Airline Service Quality: A Variance Assessment Method Based on Complaint Statistics

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Abstract

Airline service quality is an important criterion for determining the service level of airlines. Reference was made in this segment based on two-factor theory. The optimal scale analysis method was used to identify the association characteristics between all domestic and international airline complaints and the time factor, followed by the construction of an airline service quality measurement (ASQM) model based on the Civil Aviation Passenger Service Evaluation (CAPSE) index. The ASQM model was used to measure the service quality of 26 full-service airlines and six low-cost service airlines in China. The study found that: the time distribution of airline complaints is uneven, but shows a relative concentration of annual, seasonal, quarterly and monthly, with the peak of complaints in August each year; there is a high correlation between all airline complaint type variables and time variables, but there are differences in the focus of complaints at different times: summer and autumn not only have a high volume of airline complaints, but also have complex complaint types. The quality of all services provided by China's full-service airlines is better than that of low-cost service airlines. In general, the quality of service of "in-flight service and ground service" was more stable, while the quality of service of "ticketing service" decreased significantly. The service quality of "flight service" is difficult to maintain. This paper proposes an objective analysis method to evaluate airline service quality by using airline complaint statistics, and provides solutions and suggestions for airlines to improve their overall service quality.

Keywords

Airlines, Complaint, Airline Service Quality, Evaluation

1. Introduction

Airline service quality refers to the extent to which airlines collaborate with re-

levant civil aviation enterprises to provide airline services that use value to meet the needs of passengers for safety, punctuality, convenience and comfort (Lu et al., 2017), and is the subjective impression of passengers on the efficiency and utility of the service provider's services. Airline service quality, as the main criterion for passengers to evaluate airline services, is one of the factors limiting the development of the civil aviation service industry. Improving and perfecting airline service quality not only promotes the high-quality development of China's civil aviation industry and improves airline passenger revenue (Ma, 2021), it can also enhance the world influence of China's airline services (Zhang, 2019). Objective evaluation of airline service quality is a prerequisite for improving airline service quality and expanding the customer market of airline companies.

Aviation service complaints refer to the act of requesting the Civil Aviation Administration and its authorized agencies to mediate and protect the legitimate rights and interests of consumers after they have received services from public air transport enterprises and other services in order to travel or transport goods (Xu, 2020). Aviation complaints are an important manifestation of poor airline service quality, an act generated by passengers based on dissatisfaction with airline service quality, and an important criterion reflecting service quality (Zhuo, 2015), and handling aviation complaints is an important aspect of airline service quality regulation. According to the Two Factor Theory, the factors influencing service quality are divided into 2 categories: satisfaction and dissatisfaction. In a complete airline service, a complaint item is selected to refer to the dissatisfaction factor, which means that if a complaint occurs, the consumer is dissatisfied with the service; a non-complaint item is selected to refer to the satisfaction factor, which means that if no complaint occurs, the consumer is satisfied with the service. Using airline complaint data from 2015 to 2019, this paper firstly identifies the association characteristics between airline complaints and time factors in China and abroad using optimal scale analysis, and then constructs an airline service quality measurement model based on CAPSE to measure the service quality of full-service airlines and low-cost service airlines in China. Airline complaints are used to study airline service quality, to explore effective methods for researchers and industry practitioners to decipher the objective and comprehensive evaluation of airline service quality (Chen, 2016), and to make active efforts to seek reasonable suggestions and practical countermeasures for improving airline service quality.

2. Literature Review

Currently, scholars commonly use models such as customer satisfaction, service quality gap and brand asset quality for airline service quality evaluation. Customer Satisfaction Degree (CSD) is a quantitative indicator used to measure the level of consumer satisfaction with a service. "Satisfaction" is the utility obtained by consumers (Sun et al., 2011), airline customer satisfaction includes three levels: product satisfaction, experience satisfaction, spiritual satisfaction. Respec-

tively, it measured the material carrier, service perception, emotional impact of the service (Yu & Li, 2012). Improving service quality is an effective means to improve passenger satisfaction, so most of the research on airline service quality in academia is related to customer satisfaction models. For example, Wang (2014) conducted a study on customer satisfaction of Shandong Airlines in China, which was constructed based on service quality theory. Badama (2015) analyzed the service quality level of Mongolian airlines based on the customer satisfaction index model of China's civil aviation industry, and concluded that the satisfaction level of ticketing service and the satisfaction level of ground service affect consumers' airline service experience, which in turn affects customers' loyalty to the airline. Sun (2018) argued that there is a correlation between different travel patterns of passengers and indicators such as airline service quality, customer satisfaction, actual customer value and customers' willingness to stay engaged.

The service quality gap evaluation model is mainly based on the difference between the expected and experienced service quality of customers to determine the service quality (Grönroos, 1984), which can be measured by the SERVQUAL (Service Quality) scale (Sun et al., 2011), specifically including five dimensions of reliability, responsiveness, empathy, tangibility and assurance (Li & Xiong, 2014). In the field of airline services, the use of the SERVQUAL scale has been expanded by adding the service process dimension (Cunningham, Young, & Lee, 2002), the elemental dimension (Chen, 2008), the remedial service dimension (Hao & Wu, 2009), and the perception and emotion dimension (Zhou et al., 2019; Du & Chen, 2017). With the update of digital technology, Büyüközkan, Havle, & Feyzioğlu (2020) proposed a 5-dimensional quality service model of digital tangibles, reliability, digital interaction, digital trust and customer-centric to measure the service quality of passengers towards the digital products and services provided by airlines; and the Intuitionistic Fuzzy Cognitive Map (IFCM) approach, based on Group Decision Making (GDM), develops a SERVQUAL model that takes into account the hesitancy, uncertainty and intuition of the consumer decision making process and the opinions of the decision maker (Büyüközkan, Havle, Feyzioğlu, & Göçer, 2020). Some scholars introduced multiple models into the SERVQUAL scale analysis, such as Chen (2016) and Chen & Chen (2010) who used the Fuzzy Analytical Hierarchical Process (FAHP) and Mixed Fuzzy Multiple Criteria Decision Making (MCDM) model to improve the airline service quality evaluation framework model. Gong (2014) combined the Kano two-dimensional quality model with the Decision Experiment Analysis Method (DEMATEL) in order to explore how to develop proper and effective service quality improvement strategies.

Brand asset evaluation is mainly based on consumers' perception of the brand to evaluate airline service quality, and its formula is: brand asset value = f(consumer utility − expectation value). The graded value assessment of brand equity can be used for airline service quality inspection (Lu et al., 2017), which mainly

includes: firstly, determining the content and extent to which the brand understands customer needs, such as highly efficient products or services, delivery of promises, sincere service of staff, comfortable environment, timely service, right to know, personalized service, good experience, pleasant memories, trust and expectation, etc. Secondly, it is determined whether the brand is adapted to customer needs. Airlines give full consideration to the practical features of product and service functions, meet the material and spiritual needs of customers, products should be tasteful and unique, pay attention to the artistic and visual perception of the brand, and give consumers the perception of enjoyment from the inside out. Keller (1993) proposed the Consumer Based on Brand Equity (CBBD) model, which defines the value of brand equity based on the differential effect of consumer responses to brand marketing. Chinese brand scholars have independently studied the brand value development theory (Zhou et al., 2019), which organically combines brand strength evaluation with brand equity value measurement, and then evaluates the service quality of brand products (Du & Chen, 2017).

The evaluation methods of aviation service quality are gradually diversified. To improve the airline service quality evaluation model, Liu et al (2017) constructed an international airline ticket review system and found that service is the core element, price affects customers' psychological expectations, equipment and facility conditions are valued by customers, punctuality is a necessary condition, and management factors affect the image of airlines. Ma (2021) constructed a model of air passenger service quality under non-cooperative game between airlines and airports through differential game method, which was used to evaluate the relationship between service quality and passenger revenue. Lyu (2019) determined the service quality level and customer satisfaction of domestic and international airlines through the measurement of basic services such as in-flight, ground and ticketing, based on the CAPSE 2019 first quarter airline service measurement report. Li et al. (2017) incorporated total transport turnover and passenger traffic into the airline service quality evaluation system and used factor and cluster analysis models for analysis. Ma & Chen (2020) used network text analysis to analyze Xiamen airline service quality satisfaction and its influencing factors.

In summary, researches have evaluated airline service quality from multiple perspectives, but there are limitations, such as the strong subjectivity of customer satisfaction evaluation, the solidity of SERVQUAL scale assessment, which makes it difficult to fully present consumers' true feelings; brand equity evaluation mostly uses questionnaires, with limited sample size and non-representative; diversified studies are based on online review data, but the data complexity and ambiguity are strong. Therefore, in order to break through the limitations, this paper uses airline complaint data as the basis for a comprehensive evaluation of airline service quality, which not only ensures the total amount of data and its typical characteristics, but also fully reflects the real feelings of customers.

3. Methodology

3.1. Spatial-Temporal Correlation Characterization

Optimal scale analysis visually reveals the correlation between different categories of variables by means of dimensionality reduction graphs, and is often used to analyze the correlation between 2 or more variables in low-dimensional space, and allows any variable type, specifically including multiple correspondence analysis, principal component analysis and non-linear typical correlation analysis. Based on the multiple nominal and pooled quantitative characteristics of the research data, this paper focuses on multiple correspondence analysis to determine the correlation characteristics of aviation complaints with different temporal factors. SPSS was used to map the variables to a two-dimensional space and to output a discriminant measure plot and a joint category point plot. The discriminant plot shows the correlation between the dimensional scores and the quantified values of the variables, with the typical correlation between the variables being the sum of the first dimensional eigenvalues and the second dimensional eigenvalues, and if there is an extremely close acute relationship between the variables, this indicates a high correlation. If the closer the perpendicular distance from each type of point to the ray and its reverse extension, the stronger the correlation between the variables, which can be calculated using Equation (1).

$$\rho_i = \frac{\left[(k \times E_i) - 1\right]}{k - 1} \tag{1}$$

In Equation (1): ρ_i is the typical correlation value, which is the interpretation of the correlation between variables, the closer to 1, the better the correlation; k is the number of variable sets, which is used to specify the number of groups of variables to be compared with other groups of variables; E_i is the characteristic value, which is used to explain the degree of variation generated by the variables in the first and second dimensions.

3.2. Airline Service Quality Measurement

Drawing on the approach of Lyu (2019), an airline service quality measurement model was constructed based on the CAPSE method to calculate the airline service quality index, which is used to analyze the service quality level of airlines, calculated using Equation (2).

$$P_j = \sum_i \frac{1 - \frac{N_{ij}}{C_i}}{2} \tag{2}$$

In Equation (2): P is the airline service quality measurement index, and the index is divided into three levels (Chen, 2016): lower level (0 - 3), medium level (3 - 4) and very high level (4 - 5); N is the number of airline complaints (pieces); C is the air traffic volume (thousand people); i represents each airline; j indicates the type of airline service measured, including comprehensive service quality,

ticketing service quality, in-flight service quality, ground service quality and flight service quality (amount of irregular flights).

3.3. Datasets

The datasets used in this paper is derived from the monthly data of the Air Transport Consumer Complaint Bulletin issued by the Civil Aviation Administration of China, which was collated and selected from a total of 79,773 Chinese domestic and international airline complaint data for 60 months over five years from January 2015 to December 2019, including 8217 foreign airline complaint data and 71,556 domestic airline complaint data, involving 5 types of complaints (Table 1). As the optimal scale analysis method cannot automatically filter the variables, and in the case of too many variables can obscure the real information and affect the graphical display, the category variables need to be coded according to the time volume variability principle (Table 2), taking into account the characteristics of the study sample, before conducting the optimal scale analysis. For ease of reading and presentation, the International Air Transport Association (IATA) airline codes were used instead of airline names (Table 3) to measure the service quality level of each of the 26 full-service airlines and the six differential-service airlines in China.

4. Results

4.1. Characteristics of the Temporal Distribution of the Total Number of Complaints

From 2015 to 2019, the temporal distribution of domestic aviation complaints was uneven, which in turn manifested itself in the relative concentration of annual, seasonal, quarterly and monthly (Figure 1). Specifically: 1) Annual characteristics. During the study period, the number of domestic aviation complaints grew rapidly, from 2809 to 24,303, with an average annual growth rate of 153.04%, showing a cyclical characteristic with the year as the dividing line, and

Table 1. Complaint type classification.

Classification	Level 1	Level 2	Level 3
1	Flight Services	Flight problems Delays	Cancellations, schedule changes, etc.
2	Ticketing Services	Ticketing Services	Overpriced tickets, failed bookings etc.
		Over-selling problems	Double selling of seats, etc.
3	Ground service	Baggage problems	Overcharging, delayed, damaged, lost baggage, etc.
		Check-in problems	Security check and boarding procedures, failure to sign on, etc.
4	In-flight services	Airline problems	Unsatisfactory airline service, seating arrangements, food service, etc.
5	Other services	Cargo problems	Loss of cargo, delays, etc.
		Special services	Discrimination against special passengers, etc.
		Other problems	Advertising, SMS fraud, smoking, etc.

Table 2. Principles for coding variables related to the content of aviation complaints and spatial-temporal factors.

Primary variables	Secondary variables	Coding principles
Time	Year	1—2015, 2—2016, 3—2017, 4—2018, 5—2019
	Season*	1—Winter-Spring, 2—Summer-Autumn
	Quarter	1—1st quarter, 2—2nd quarter, 3—3rd quarter, 4—4th quarter
	Monthly	1—January, 2—February, 3—March, 4—April, 5—May, 6—June, 7—July, 8—August, 9—September, 10—October, 11—November, 12—December
Complaint against		1—Domestic airline, 2—Foreign airline.
Type of complaint		1—Flight problems, 2—Fare problems, 3—Baggage problems, 4—Check-in problems, 5—Airline problems, 6—Over-selling problems, 7—Special services, 8—Cargo problems, 9—Other problems

*The seasonal factor is based on the seasonal change of flights, i.e. From April to October in the summer/autumn season and from November to March in the winter/spring season. The annual factor is based on the study year from January 2015 to December 2015 (referred to as annual), and so on.

Table 3. IATA airline two-character codes.

Airline Name	Codes	Airline Name	Codes	Airline Name	Codes
Okay Airways Limited Co.	BK	Ruili Airways Limited Co.	DR	China Eastern Airlines Co.	MU
Beijing Capital Airlines Co.	JD	Xiamen Airlines Co.	MF	Air China Ltd.	CA
Chengdu Airlines Co.	EU	Shandong Airlines Co.	SC	China Southern Airlines Co.	CZ
East China Sea Airlines Co.	DZ	Shanghai Airlines Co.	FM	Chongqing Airlines Co.	OQ
Fuzhou Airlines Co.	FU	Shanghai Juneyao Airlines Co.	HO	Spring Airlines Limited Co.*	9C
Guangxi Beibu Gulf Airlines Co.	GX	Shenzhen Airlines Co.	ZH	Jiuyuan Airlines Limited Co.*	AQ
Hainan Airlines Co.	HU	Sichuan Airlines Co.	3U	Urumqi Airlines Limited Co.*	UQ
Hebei Airlines Co.	NS	Tianjin Airlines Co.	GS	Western Airlines Limited Co.*	PN
Huaxia Airlines Co.	G5	Tibet Airlines Co.	TV	Xiangpeng Airlines Limited Co.*	8L
Kunming Airlines Co.	KY	Happy Airways Limited Co.	JR	China United Airlines Limited Co.*	KN
Qingdao Airlines Co.	QW	Long Dragon Airlines Co.	GJ	—	—

Those marked with * are low-cost service airlines, those not marked with a symbol are full-service airlines.
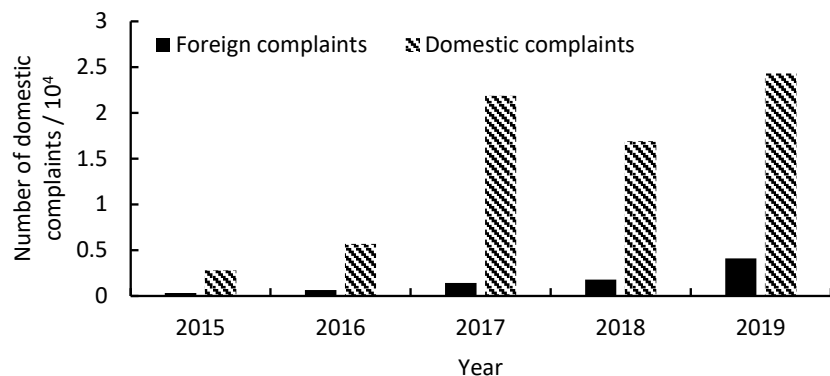
Figure 1. Time distribution characteristics of domestic and international airlines in China.

each cycle followed an inverted "V" growth trend. In 2017, the number of domestic airline complaints grew the fastest (285.50%), with complaints in the categories of "flight problems", "baggage problems" and "check-in problems" respectively. The number of complaints increased by 373.18%, 285.80% and 268.44% respectively, focusing on "flight delays and cancellations, baggage delays and losses, security checks and check-in procedures", with the average delay time of flights increasing by 8 minutes over the same period (from 2015 to 2019, the average delay time of passenger flights nationwide was 21 and 16 minutes respectively). The average delay time of passenger flights was 21, 16, 24, 15 and 14 minutes respectively, and the national passenger flight normalization rate was 68.33%, 76.76%, 71.67%, 80.13% and 81.65% respectively.) The 5.09% decline in the passenger flight normalization rate was the main reason for the increase in complaints during the year, which did not match the growth rate of air traffic volume and transport turnover (11%) during the year. 2) Seasonal characteristics. The peak of aviation complaints mainly occurred in the summer and autumn seasons, with the number of complaints accounting for 66.50% of the total, which was significantly higher than that of the winter and spring seasons (Figure 2). 3) Quarterly characteristics. Domestic aviation complaints mainly occurred in the second and third quarters of each year, with the third quarter accounting for the highest number of complaints (33.81%), and the number of complaints about "cargo, fares and airline problems" was 3.3 times, 1.4 times and 1.4 times higher than the other quarters respectively. The highest number of complaints were in the categories of "cargo delays, duplication of seats for sale, dissatisfaction with airline service and seating arrangements". The first quarter of the year had the lowest number of complaints (17.61%), mainly due to the low number of complaints about "over-sales" and the high level of air service. 4) Monthly characteristics. The highest number of complaints (12.98%) was recorded in August each year, mainly due to weather and traffic monitoring, and the number of complaints about flight problems increased significantly; the lowest number of complaints (5.10%) was recorded in March (Figure 3).
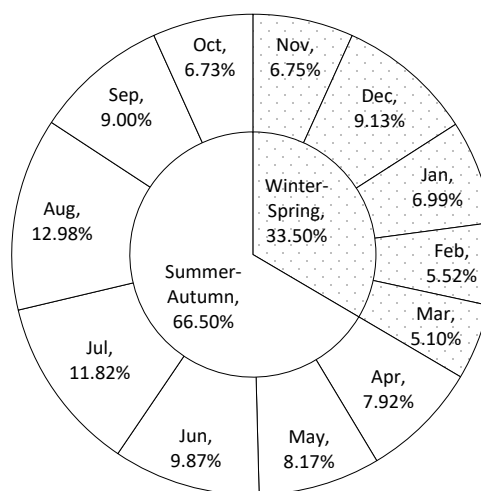
Figure 2. Seasonal distribution characteristics of domestic aviation complaints in China.
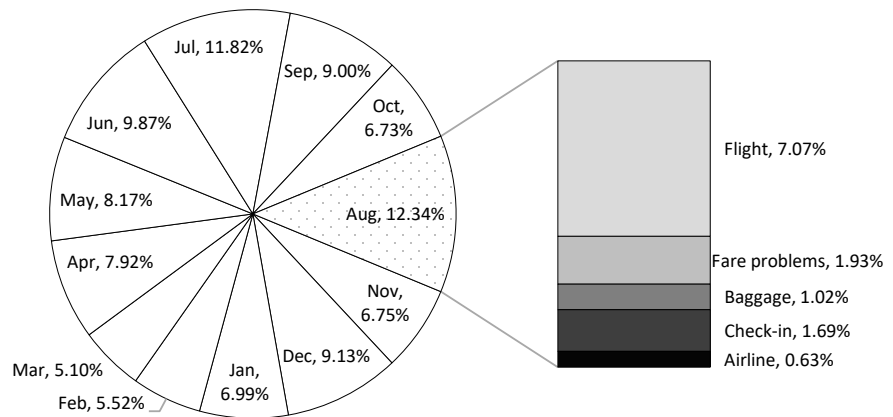
Figure 3. Monthly distribution characteristics and categories of domestic aviation complaints in China.

The uneven distribution and relative concentration of foreign aviation complaints is more significant. Specifically: 1) Annual characteristics. From 2015 to 2019, foreign aviation complaints showed a rapid growth trend, from 293 to 4,076, with an average annual growth rate of 258.23%, and the cyclical characteristics were not significant. Among them, the number of foreign aviation complaints grew the fastest in 2019 (127.08%), mainly manifested by the significant increase in complaints about "ticketing services". 2) Seasonal characteristics. The peak of aviation complaints mainly occurred in the summer and autumn seasons, with 67.86% of complaints, which was significantly higher than that of the winter and spring seasons. 3) Seasonal characteristics. The seasonal distribution of foreign aviation complaints was significant, mainly occurring in the third quarter, accounting for 33.81% of the total number of complaints, of which "flight service" and "ticketing service" were the main reasons for the significant increase in the number of complaints; the first quarter accounted for the lowest percentage (18.38%). The first quarter was the lowest (18.38%). 4) Monthly characteristics. Similar to domestic complaints, the number of complaints about "flight delays and cancellations" increased significantly in August, accounting for 21.70% of the total number of complaints.

4.2. Temporal Correlation Characteristics of Aviation Complaint Types

4.2.1. Time-Related Characteristics of Domestic Aviation Complaints

IBM SPSS Statistics software was used as the implementation tool for the temporal correlation characteristics analysis. Time variables such as annual, seasonal, quarterly and monthly are the influencing factors of aviation service quality and are closely related to the comprehensive performance of service delivery environment and passenger status, which can reflect the changing characteristics of aviation activities or passenger behavior in a specific time stage and cycle. Table 4 shows the summary results of the analysis of the relationship between the types of domestic aviation complaints and the time factor variables, with a typical correlation value of 0.998 between the variables, indicating a good explanation of

Table 4. Summary results of the time-related characteristics analysis of domestic aviation complaints.

Category	Number of episodes	Dimension		total
		1	2	/
	Year	0.015	0.133	0.148
Time factor dimensional characteristic values	Quarterly	0.940	0.962	1.902
	Monthly	0.994	0.963	1.959
	Season	0.963	0.000	0.963
	Complaint type	0.031	0.018	0.049
Total Eigenvalues		0.583	0.415	/
Fitted values		/	/	0.998

the correlation between the variables. As seen in the relationship between the time factor and the aviation complaint discrimination measure (Figure 4), there is an acute angle relationship between the domestic aviation complaint type variable and the annual, seasonal, quarterly and monthly variables, indicating a high degree of correlation.

The plots of the center of mass for the time factor and the type of aviation complaint visualize the characteristics of the association between the variables. The majority of the variables have a point of mass located between ([−1, 1], [−1, 1]) (Figure 5). In the analysis of the correlation between time factor and complaint type, by making a vertical line from the complaint type point to the ray connecting the prime point of the time factor to the origin, the closer the vertical distance from the complaint type point to the ray and its reverse extension line, the stronger the correlation between the elements. The specific relationship is manifested in four aspects: 1) Annual correlation characteristics. All five years from 2015-2019 are distributed in the ([−1, 1], [−1, 1]) circle, indicating that the annual factors are all highly correlated with domestic aviation complaint types. Specifically, domestic aviation complaints were highly correlated with the categories of "fare issues, flight issues, check-in and airline issues, special services and cargo issues" in each of the five years, indicating that the focus of complaints varied from year to year. 2) Seasonal correlation characteristics. The winter and spring seasons are located roughly on the horizontal axis past the origin and far from the mass point of each complaint type, indicating that there are fewer complaints in the winter and spring seasons, among which the correlation with "baggage service" is closer; the correlation between the summer and autumn seasons and all other types of airline complaints except "special service and cargo issues" is higher. The correlation between the summer and autumn seasons and all other types of aviation complaints, except for "special services and cargo issues", is higher, indicating that the summer and autumn seasons not only have a large number of aviation complaints, but also have complex types of complaints. 3) Quarterly correlation characteristics. The first and fourth quarters
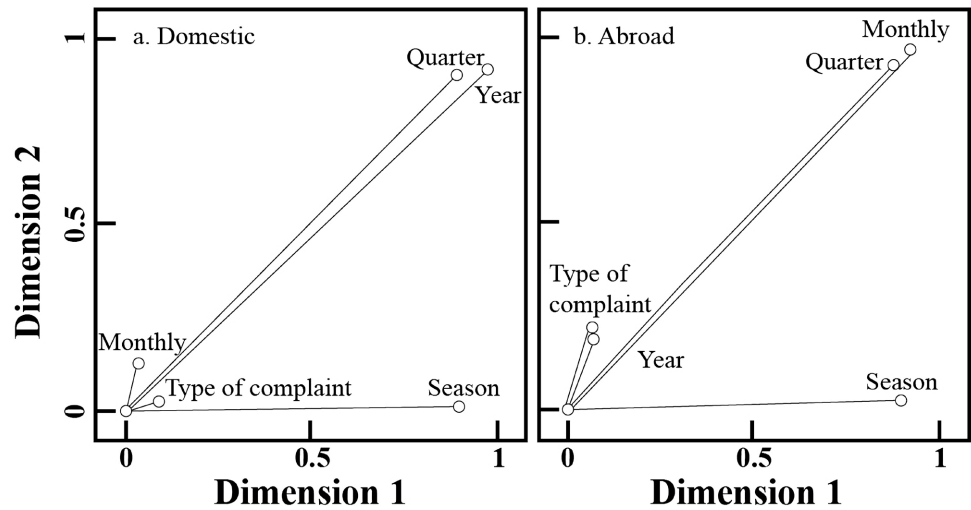
Figure 4. Multivariate correspondence identification metrics for time factors between domestic and foreign aviation complaints.
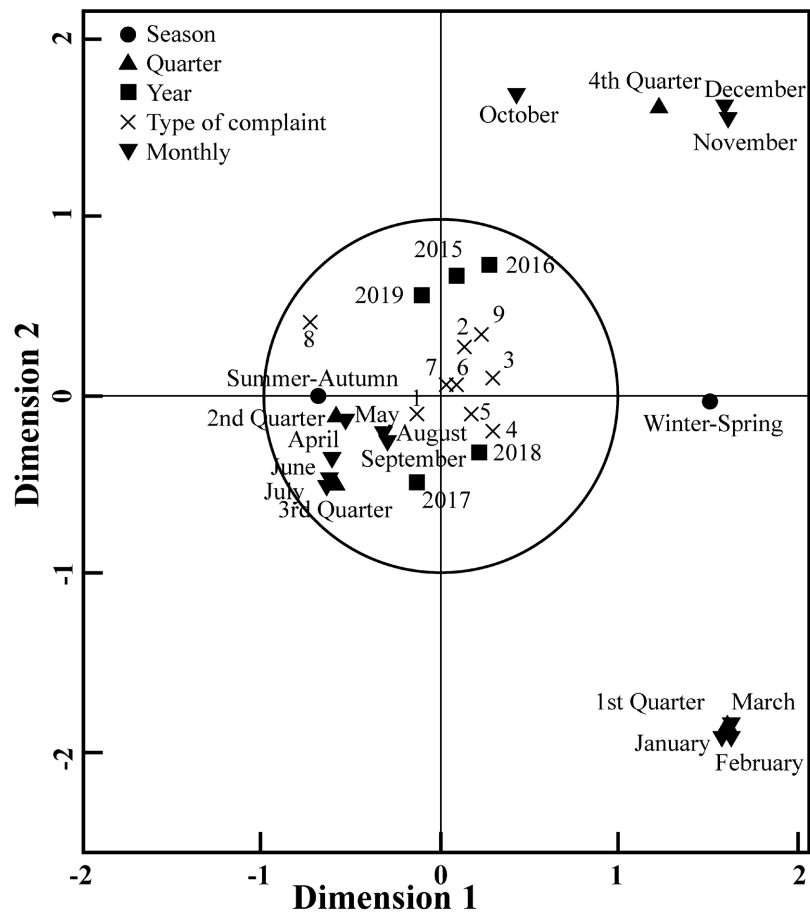
Figure 5. Mass plot of the relationship between time factor and domestic aviation complaints.

were both located outside the ([−1, 1], [−1, 1]) circle, far from the prime points of each complaint type, indicating that these two quarters were not closely asso-

ciated with each type of complaint; the second and third quarters were associated with "cargo problems" and "flight problems" respectively. 4) Monthly correlation characteristics. April-June was more closely associated with "cargo issues" and "overselling issues", which is a practice of airlines to increase the economic efficiency of seats, but which increases airline complaints due to the failure to correctly estimate the actual number of passengers taking the flight; July-September was more closely associated with "flight issues". July-September had the strongest correlation with "flight problems", mainly due to the impact of summer thunderstorms, which prevented flights from departing as planned and resulted in a high number of complaints about irregular flights; the other months had a less pronounced correlation with aviation complaints.

4.2.2. Characteristics of the Temporal Correlations of Foreign Airline Complaints

Table 5 shows the summary results of the analysis of the relationship between the type of foreign airline aviation complaint and the time factor variable, with a typical correlation value of 1.016 between the variables, indicating a good explanation of the correlation between the variables. The time factor and foreign airline complaint discrimination measure (Figure 4) shows that there is also an extremely close sharp angle relationship between the foreign airline complaint type variable and the annual, quarterly, monthly and seasonal variables, which are highly correlated.

Specifically: 1) Annual correlation characteristics. The five years from 2015 to 2019 were all distributed in the ([−1, 1], [−1, 1]) circle, indicating that the annual factors were all highly correlated with the types of foreign aviation complaints (Figure 6). For each of the five years, foreign airline complaints were associated with "over-selling, baggage, check-in, airline, and fare". 2) Seasonal correlation characteristics. The winter and spring seasons are located roughly on the horizontal axis past the origin and far from the mass point of each complaint type, indicating that the number of complaints in the winter and spring seasons is low, with the highest correlation with "over-selling problems". The correlation

Table 5. Summary results of the time-related characteristics analysis of foreign aviation complaints.

| Category	Number of episodes	Dimension		total
		1	2	/
	Year	0.056	0.126	0.182
Time factor dimensional characteristic values	Quarterly	0.931	0.909	1.840
	Monthly	0.985	0.927	1.912
	Season	0.917	0.014	0.931
	Complaint type	0.060	0.152	0.212
Total Eigenvalues		0.590	0.426	/
Fitted values		/	/	1.016
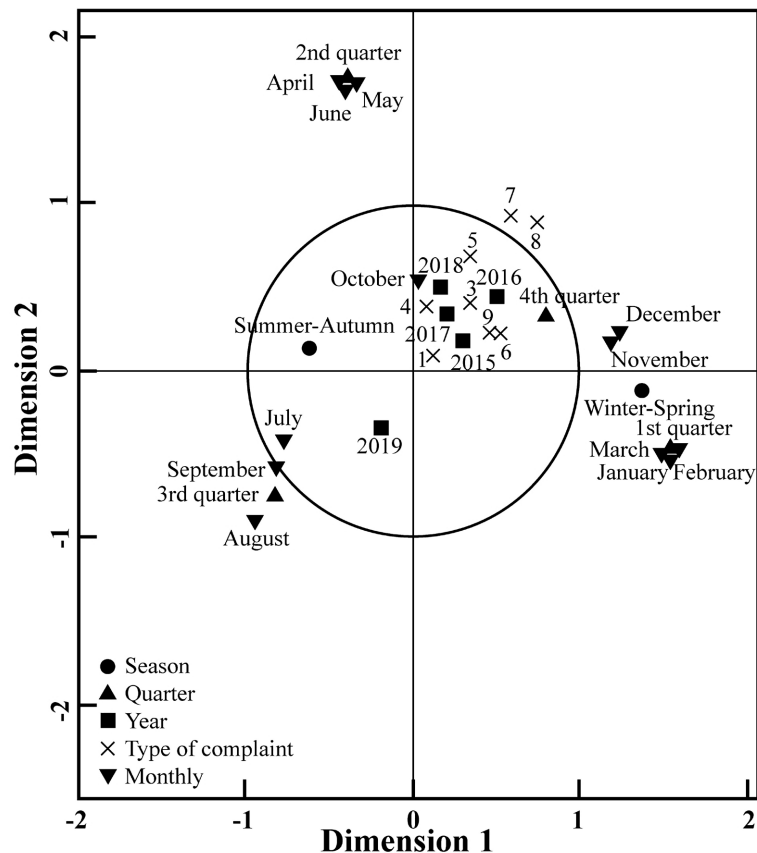
Figure 6. Mass plot of the relationship between time factor and foreign airline complaints.

between the summer and autumn seasons and other types of airline complaints, except for "special service and cargo issues", is high, with the highest correlation with "flight problems and fare problems", indicating that not only is the volume of airline complaints high in the summer and autumn seasons, but also the types of complaints are abundant. 3) Quarterly correlation characteristics. The first and second quarters are both located outside the ([−1, 1], [−1, 1]) circle, far from the quality points of each complaint type, indicating that these two quarters are not closely related to each type of complaint; the third quarter has a higher correlation with "fare issues", with most of the complaints about ticketing services occurring in the third quarter; the fourth quarter has a higher correlation with The correlation with "over-selling and other issues" was high in the fourth quarter. 4) Monthly correlation characteristics. July and October had the strongest correlation with various types of complaints, mainly in the areas of "fare issues, check-in services and airline problems", while the other months were farther away from the qualitative points of each complaint type and had less obvious correlation with the types of airline complaints.

4.3. Analysis of Airline Service Quality of Full-Service Airlines

From 2015 to 2019, the annual average measured index of comprehensive ser-

vice quality of 26 full-service airlines in China was 3.79, which was at a medium level, but showed a decreasing trend year by year, from 4.70 to 3.79, a decrease of 19.43% (Figure 7), with the lowest average measured index of comprehensive service quality in 2017 (2.38), mainly due to the increase in the number of complaints by each airline. In terms of the level of each company's comprehensive service quality index, Chongqing Airlines and Happiness Airlines had the highest in 2015, both at 5.00, and Hebei Airlines (4.28) had the lowest; Chongqing Airlines (4.96) and Shanghai Airlines (4.74) had the highest and East China Sea Airlines (3.33) had the lowest in 2016; Chongqing Airlines (4.96) had the highest in 2017, and East China Sea Airlines, Ruili Airlines, Happiness Airlines and China Airlines were the lowest, all at 0.01; Shanghai Airlines (4.32) was the highest and Happiness Airlines (1.10) the lowest in 2018; Ruili Airlines was the highest (4.56) and Happiness Airlines (2.20) the lowest in 2019, showing the high volatility of the service quality ranking of each airline. Among them, Happiness Airlines has the fastest drop in the ranking of all companies, from No. 1 in 2015 to No. 26 in 2019, with a 55.92% drop in the service quality measurement index from 5.00 to 2.20. The number of complaints has increased 73 times while the traffic volume has maintained a stable growth, specifically from "flight service and ground service the number of complaints was 73 times higher, specifically from "flight service and ground service". The overall performance of China Airlines remained relatively good, decreasing only by 1.43% from 4.42 to 4.35. The number of complaints did not increase significantly while the traffic volume maintained a steady growth, and it maintained a high level of service in terms of air service and check-in and check-out procedures.
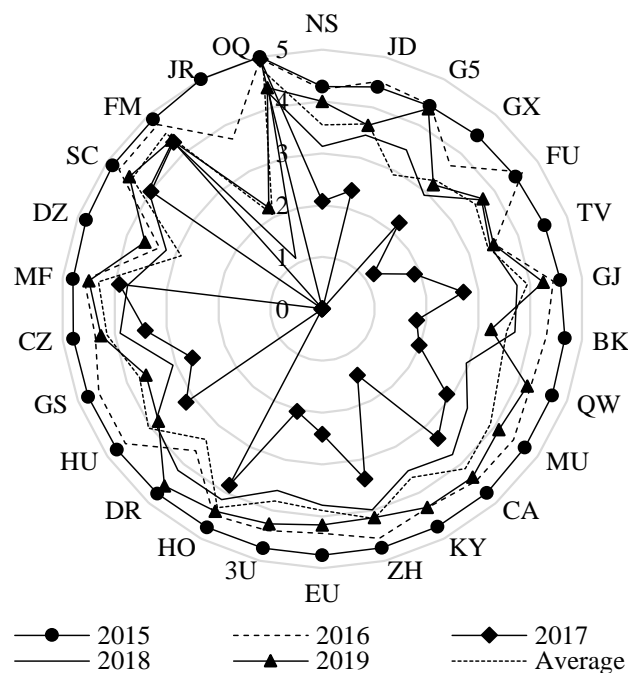
Figure 7. Annual change in the full-service airline general service quality measurement index from 2015 to 2019.

In terms of the types of complaints, the average index of service quality measurement of the 26 full-service airlines, in descending order, was inflight service (4.94), ticketing service (4.90), ground service (4.76) and flight service (4.15) (Figure 8). In particular, the annual indexes of airline service quality in the three categories of in-flight service, ticketing service and flight service all decreased to varying degrees, by 0.20%, 4.26% and 9.44% respectively; the quality of ground service increased slightly by 0.03%, with the lowest level of flight service quality in 2017, with an annual average measurement value of only 2.95 (Figure 8(d)), in line with the reasons for the sudden increase in the number of complaints mentioned above This is consistent with the reasons for the sudden increase in complaints mentioned above. In terms of the ranking of the 26 airlines by complaint type, Chongqing Airlines had the highest quality measurement indices for in-flight service, ticketing service, ground service and flight service, while Happy Air was relatively low.

4.4. Analysis of the Service Quality of Differentiated Service-Oriented Airlines

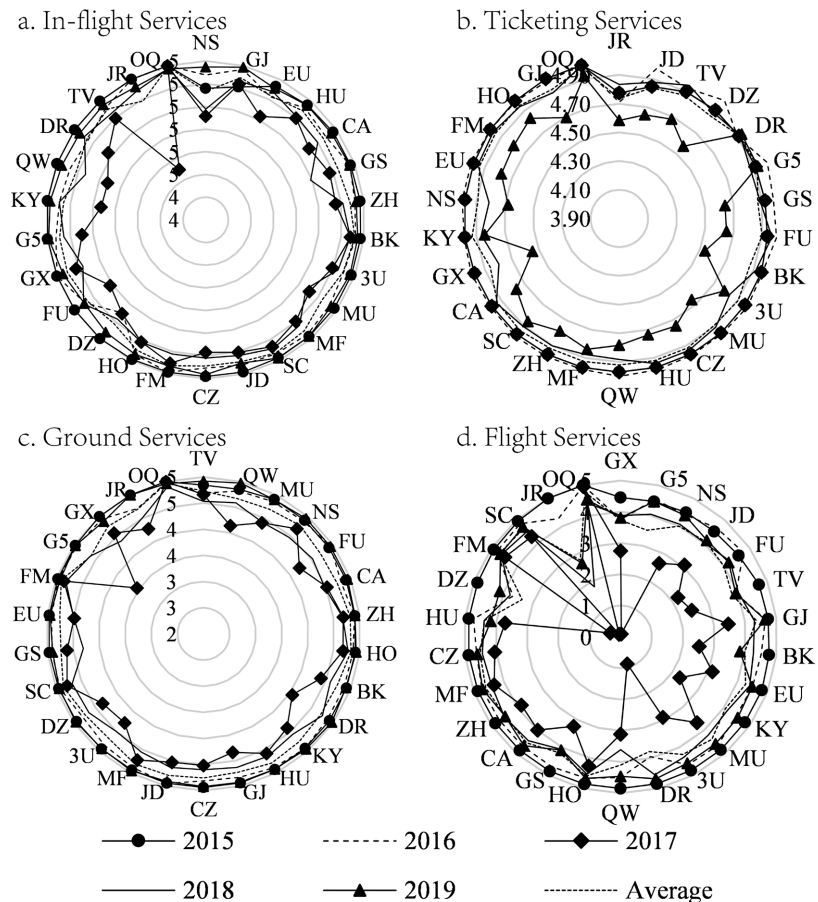From 2015 to 2019, the six differentiated service-oriented airlines in China had a


Figure 8. Annual change in each indicator measurement index of full-service airline service quality from 2015 to 2019.
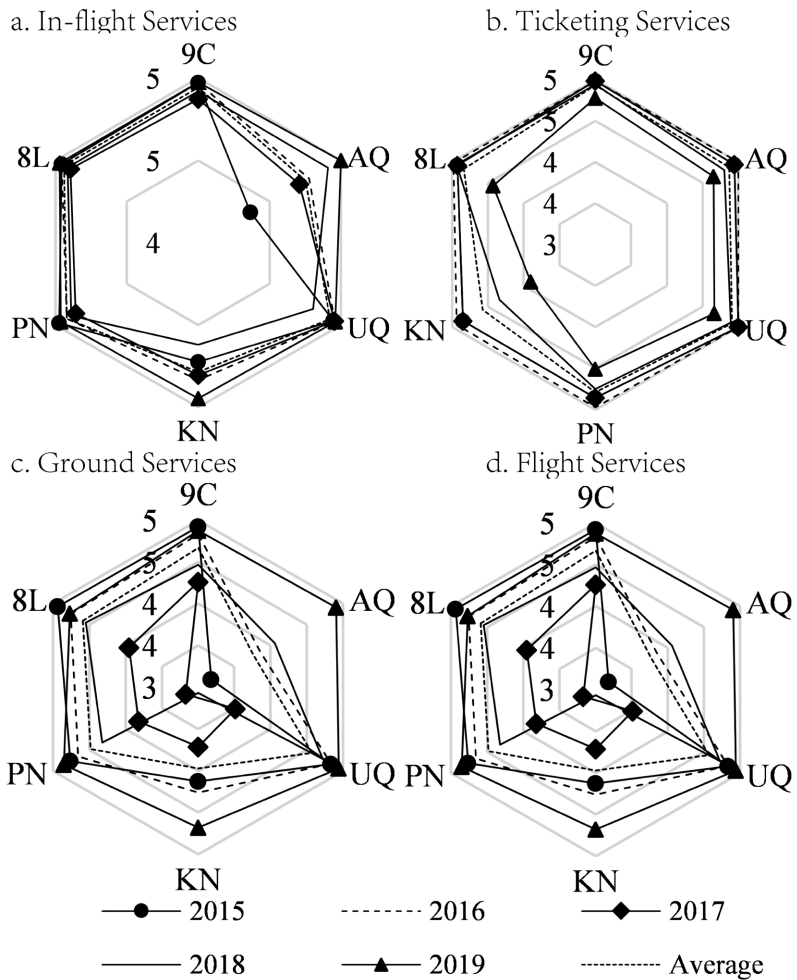
lower level of comprehensive service quality than full-service airlines, with an annual average airline service quality measurement index of only 2.73, and an overall decreasing trend, from 3.27 to 2.92, a decrease of 10.80% (Figure 9). In terms of each company's overall service quality index, Spring Airlines (4.77) was the highest and Jiuyuan Airlines (0.73) was the lowest in 2015; Spring Airlines (4.49) was the highest and Jiuyuan Airlines (2.45) was the lowest in 2016; Spring Airlines (3.08) was the highest and China United Airlines (0.01) was the lowest in 2017; Spring Airlines (3.89) was the highest and China United Airlines (0.07) the lowest; Spring Airlines (4.11) the highest and China United Airlines N (0.79) the lowest in 2019. Among them, Spring Airlines maintained a high level of service quality during the study period; Jiuyuan Airlines improved its service quality most significantly, from 0.73 to 4.07, and was the only airline with positive growth in differentiated services; Yunnan Xiangpeng Airlines experienced the most significant decline in service quality, from 4.63 to 2.01, mainly due to an increase in complaints in the "ticketing service and This was mainly due to the increase in complaints in the "ticketing and flight services" category.

In terms of the types of complaints, the average service quality indices of the six differentiated airlines were, from highest to lowest, in-flight service (4.88), ticketing service (4.82), ground service (4.34) and flight service (3.70). Among them, the service quality measurement indexes of in-flight service and ground service increased by 3.02% and 8.45% respectively, while those of ticketing service and flight service decreased by 8.89% and 8.74% respectively (Figure 10). The higher level of airline ticketing service quality was achieved by Urumqi Airlines, with a measured index of 5.00 for both, which decreased in FY2019, but only by 6.68%; China United Airlines had the fastest decline in ticketing service quality, from 4.85 to 3.90 during the study period. The higher level of airline in-flight service quality was achieved by Spring Airlines, with a 5-year average
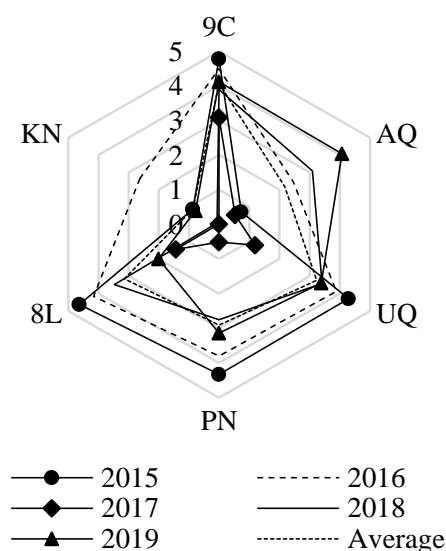
Figure 9. Annual change in the service quality index of low-cost airlines from 2015 to 2019.

a. In-flight Services

b. Ticketing Services

c. Ground Services

d. Flight Services

2015 ──●──   2016 ------   2017 ──◆──

2018 ────   2019 ──▲──   Average ----------

Figure 10. Annual change of each index measuring the service quality of low-cost airlines from 2015 to 2019.

measured index of 4.94. The ground service quality measurement index of Jiuyuan Airlines was relatively low, but was in the process of gradual improvement, while the indexes of the other five differentiated service airlines also declined to varying degrees. The higher service level of airline flight services is Spring Airlines, with a 5-year average of 4.53; the lower service level is China United Airlines, with a 5-year average of only 2.60.

Overall, China's full-service airlines outperformed the differentiated service airlines in all service quality levels, and the differentiated service airlines had to continuously improve and enhance their service quality in multiple indicators to gain more market advantages. It can be seen that the service quality of "in-flight service and ground service" is more stable and customer satisfaction remains at a high level, while "ticketing service" declines significantly mainly due to the "over-selling problem". The decline in "ticketing service" is mainly due to the difficulty in solving the "over-selling problem", while "flight service" has difficulties in maintaining the quality of service due to the complex causes and difficulty in controlling them.

5. Conclusion and Discussion

In this paper, using monthly data of domestic and international airline complaints, the correlation characteristics between domestic and international airline complaints and time factors were determined by using the optimal scale analysis method, and an airline service quality measurement model was constructed according to CAPSE to measure the service quality of full-service airlines and differentiated service airlines in China. The results of the study are as follows.

1) From 2015 to 2019, the time distribution of domestic aviation complaints was uneven, which in turn showed a relative concentration of annual, seasonal, quarterly and monthly. The average annual growth rate of domestic aviation complaints was 153.04%, and it showed an inverted "V" cycle with the year as the dividing line; the peak period of complaints was in the summer and autumn seasons, especially in August of the third quarter. The time distribution of foreign aviation complaints is uneven and relatively concentrated, while the annual cyclicality is not significant, but the peak of complaints is also concentrated in August every year. Both domestic and foreign aviation complaint type variables are highly correlated with annual, seasonal, quarterly and monthly variables, but the focus of complaints varies from year to year; summer and autumn seasons not only have a high volume of aviation complaints, but also have complex complaint types. Domestically, the second and third quarters were highly correlated with "cargo problems" and "flight problems" respectively. In foreign countries, the third and fourth quarters were associated with "ticketing services" and "oversales and other services" respectively. It can be seen that the number of service complaints of both domestic and foreign airlines will increase due to the increase in passenger traffic; therefore, improving the quality of staff and service level is an important basis to ensure the stability of service quality.

2) From 2015 to 2019, the annual average measured index of comprehensive service quality of 26 full-service airlines in China was at a medium level, but showed a decreasing trend year by year. The high and low levels of each company's comprehensive service quality index varied from year to year, and the ranking was highly volatile, with Happiness Airlines Limited having the fastest decline in ranking, mainly due to a 73-fold increase in the number of complaints; China Airlines had stronger stability in service quality, with a low growth rate in the number of complaints, and maintained a high level of service in air service and check-in and check-out procedures. The airline service quality measurement index of China's differentiated service airlines dropped by 10.80%, with Spring Airlines maintaining a high level of service quality measurement index, Jiuyuan Airlines Limited improving its service quality the most, and Yunnan Xiangpeng Airlines Limited showing the most significant decline in service quality. It can be seen that, regardless of the type of airline, improving the brand image and the conditions of the enterprise's hardware facilities and equipment, as well as improving the incentive mechanism of employees, can help maintain the service quality of airlines.

3) China's full-service airlines outperformed the differentiated service airlines in all service quality categories. The service quality of "in-flight service and ground service" is more stable than that of other airlines, while "ticketing service" has decreased significantly due to the difficulty of solving the "over-selling problem". The quality of "flight services" is difficult to maintain due to the complexity of the causes and the difficulty of controlling them. It is therefore important for airlines to focus on the full range of services offered and to pay due attention to the quality of all aspects and products. For "in-flight services", it is necessary to enrich the content of service products while maintaining service quality; for "ticketing services", which are prone to service complaints, it is necessary to fully anticipate the market in order to reduce overselling; for "flight services", "flight services", "flight services" and "flight services", it is necessary to maintain the quality of service. For the service segments with high complaints such as "flight service" and "ground service", we should conduct an in-depth and systematic analysis of the complaint data and its causes to find out where the problems lie and prescribe the right remedy to solve them.

This paper proposes an objective analysis method to assess the quality of airline services based on airline complaint data, which not only ensures the total amount of data and typical characteristics, but also fully reflects the real feelings of customers. Based on the two-factor theory, the evaluation of aviation complaints can effectively reflect the quality of aviation services. The number of flight service complaints is highly correlated with the overall level of service quality in the civil aviation industry, and airline service quality is an important basis and evaluation indicator for airlines to obtain is market competitiveness. With the continued expansion of the civil aviation service market and the continued liberalization of access to the civil aviation market, competition for services among airlines will become more intense. Improving the level of various airline services and reducing airline complaints are specific practices for airlines to improve their service quality. However, it should be noted that airline service quality is influenced by a combination of complex factors; therefore, airlines should also coordinate macroscopically to promote the continuous improvement of airline service quality in order to obtain stable market and passenger recognition and promote the sustainable development of airlines.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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