The Research of Influence Factors that Contribute to the Airplane Passengers Satisfaction

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Abstract. This paper examines the factors that most significantly influence airline passenger satisfaction using a Binary Probit Regression model. The study uses comprehensive data from over 120,000 international airline passengers, focusing on 10 key factors: age, flight distance, departure delay, arrival delay, ease of online booking, check-in service, online boarding, gate location, on-board service, and baggage handling. The research fills gaps in previous studies that were either too limited in scope or overlooked certain potential factors influencing passenger satisfaction. Findings reveal a significant relationship between passenger satisfaction and flight distance, arrival delay, online booking and boarding, check-in and onboard service, and baggage handling. No correlation is found with age, departure delay, and gate location. The paper emphasizes the importance of digital transition, front-line services, and operational reliability. It achieves an overall prediction accuracy of 85.39%, reflecting a robust model. Despite this, it suggests continual refinement of the model with a more comprehensive dataset for deeper insights into passenger satisfaction dynamics. The outcomes offer airlines valuable knowledge to enhance service quality and establish long-lasting relationships with passengers.

Keywords: Airline passenger satisfaction; influence factors; binary logit regression model.

1. Introduction

Air travelling, a momentous part of global transportation, has experienced unprecedented growth in the last few decades. Nowadays the key to company success in this fiercely competitive airline market is to develop long-lasting passenger connections. With a rising number of passengers choosing to fly for both business and leisure, airlines and aviation stakeholders are keenly interested in understanding and improving flight passenger satisfaction. This paper aims to study different potential factors that possibly impact flight passenger satisfaction and help airline companies attract more passengers.

There are many factors that influence flight passenger satisfaction. The results of Park et al. study showed that the standard of several service characteristics, including cleanliness, on-board entertainment, and food and drink quality, influences the satisfaction level positively while other aspects, such as customer support, check-in, and boarding, have an impact on satisfaction level negatively [1]. Sezgen et al. report found that baggage/flight problems, employee behavior, and seat space and comfort are the main reasons why passengers are unsatisfied across all demographic categories [2]. However, based on previous studies, some factors are too detailed while some possible factors have been overlooked by these researchers. Therefore, this paper focuses on these 10 factors to study which one has the greatest impact on airline passenger satisfaction, and further select an appropriate model to study the degree of correlation between these factors and airline passenger satisfaction.

In similar directions, Salah and Abou-Shouk's study, Boubker and Naoui's study, Hussain et al. study, and Suki's study all used structural equation modeling to find the relationship between some factors and airline passenger satisfaction [3-6]. However, their studies are all too limited. Salah and Abou-Shouk only studied about EgyptAir passengers [3]. Boubker and Naoui only focused on Royal Air Maroc [4]. Hussain et al. only investigated UAE-based airlines [5]. And Suki only included Malaysia Airlines [6]. Similarly, Tsafarakis, et al. used MUSA in their study to compare the factors that affects satisfaction level of Aegean Airlines [7] and Leon and Martín used Amazon Mechanical

Turk to collect online data from American passengers [8]. But their studied population is also very narrow. Moreover, Gao et al. used leveraging machine-learning (ML) to approach their result [9]. However, their method didn't show a clear degree of correlation between those factors and airline passenger satisfaction. Korfiatis et al. introduced a new way—Structural Topic Models (STM)—to use internet reviews to illustrate how unstructured data from topic modeling can be utilized to find traits that can be considered and offer a flexible addition to numerical ratings in order to gauge customer satisfaction level [10]. However, some people may choose not to answer questions online frequently and their data may have some bias when passengers are answering online.

In summary, after consideration and optimization, this paper will use the Binary Logit Regression model to study the effect of these 10 factors on airline passenger satisfaction, i.e., which one might be the most influential factor to airline passenger satisfaction.

2. Methods

2.1. Data Source

The data for this literature is collected from the Kaggle website, which was compiled by Mysar Ahmad Bhat from airline passenger satisfaction scores and published and updated in 2022 for more than 120,000 airline passengers.

2.2. Variable Introduction

The data used in this paper count a total of 3,000 international airline passengers from over 120,000 samples (Table 1). The data contains 10 variables listed in Table 1.

Table 1. Logogram and Numbers of the 10 Factors

Element	Logogram	Mean	Standard Deviation
Age	x_1	41.159	14.806
Flight Distance	x_2	1103.901	1144.827
Departure Delay	x_3	12.494	34.015
Arrival Delay	x_4	14.390	36.055
Ease of Online Booking	x_5	2.677	1.455
Check-in Service	x_6	3.443	1.205
Online Boarding	x_7	3.385	1.339
Gate Location	x_8	2.938	1.284
On-board Service	x_9	3.462	1.279
Baggage Handling	x_{10}	3.726	1.171

2.3. Method Introduction

This paper uses the Binary Logit Regression model, whether or not airline passenger satisfaction is the dependent variable(Y), and the 10 factors are the independent variables(X), where 0 represents neutral or dissatisfied and 1 represents satisfied. Next, this paper uses SPSS to analyze the relationship between the effect of X on Y, i.e., the relationship between the 10 factors on airline passenger satisfaction.

3. Results and Discussion

3.1. Descriptive Analysis

As shown in Figure 1, the research included a number of variables that might be linked to airline passenger satisfaction into the model.

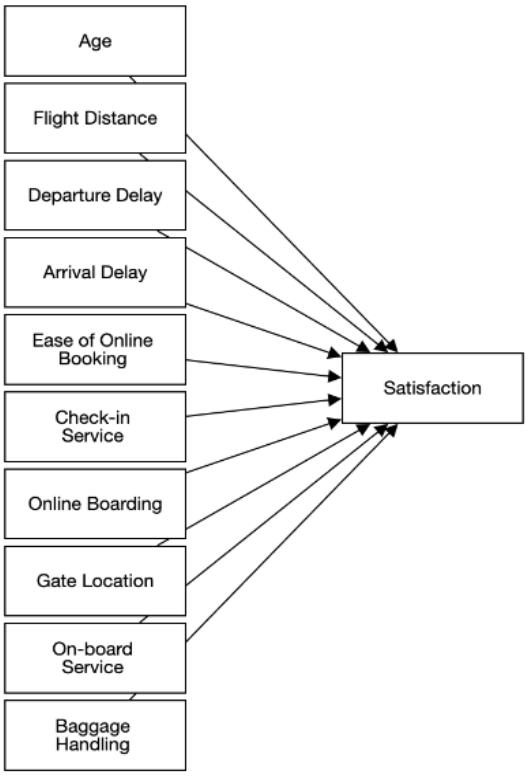


Fig. 1 Variable-related schematic

The final linear regression equation for this investigation is obtained through calculations as follows:

$$\ln\left(\frac{p}{1-p}\right) = -9.229 + 0.002x_1 + 0.001x_2 + \cdots + 0.362x_{10} \quad (1)$$

Where p represents the probability of airline passenger satisfaction being 1.

3.2. Correlation Analysis

Table 2 uses Pearson's correlation coefficient to show the strength of the correlation. The results show that except for gate location which has a correlation coefficient of 0.012 and p-value of 0.500, indicating that there is no correlation between gate location and satisfaction; age, flight distance, departure delay, arrival delay, ease of online booking, check-in service, online boarding, on-board service, and baggage handling has correlation coefficient 0.173, 0.345, -0.078, -0.085, 0.099, 0.321, 0.551, 0.408, and 0.323 respectively which are all significant at 0.01 level, thus indicating that there is a significant positive relationship between airline passenger satisfaction and these nine factors.

Table 2. Pearson Correlation Analysis

elements	correlation coefficient	p-value	sampling number
x_1	0.173**	0.000	3000
x_2	0.345**	0.000	3000
x_3	-0.078**	0.000	3000
x_4	-0.085**	0.000	3000
x_5	0.099**	0.000	3000
x_6	0.321**	0.000	3000
x_7	0.551**	0.000	3000
x_8	0.012	0.500	3000
x_9	0.408**	0.000	3000
x_{10}	0.323**	0.000	3000

Note: *<0.05 **<0.01

3.3. Regression Model Results

Based on Table 3, the model concludes by judging whether the p-value is greater than 0.05, this study can further infer what factors may be associated with airline passenger satisfaction. On the one hand, the p values for age and departure delay are all more than 0.05, indicating they have no effect on airline passenger satisfaction. In contrast, the p values of arrival delay are smaller than 0.05 but larger than 0.01, indicating that these factors have a relatively strong affection on airline passenger satisfaction and the p values of flight distance, ease of online booking and boarding, check-in and on-board service, gate location and baggage handling are all less than 0.01, indicating that these factors have a particularly strong relationship with airline passenger satisfaction. In addition, the change (increasing) in airline passenger satisfaction will be 101.1%, 98.7%, 75%, 137.3%, 326.2%, 125.6%, 169.1%, and 143.6% with one unit increase of flight distance, arrival delay, ease of online booking, check-in service, online boarding, gate location, on-board service, and baggage handling. When it comes to the influence relations, the regression coefficient value combined with the marginal effect value shows the specific influence factors. Moreover, the model prediction has an overall prediction accuracy of 85.39% and the model fitting is acceptable. In addition, the prediction accuracy is 82.48% and 87.72% when the true value is 1 and 0. Given that these statistics are all sizable by comparison, they have some study and reference value. There is no doubt that these characteristics have a considerable impact on the chance of developing airline passenger satisfaction.

Table 3. Model Results

elements	coefficient	standard error	z-score	p-value	95% CI	marginal effect
x_1	0.002	0.004	0.605	0.545	0.995 ~ 1.010	1.002
x_2	0.001	0.000	11.551	0.000	1.000 ~ 1.001	1.001
x_3	0.005	0.006	0.864	0.388	0.993 ~ 1.018	1.005
x_4	-0.013	0.006	-2.216	0.027	0.976 ~ 0.999	0.987
x_5	-0.288	0.046	-6.315	0.000	0.685 ~ 0.820	0.750
x_6	0.317	0.048	6.553	0.000	1.249 ~ 1.509	1.373
x_7	1.182	0.056	21.197	0.000	2.924 ~ 3.639	3.262
x_8	0.228	0.046	4.995	0.000	1.149 ~ 1.374	1.256
x_9	0.526	0.057	9.162	0.000	1.512 ~ 1.893	1.691
x_{10}	0.362	0.062	5.824	0.000	1.271 ~1.622	1.436
Constant	-9.229	-	-	-	-	-

*Dependent variable: Airline passenger satisfaction

4. Conclusion

In conclusion, this study painstakingly analyzes the impact of various factors on airline passenger satisfaction. Through the exhaustive use of the Binary Logit Regression model and an extensive dataset procured from Kaggle, this paper underscores that variables such as flight distance, arrival delay, online booking and boarding, check-in and on-board service, and baggage handling share a significantly potent relationship with passenger satisfaction, as evidenced by the high correlation coefficients.

In contrast, the analysis found that age and departure delay, despite being common considerations in previous studies, do not hold substantial significance in predicting airline passenger satisfaction, while the gate location has absolutely no correlation with satisfaction. This highlights that all factors impacting passenger experience do not possess equal weightage, leading us to prioritize certain aspects of service over others.

It's noteworthy that standards such as check-in service, on-board service, and online boarding showed a particularly strong correlation, emphasizing the need to prioritize digital transition and

front-line services. As another key observation from the study, arrival delay contributed substantially to passenger dissatisfaction indicating the need for timeliness and reliability in operations.

These findings hold considerable implications for airlines seeking to boost passenger satisfaction, and subsequently, market share. By adapting to these insights, airlines can enhance their service quality, cater better to passenger needs, and eventually foster long-lasting passenger relationships.

Finally, although this model boasts a 85.39% prediction accuracy, which demonstrates an acceptably fitted model, continual refinement of the model with the integration of more variables and a broader dataset could offer even deeper insights into the dynamics of airline passenger satisfaction. The ongoing commitment to understanding the evolving needs, preferences, and expectations of the flying public is integral to ensuring the sustainable success of airline carriers.

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