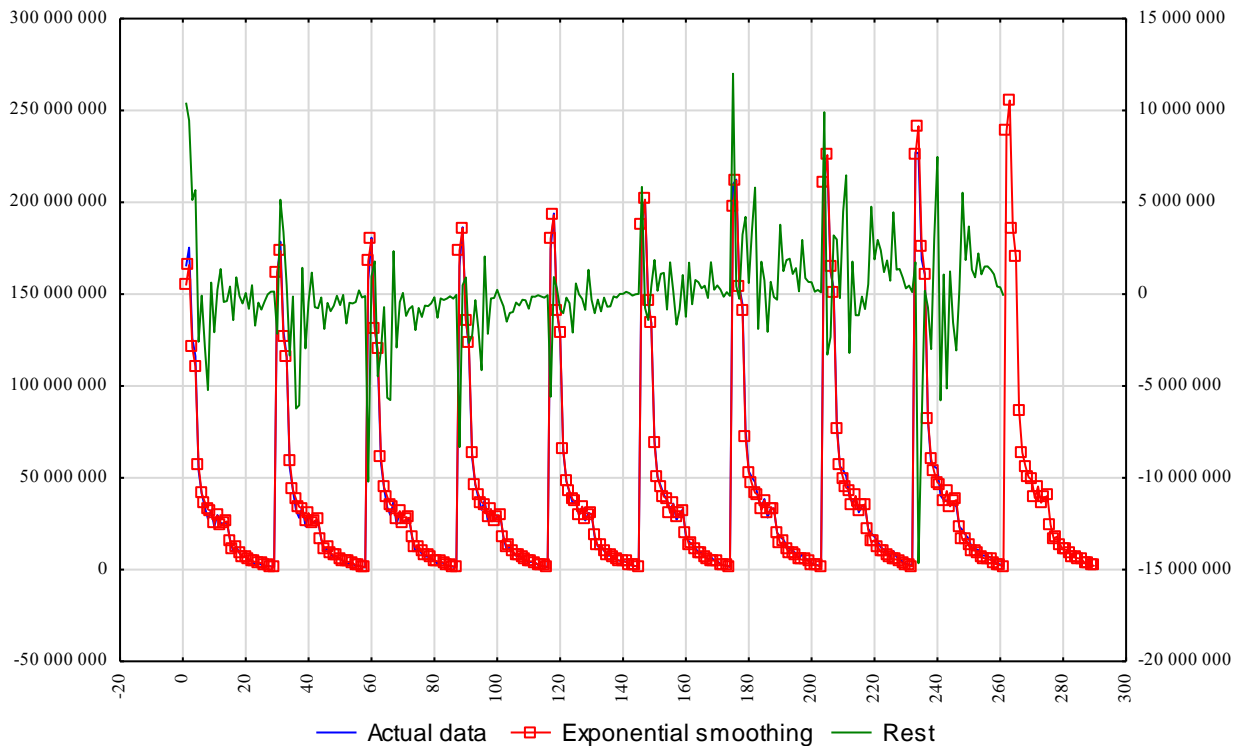


Figure 5: Forecasting of the sum of the number of passengers transported by air in 29 European countries for 2020 with the use of the Holt-Winters method multiplicative model

Source: own study based on data obtained from the website: <https://ec.europa.eu/>; (20.07.2021)

The forecast for 29 respective European countries of the number of transported passengers for 2020 with the use of the Holt – Winters exponential smoothing method in the multiplicative version is as follows:

- 1. Germany 255447309;
- 2. Spain 238589506;
- 3. France 185972410;
- 4. Italy 169921730;
- 5. Netherlands 86731024;
- 6. Switzerland 63720925;
- 7. Greece 56254978;
- 8. Sweden 45226590;
- 9. Norway 48769463;
- 10. Portugal 50318515;
- 11. Denmark 40064810;
- 12. Ireland 39019322;

13. Belgium 39087340;
14. Austria 36427685;
15. Finland 24403840;
16. Czechia 17933116;
17. Romania 16967060;
18. Hungary 13730638;
19. Cyprus 10879614;
20. Bulgaria 10929926;
21. Croatia 8828522;
22. Latvia 7033983;
23. Iceland 6364891;
24. Malta 6063636;
25. Lithuania 5401788;
26. Estonia 2946731;
27. Slovakia 2560433;
28. Luxembourg 3419500;
29. Slovenia 1866158.

The obtained forecasts maintain the upward trend from the past (2011-2019) and the seasonality every 29 periods. The mean percentage error of the obtained forecast was -0,27% while the mean absolute percentage error was 7,96%.

The next stage of the research is the ranking of % concerning the declines in the number of passengers transported by air in 29 respective European countries between the forecast for 2020 and 2019.

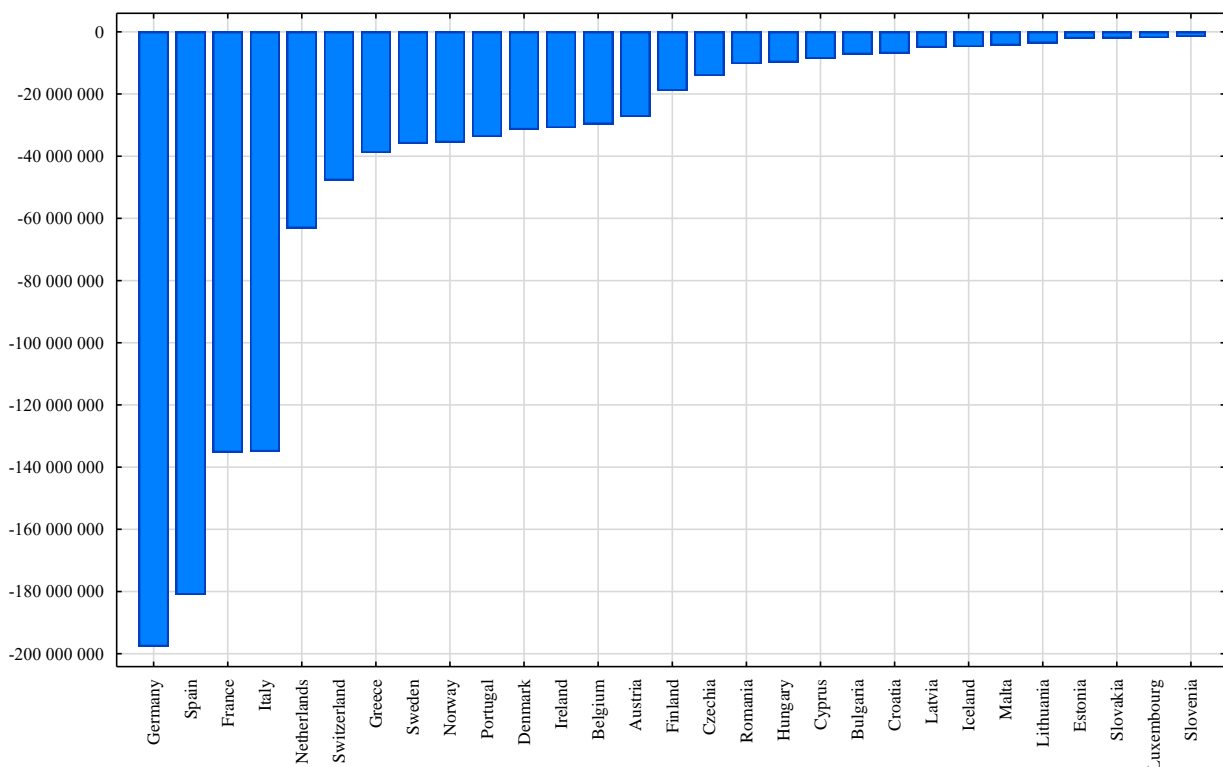


Figure 6: Ranking of % concerning the declines in the number of passengers transported by air in 29 European countries between the forecast for 2020 and 2019

Source: own study based on data obtained from the website: <https://ec.europa.eu/>; (20.07.2021)

The ranking of % concerning the declines in the number of passengers transported by air in 29 respective European countries between the Holt – Winters forecast for 2020 and 2019 from the highest to the lowest values is as follows:

1. Germany – 197651332;
2. Spain – 180996099;
3. France – 135201639;
4. Italy – 134959591;

5. Netherlands – 63136242;
6. Switzerland – 47721267;
7. Greece – 38913800;
8. Sweden – 35896001;
9. Norway – 35552581;
10. Portugal – 33769523;
11. Denmark – 31407825;
12. Ireland – 30927855;
13. Belgium – 29621513;
14. Austria – 27259255;
15. Finland – 18975219;
16. Czechia – 14111745;
17. Romania – 10316951;
18. Hungary – 9767952;
19. Cyprus – 8609038;
20. Bulgaria – 7200910;
21. Croatia – 6909423;
22. Latvia – 5038851;
23. Iceland – 4837423;
24. Malta – 4311192;
25. Lithuania – 3597289;
26. Estonia – 2088929;
27. Slovakia – 2059830;
28. Luxembourg – 1993191;
29. Slovenia – 1578372.

The sum of the declines in the number of passengers between the forecast made by the Holt – Winters method for 2020 and the actual data in 2020 amounted to 1 124 410 840 passengers. The arithmetic mean of the analyzed data is 38 772 788 while the median was lower and amounted to 18 975 219. The standard deviation from the arithmetic mean of the analyzed data was 53 714 517 passengers.

The further stage of the research was the grouping of the considered primary data for the years and their compilation in Figure 7.

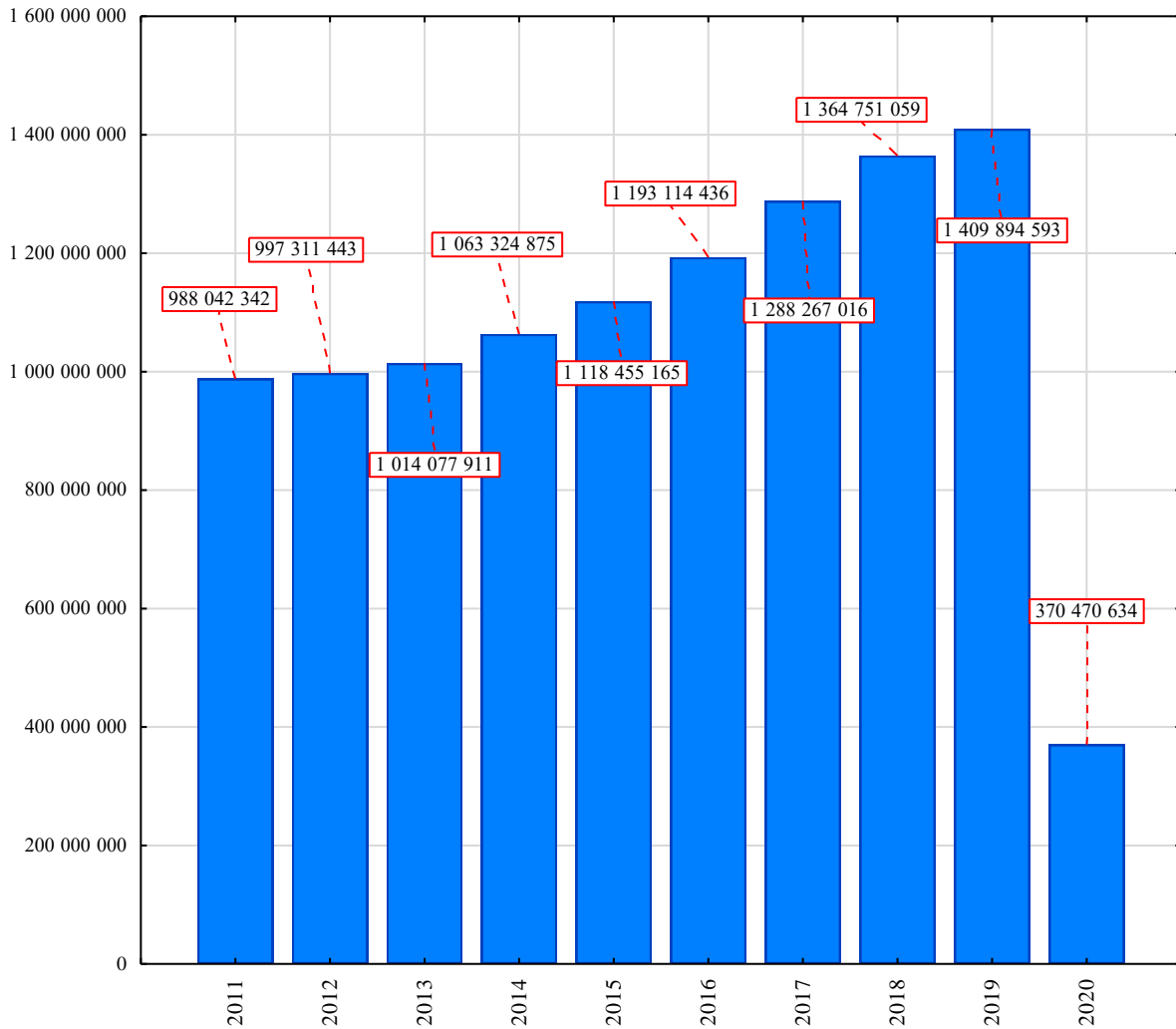


Figure 7. Comparative analysis of the sum of the number of passengers transported by air in 29 European countries between 2011-2019

Source: own study based on data obtained from the website: <https://ec.europa.eu/> (20.07.2021)

The observation of the data in Figure 7 allows for the conclusion that from 2011 (988 042 342) to 2019 (1 409 894 593) there was a growing tendency in the number of passengers transported by air in 29 European countries in total. On the other hand, in 2020 there were declines compared to 2019 by 1 039 423 959 passengers.

Then, for illustrative purposes, an analysis of dynamics indices with a fixed basis of the sum of the number of passengers transported by air in 29 European countries between 2011-2019 was conducted. The results are outlined in Figure 8.

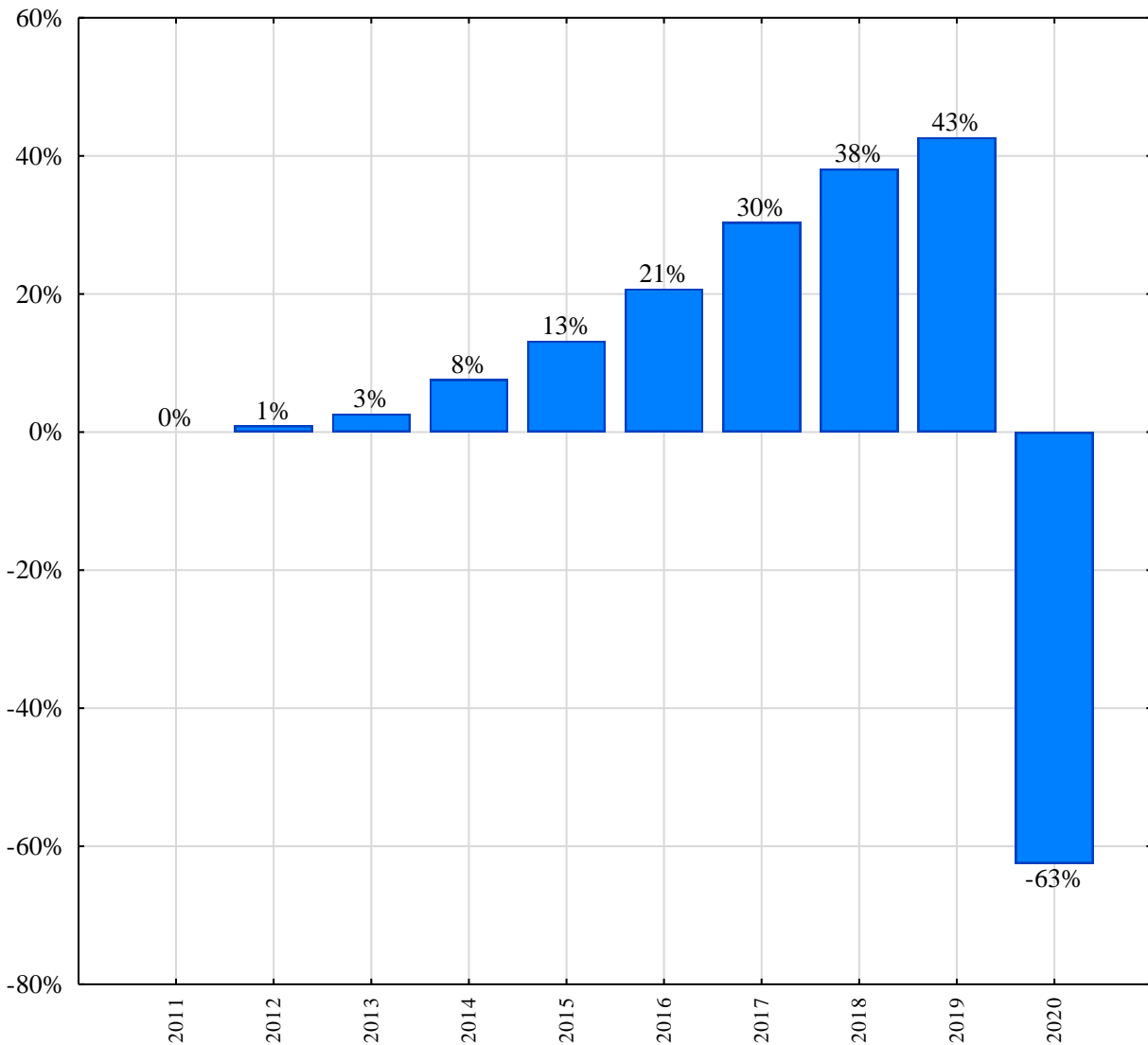


Figure 8: Bar chart of dynamics indices with a fixed basis of the sum of the number of passengers transported by air in 29 European countries between 2011-2019 (fixed - the number of passengers transported in total in 29 European countries in 2019)

Source: own study based on data obtained from the website: <https://ec.europa.eu/>; (20.07.2021)

From 2011 to 2019, the number of passengers transported by air in 29 analyzed European countries increased by 43%. On the other hand, declines in 2020 accounted for approximately 63% of the number of passengers transported by air in the 29 European countries under consideration in 2011.

The last stage of the research was the analysis of the chain dynamics indices of the number of passengers transported by air in 29 European countries (Fig. 9).

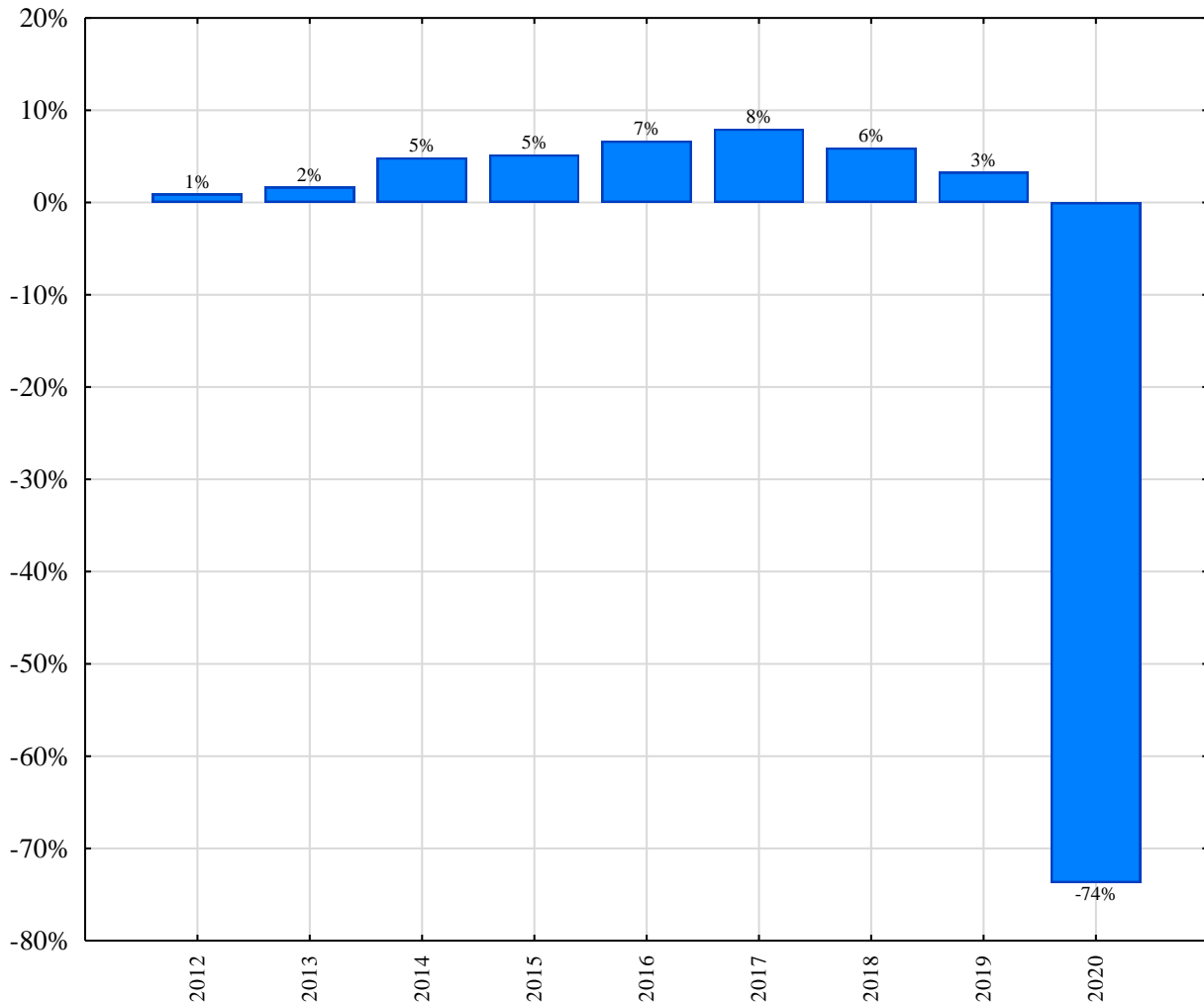


Figure 9: Bar chart of dynamics indices with a chain basis of the sum of the number of passengers transported by air in 29 European countries between 2011-2019

Source: own study based on data obtained from the website: <https://ec.europa.eu/> (20.07.2021)

From 2011 to 2019, increases were observed in each of the analyzed year. The largest ones were seen in the following years (from the largest to the smallest):

1. 2017: 8%;
2. 2016: 7%;
3. 2018: 6%;
4. 2014 i 2015: 5% each;
5. 2019: 3%;
6. 2013: 2%;
7. 2011: 1%.

On the other hand, in 2020, compared to 2019, a 74% decline in the number of passengers transported by air was observed in the 29 European countries under consideration.

Summary and conclusions

From 2011 to 2019, a growing trend in the number of passengers transported by air is visible in the 29 European countries concerned. From 2011 to 2018, Germany was the leader among the 29 analyzed European countries in terms of the number of passengers transported amounting to the level of 1 777 335 694 people in the analyzed period. In 2019, Spain became the leader with the result of 227 189 012 transported passengers.

In 2020, due to the impact of the COVID-19 pandemic, the total number of passengers transported by air decreased to the level of 370 470 634, i.e. by 1 039 423 959 people less. The arithmetic mean of the sum of the number of transported passengers in 29 European countries amounted to 48 617 055 passengers while in 2019 it reached the level of 12 774 849 passengers.

Declines were recorded in all 29 European countries considered and four countries were the leaders in terms of the highest decline: Spain - 169 595 604; Germany - 168 968 108; Italy - 125 705 799 and France - 117 959 160.

The ranking of % concerning the declines in the number of passengers transported by air in 29 respective European countries between 2019 and 2020 ranged from 67,24% to 83,26%. Slovenia was the leader with 83,26%. Norway was the lowest one in the ranking with 67,24%.

When analyzing the forecast for 2020, of the number of passengers transported by air in 29 analyzed European countries with the use of the Holt-Winters method, the following countries are the leaders of declines in 2020 caused by the COVID-19 pandemic: Germany – 197 651 332; Spain – 180 996 099; France – 135 201 639 and Italy – 134 959 591. The sum of the declines in the number of passengers between the forecast made by the Holt – Winters method for 2020 and the actual data in 2020 amounted to 1 124 410 840 passengers.

From 2011 to 2019, the number of passengers transported by air in 29 analyzed European countries increased by 43%. On the other hand, decreases in 2020 accounted for approximately 63% of the number of passengers in the 29 European countries under consideration compared to 2011. In 2020, in comparison to 2019, a 74% decrease in the number of passengers transported by air was observed.

The passenger air transport sector was the first to suffer most from the COVID-19 pandemic. The reduced demand for transport services has consequently led to long-term low oil prices. This in turn has had and continues to negatively affect other economic sectors. One of the first sectors of the economy, after aviation, affected by the COVID-19 pandemic, was tourism. The closure of borders, the prohibition of travelling and other restrictions meant that industries such as hotels, camping, restaurateurs began to suffer long-term losses. Similarly, a decrease in income on the housing rental market in large agglomerations in the European Union countries, including Poland, was caused by the pandemic by suspending classes, mainly at universities, or conducting them distantly. The slowdown in the rental sector was also influenced by foreigners who were employees of companies and organizations, and when the pandemic began, they returned to their countries and ceased to provide financial support to this sector. Countries like Russia, where 67% of its budget income is derived from oil sales, have certainly been hit hard by the COVID-19 infectious disease in 2020. Recovering from the coronavirus crisis requires long-standing international agreements and other regulations that will lead to a situation where both aviation personnel and passengers feel safe and their travel needs will therefore show a growing trend.

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