Analysis project

Passengers' satisfaction with airline service

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1. Project outline and purpose

Nowadays we are experiencing a huge interest in travel. Travelers have become everyone and in every direction. This is due, among other things, to the fact that exploring the world nowadays is much easier than ever. In addition to the availability of many airlines and a variety of connections, the existence of low-cost airlines is a major contributor to the growing interest of the whole society in traveling. Low-cost airlines in their conception are supposed to allow much cheaper, simpler and easier migration of the population. Therefore, due to the popularity of this topic these days, but also my personal interest in flying and travel, also being a customer of many popular airlines, I decided in the study to obtain data on one of the more popular carriers and analyze it in terms of customer satisfaction from different regions of the world over the research years in order to obtain qualitative feedback on customer opinions, their recommendations, and the impact of various factors on satisfaction with the use of a particular airline.

2. Data used for project

Data for the project was obtained from the platform www.kaggle.com and are available at the link: ✈ Ryanair Passenger Experience Reviews (kaggle.com). The analyzed dataset contains a variety of opinions and evaluations provided directly by the airline's passengers themselves, covering various aspects of the company's flights from 2012 to 2024. The data contains a lot of relevant information to make analyses, and importantly it was collected continuously over the last dozen years which can also be used to observe certain trends in the airline market, as well as show whether the company's actions over the years have made customer satisfaction increase.

3. Software used for analysis

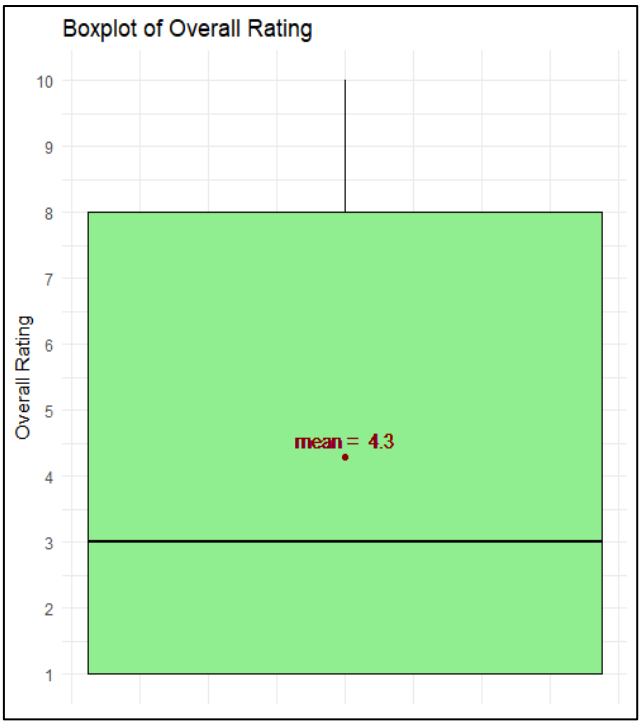
The analysis used the R programming language with its libraries for data analysis. All the code was written in RStudio to make the project easier to run and to process information more conveniently.

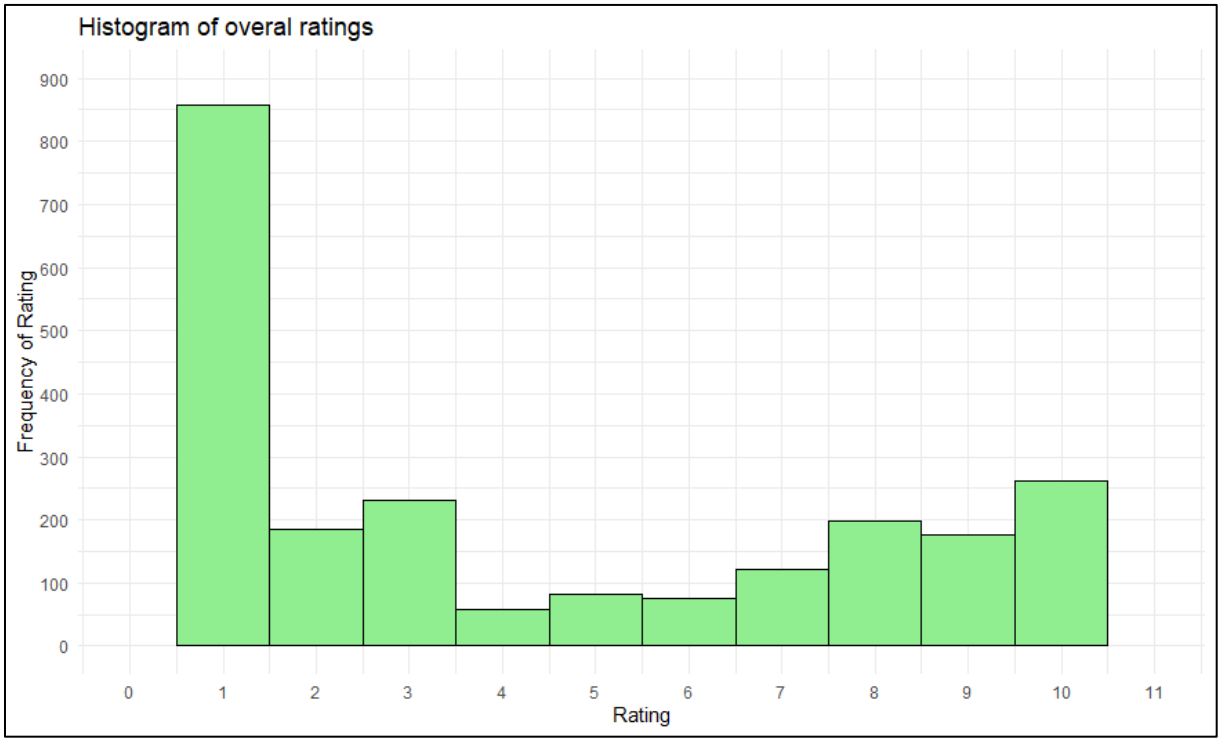
4. Reasearch issues

The first part of the project focuses mainly on organizing and cleaning the data. Due to the fact that the data came from surveys, the key to further analysis turned out to be processing the data into a form that would allow us to perform the analytical part.

4.1. Overall rating of the flight

At first, after reviewing the data, the first thing that will tell us something about the collection is the overall rating of the flight. To analyze its value, descriptive statistics for the overall rating will be illustrated for all responses in the boxplot. The scale of our ratings is ranked from 1 to 10, hence the characteristic will be equal values for the median, as well as the quartiles of our dataset. In addition, to illustrate the frequency of specific ratings and assess the distribution of the variable, the data will be shown on a histogram. The boxplots and histogram for the overall flight rating are shown below:

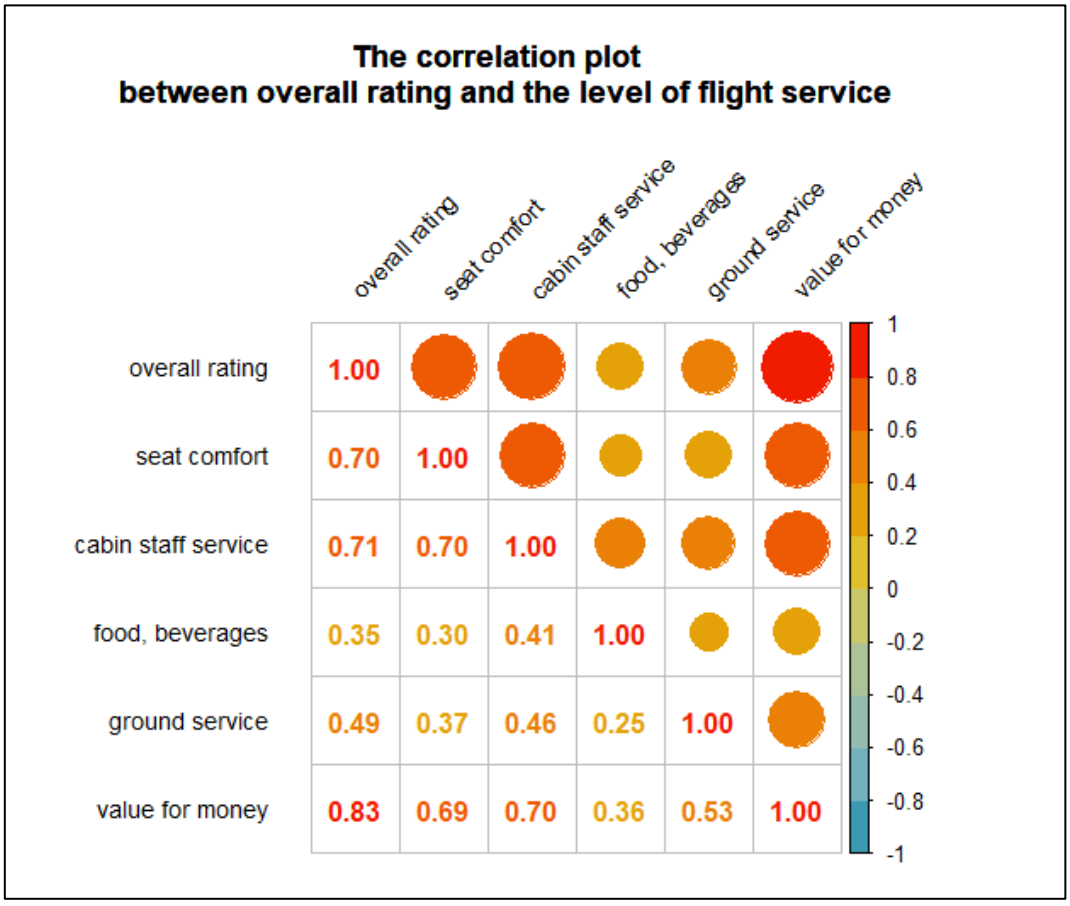




As you can see in the first graph, our range of ratings extends over the entire dataset, i.e. from 1 to 10. The median, or middle value, is only 3 and is below the mean value which is 4.3. This indicates the presence of right-sided asymmetry in our dataset. This asymmetry is also very visible in the histogram below, the ratings are dominated by the rating with a value of 1. It is also well seen that the distribution is not close to a normal distribution, the values do not accumulate around the mean, and in fact there is a small percentage of ratings around it. It is also worth noting that there is a relatively large number of ratings with values between 8 and 10 on the scale of the collection, which acts to raise the value of the average relative to the median.

4.2. The impact of individual flight attendant factors on its overall rating

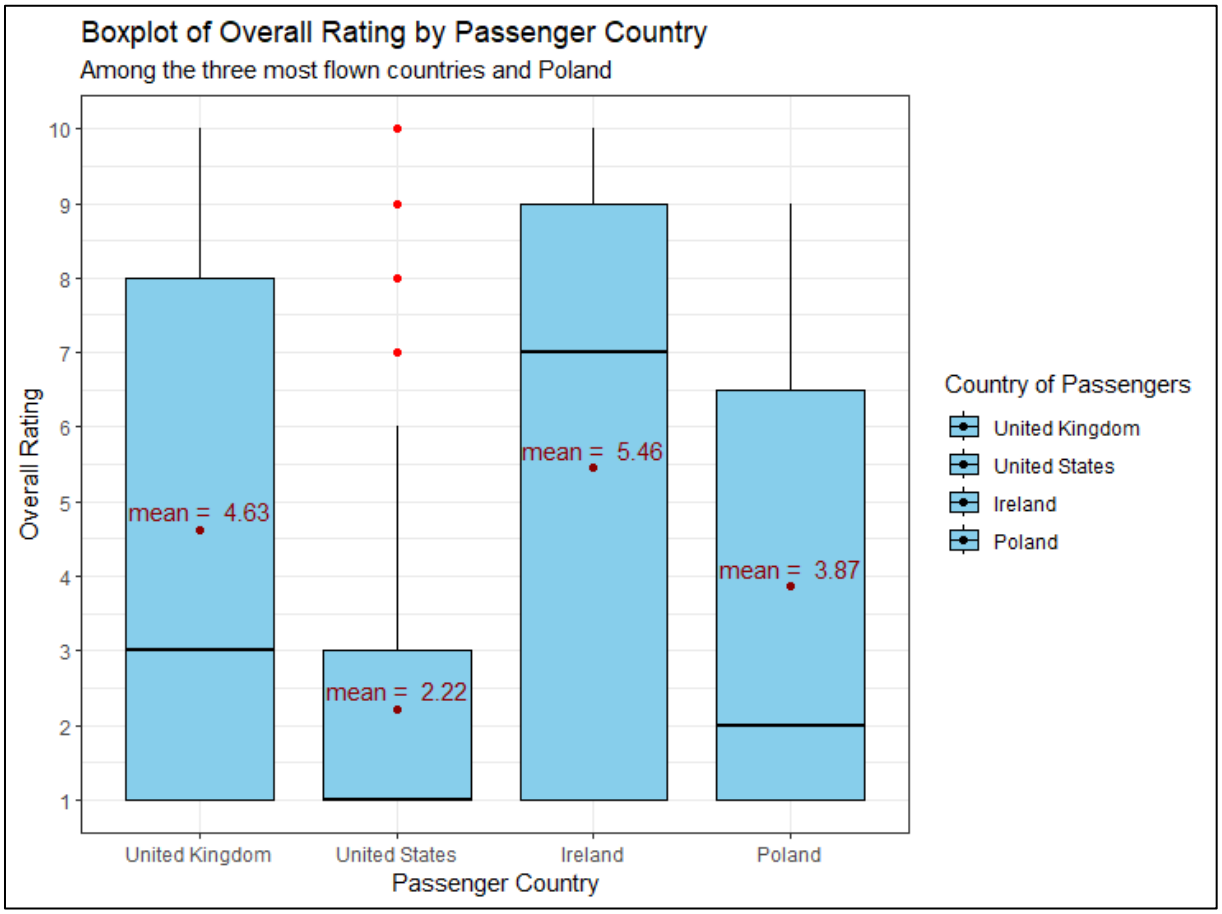
The question I asked myself during the detailed analysis was how the individual service factors to which the results are available, i.e. seat comfort, on-board service, meal quality, ground service and value for money, affect the overall rating given by the passenger. For this purpose, the analytically determined Spearman correlation matrix was used. The Spearman correlation matrix is a statistical tool that is used to analyze the relationship between variables. It allows us to examine how variables are related to each other, but unlike Pearson's correlation, Spearman does not require the assumption of a linear relationship. Spearman's correlation coefficient ranges from -1 to 1. A value close to -1 or 1 indicates a strong relationship, and a value close to 0 indicates little or no relationship. Below is a graph showing the correlations between the mentioned variables.



From the above correlation chart, important conclusions can be drawn about the factors that affect the overall rating of a flight. As you can see, the biggest influence on the overall rating is the price/quality ratio, the correlation is very strong at 0.83, the next two features that strongly affect the rating are seat comfort and cabin staff service, which tells us that passengers pay significant attention to seat comfort and cabin crew behavior during the flight, features that affect to a much lesser extent are ground service (although still close to 0.5) and food and beverages - passengers of low-cost airlines tend not to pay attention to this issue. Thus, we see that in general people most often choose low-cost airlines because they are "cheap" i.e. they are relatively more cost-effective than others, while the overall rating of the flight is also very significantly influenced by the comfort of the trip i.e. both the service on board and the comfortable seat.

4.3. Comparison of ratings among the three most traveled countries and Poland

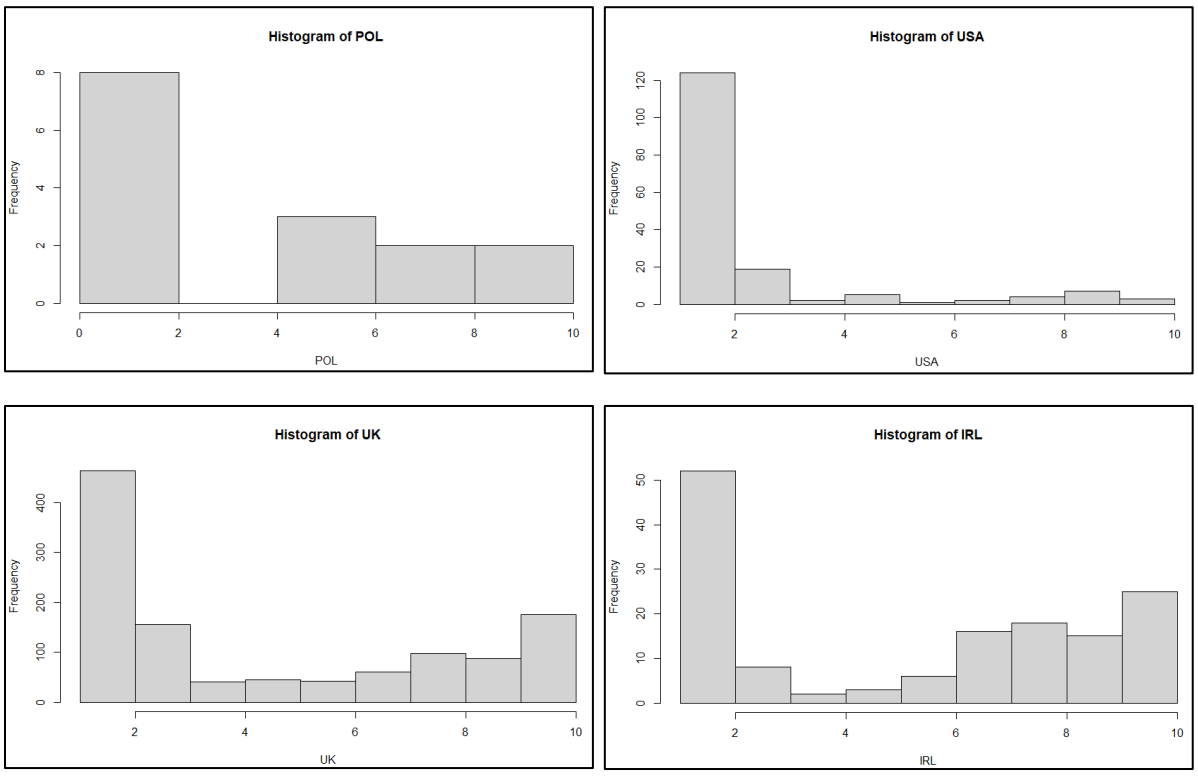
In the next step, I took for analysis what the distribution of overall passenger ratings looks like in the three most frequent flyer countries and, for comparison, in my country, Poland. For this purpose, I used a boxplot chart from the ggplot2 package in R, which will conveniently show us the distribution of ratings for each of the analyzed groups collected in a single window, which will allow a pictorial as well as analytical evaluation of events. On the chart, in addition to the basic elements of the boxplot, the average value in each group was added to better illustrate the situation. Below is a chart showing the distribution of ratings for each passenger country:



From the chart you can see a wide variation from country to country, the most dissatisfied passengers are those from the US, the average value of the rating is only 2.22 on a 10-degree scale and the median or middle value is 1, which means that as many as half of those taking part marked the value 1. The most satisfied passengers were the Irish, where the average was 5.46 and the median as high as 7, an interesting fact is that among this group is the only one where the median exceeded the average value. For the UK, the median is not very high at 3, the average value hits 5, which is a relatively good result among the group. Poles are relatively unhappy, which is also very noticeable, the average value for Poland exceeds the median the most (almost twice). All countries have the first quartile coinciding with the minimum value and it is 1, while the 3rd quartile is already divergent, definitely the highest for Ireland, quite high also for the UK, slightly lower in Poland, while in the US it is only 3. In the US there are also visible outliers marked in red on the graph, which may mean that the average value has been relatively inflated through them anyway.

4.4. Examine whether the differences detected are statistically significant

Based on the analysis in Section 4.2, two pairs of data with relatively closest characteristics were selected, i.e. Ireland and the UK, and Poland and the US. For such pairs, we want to test whether the differences in flight ratings are significantly different, the samples tested are independent, a value of 5% was used as the significance level. In order to decide on the choice of test, four simple histograms were made to verify whether the distribution is close to a normal distribution. The graphs are shown below.



Due to the fact that the distribution is not close to normal and we are testing two independent samples, a non-parametric Mann Whitney U test is appropriate in R language the test is called Wilcoxon test for independent samples.

– The first to come under the microscope is the pair Poland and USA

H0: Satisfaction in both groups is at similar levels

H1: Satisfaction in Poland is higher than in the U.S. with airline company services

We use a one-sided test as suggested by the higher average in POL. The result of the test conducted is attached below as a report:

```
Wilcoxon rank sum test with continuity correction

data:  POL and USA
W = 1642.5, p-value = 0.009659
alternative hypothesis: true location shift is greater than 0
```

p-value = 0.009659, we reject the null hypothesis in favor of the alternative hypothesis, which in practice means that the Poland group was more satisfied with the airline company's services than the US respondents.

– Then we move on to the pair UK and Ireland

H0: Satisfaction in both groups is at similar levels

H1: Satisfaction in Ireland is higher than in UK with airline company services

We use a one-sided test as suggested by the higher average in POL. The result of the test conducted is attached below as a report:

```
Wilcoxon rank sum test with continuity correction

data:  IRL and UK
W = 94070, p-value = 0.01252
alternative hypothesis: true location shift is greater than 0
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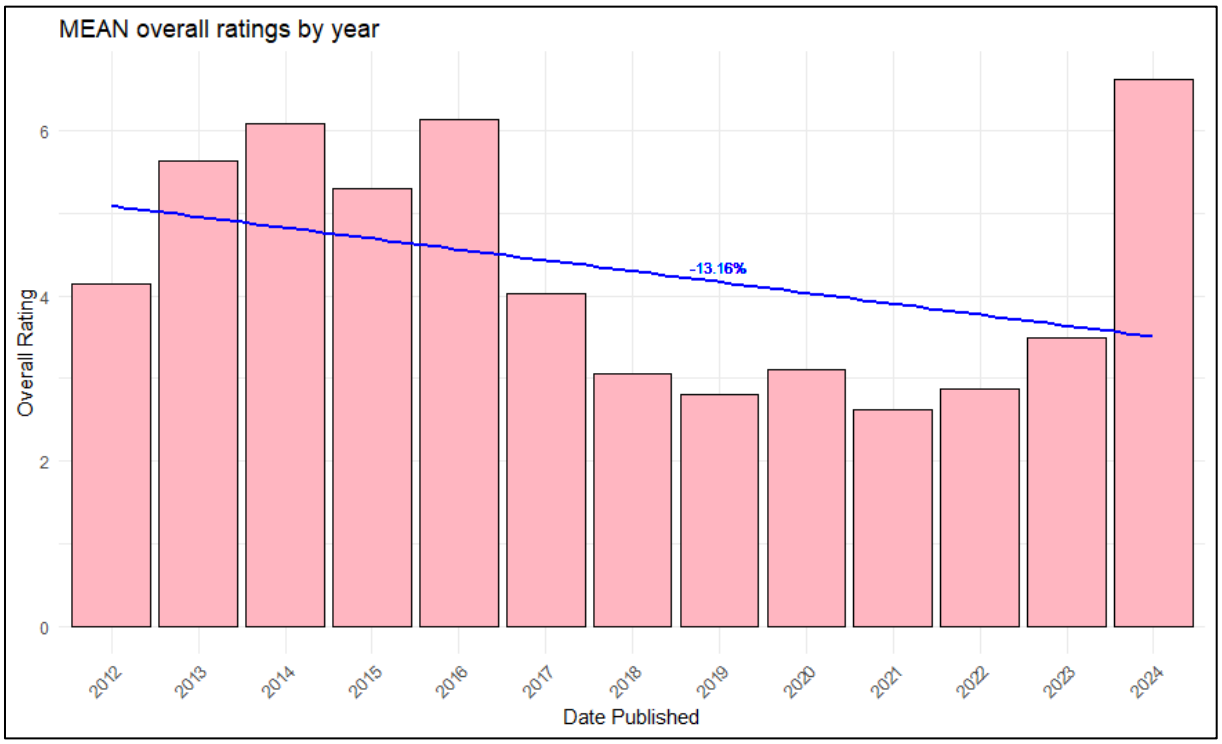
p-value = 0.01252, we reject the null hypothesis in favor of the alternative hypothesis, which in practice means that the Ireland group was more satisfied with the airline company's services than the UK respondents.

Statistical tests conducted for both pairs showed us that the apparent differences in each nation's satisfaction with the airline company's services in the boxplot were confirmed.

4.5. Check ratings over consecutive survey years with estimated trend for the entire survey period

In the next stage of the analysis are subjected to the average ratings in a given year in the space of all the years of conducting surveys. We want this way to show how the ratings changed in each year, and determine the estimated trend, which can assist in the prediction for the next years. To this purpose has been used column chart and regression line with the use of ggplot2 package in R. The resulting graph is shown below:

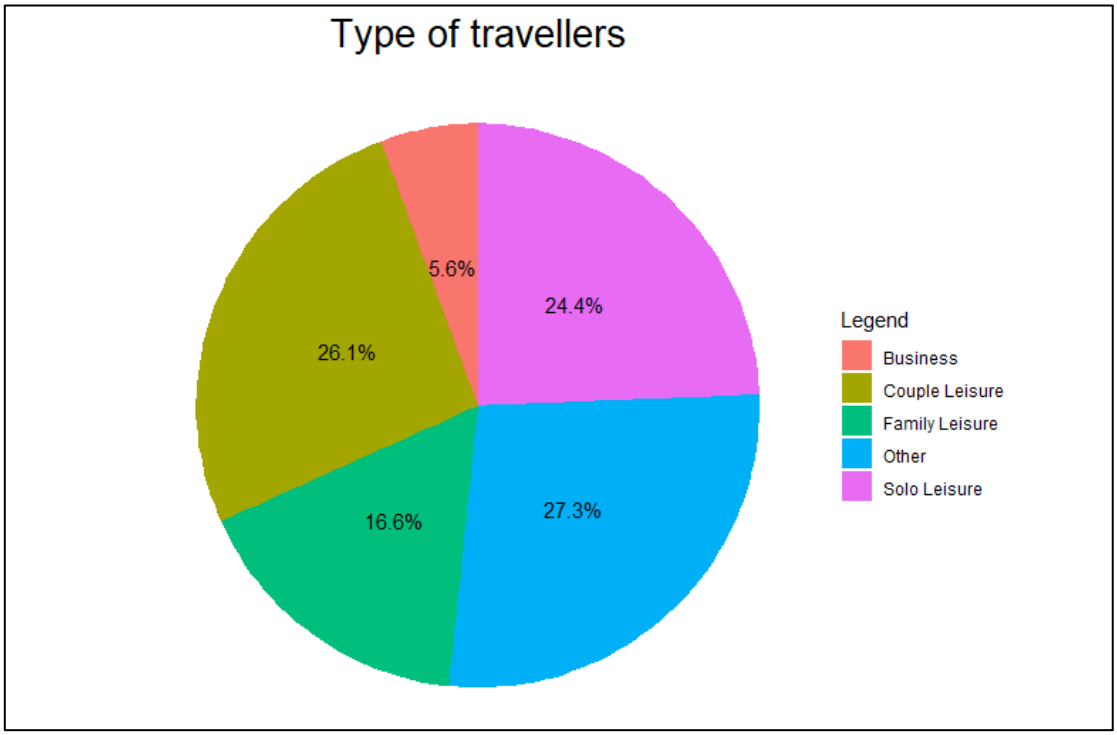


From the above graph we can see that in the first years of the study between 2012 and 2016 the average score gradually increases, with a slight decrease in 2015, then from 2017 to 2023 we have

a dip, a visible decrease of about 2 points downward continuing through 2017-2023 where the worst scores fall in 2019 and 2021 and are below 3 points, in 2024 we see a sudden increase in the average overall score which reaches the highest score of all the years studied and exceeds 6 points. Based on the collected data, a trend was determined using linear regression, the value of which was -13.16%, which could suggest declines in the following years, but looking at the break in the graph described above, and the sudden increase in the average score in 2024, it is hard to expect declines, but rather more likely an increase in the following years.

4.6. Determining what percentage of passengers are in each travel group

The next question to be resolved was how the structure of passengers is. Passengers in the survey were given the opportunity to indicate which group they belonged to, based on this, categories were created: Family Leisure, Couple Leisure, Solo Leisure, Business, and a category for other travelers Other. To illustrate the structure of passengers, a pie chart was used, which illustrates this type of data in a good way, in addition, the values were recalculated as a percentage of the entire surveyed group. The graphical result of developing this part of the analysis is presented below:

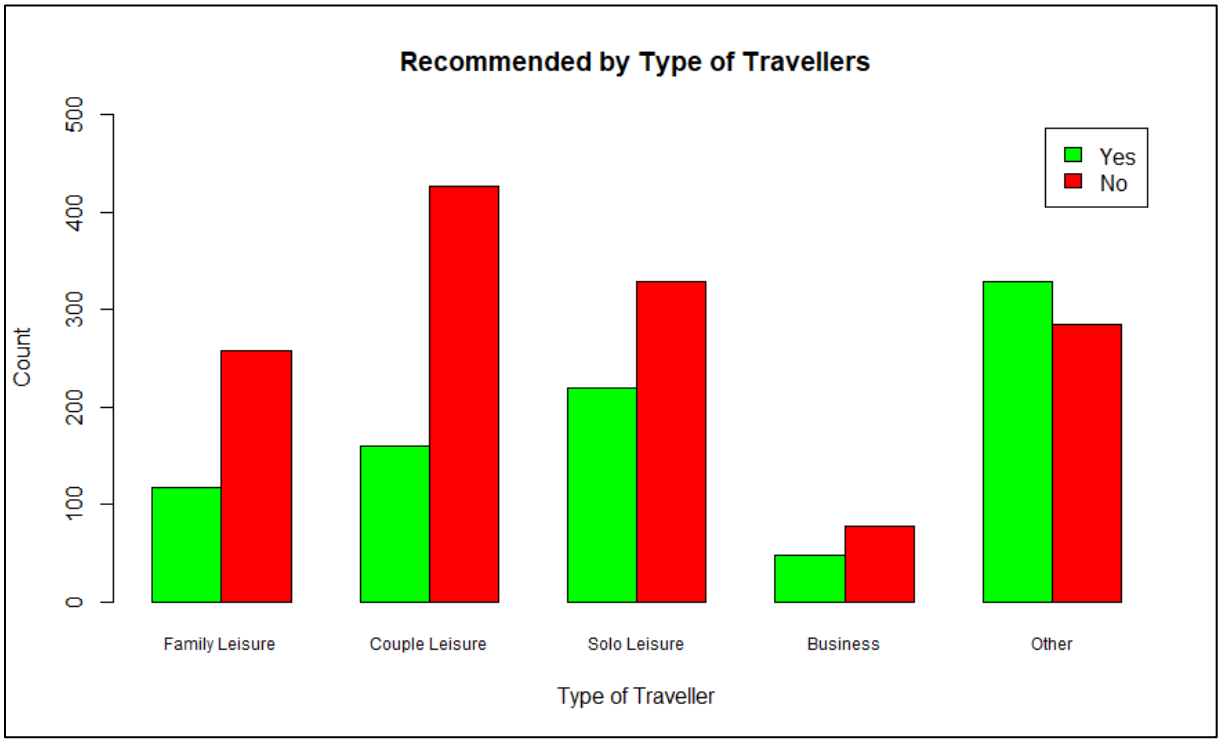


From the chart we can see that as many as 27.3% of the respondents are of the Other type - which may mean that many categories were fragmented, which contributed to the high result of the others, in addition, the largest group are couples more than 26% and singles 24.4% a slightly smaller value are traveling families, at 16.6%, while the smallest group is business customers, accounting for only 5.6% of the respondents. From this, it can be concluded that low-cost airlines appeal best to groups who primarily want to save money, while people usually with larger budgets like business customers make up the smallest share of travelers with this type of travel.

4.7. Recommendations by type of traveler

Having in the midst of the data information about the structure of passengers, and information about whether they recommend the use of airlines in this step, I decided to see how the different groups

related to the question of recommending airlines. A column chart showing passenger recommendation by structure was used for this purpose:



From the chart we can see that in general in each group airlines were not recommended, the difference is quite clear in each group while in family leisure and couple leisure practically 2 times as many people gave a negative answer, it may be surprising that in the categorized part as other the result of the survey is positive.

4.7. Summary

The analysis conducted was to answer our questions related to the evaluation of low-cost airlines, which are one of the most important means of transportation today. As can be seen from the analysis carried out, relatively speaking, the average rating is below 5 on a 10-degree scale, the median also does not exceed 5, and most ratings are of a value of 1. This may mean that customers show interest below the average on the established research scale, so it can be concluded that satisfaction is not satisfactory. From the analysis of the influence of individual factors, it was deduced which elements of service should be focused on in order to best influence the increase of the overall rating. Then the ratings in Poland and the countries most frequently using the line were compared, detecting significant differences between them. A downward trend of nearly 13% is evident from the analysis of ratings over the years, although the sudden increase in the last year of the survey is surprising. The next step examined the structure of passengers, separating the groups under the category of passenger type, and the final step examined the distribution of recommendations in each group. This is another result that indicates that airlines should improve the level of service because, in general, we have a preponderance of negative versus positive responses.