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Empirical Study and Discriminant Analysis of Airline Services in the Yangtze River Delta of China

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Like any other civil aviation marketplace around the world, the airline services in China become fiercely competitive. To stay competitive in the airline industry in China, it is critical for an airline to get an essential understanding of customer's ongoing needs and know whether their needs are satisfactorily met. In this paper, an empirical study of the current airline service needs and quality in the Yangtze River Delta of China is explored using exploratory factor analysis. Discriminant analysis is further conducted to identify key service dimensions. Quantitatively and in an exploratory manner, structural equation models are employed by utilizing the IBM SPSS statistics tool. The findings in this study show that price, flight schedule, and customer relational benefit are crucial factors impacting on service quality and customer satisfaction in the current Chinese civil aviation market. To an airline, the highly valuable implications of the findings include a strong recommendation of adopting dynamic pricing schemes and improving flight schedules in the regions of China where high-speed train services become available.

Key Words: Airline service; civil aviation; customer expectation; service dimension

Research Background

With the rapid growth of China's economy and the improvement of people's living standards, airline services a quick and comfortable means of transportation play an increasingly important role in people's daily life. Indeed, the Chinese civil aviation industry has shown a rapid growth for over decades. The number of air passengers in China has tripled since 2000. According to the forecast of the International Air Transport Association, China will continue to be the world's fastest growing airline service market in the next 25 years.

Studies on service quality and customer satisfaction in the service sector have drawn substantial attention from scholars and practitioners over several decades. Truly, there have been a variety of publications in addressing different issues confronted by the civil aviation industries over the years around the world, in particular in the developed countries (Doganis and Graham, 1987; Doganis, 2002; Aksoy et al., 2003; Steven *et al.*, 2012; Baker, 2013), but explorations of Chinese airline services are still in its infant stage if compared to studies, for instance, completed in the US and Europe (Li *et al.*, 2010). However, like any other civil aviation marketplace around the world, the airline services in China are fiercely competitive. As customer needs of and perceptions on airline services vary with their cultures, backgrounds, and socio-economic statuses, findings for airline services in one marketplace might be considerably different from ones in another marketplace. Hence, an airline must understand its own marketplace well in order to offer and deliver competitive and satisfactory airline services (Sultan and Simpson, 2000; Buell *et al.*, 2013).

In the Chinese civil aviation industry, the recent introduction of private airline services from the governmental deregulations has significantly reshaped the Chinese airline service market. Moreover, the booming high-speed train services among megacities in China have made the competition of public transportation more intensifying than ever before. It becomes essential for an airline to understand and meet the customer's changing needs in a timely manner in order to stay competitive in the airline industry. Once again, it is well understood that different air passengers have different expectations of airline services (Buell *et*

al., 2013). Thus, in this paper an empirical study of airline service needs in a major cultural, economic, and political center of China, the Yangtze River Delta, is specifically explored using exploratory factor analysis, aimed at understanding customer expectations of airline services, defining fundamental service dimensions, and then identifying key service dimensions that significantly impact customer satisfaction in the Chinese civil aviation industry.

The remaining paper is organized as follows. Section 2 briefly provides some review of relevant publication in the literature. Section 3 presents the adopted research exploratory approach in this study. Descriptive analyses of collected survey data are presented in Section 4, while the core research findings from comprehensive analytics will be provided in detail in Section 5. Finally, Section 6 concludes this paper and highlights future investigations.

Literature Review

Kandampully and Duddy (1999) argue that capturing and understanding the needs of customers plays an important role in enabling and delivering quality services. They articulate that the creation of superior values for customers highly depends on a detailed understanding of the needs and expectations of customers. More importantly, by improving, innovating products and services, and anticipating the changing needs of customers on a continuous basis, an organization can meet the consumer needs in both the short term and long run, which ultimately defines the organization's competitive advantage in business. Through conducting an empirical research, Gustafsson et al. (1999) confirm that a deep understanding of customer needs, expectations, and preferences is essential for the successful delivery of customer services. By looking into the concerns of air passengers throughout their entire travel experience with the Scandinavian Airlines System (SAS), they show how the understanding of consumer needs helps SAS improve SAS's operational efficiency, formulate a good marketing strategy, and execute service deliveries to increase consumer satisfaction. Although in a different marketplace, Aksoy *et al.* (2003) also find that air passengers' different service needs and expectations derived from their demographic differences can considerably impact on how airline service strategic decisions should be made. An and Noh (2009) then highlight that the in-flight service quality impacts on airline customer satisfaction and loyalty.

In general, airlines must continuously capture and understand the changing needs of customers and swiftly take action on the changed needs for competitive advantage (Buell *et al.*, 2013). To address customers' concerns and changing needs in a cost-effective, efficient, and satisfactory manner, we must look into customers' entire travel experience, which requires detailing the needs of customers and understanding of the acceptance of offered services, such as the choice of airlines, aircrafts, cabin features, punctuality, etc. It is well recognized that the quality of an airline's services to customers is the overall perception from comparing the airline's actual performance with the customers' general expectations of how airlines in the civil aviation industry should perform (Doganis and Graham, 1987; Baker, 2013; Chen and Hu, 2013; Wu and Cheng, 2013). More specifically, the customers' satisfaction is mainly determined by their entire travel experience with the airline; the customers' experience, in turn, is their perception based on their experienced service encounters throughout their entire travel experiences (Qiu, 2013).

Through the analysis of the British civil aviation market, Doganis and Graham (1987) find that customers would consider the following factors when they choose flights and airlines: airfares, flight routes, flight frequency, time of departure, punctuality rate, connecting trains, ground and cabin service, in-flight entertainment system, cabin layout, models, safety and credibility, brand image, the frequent flyer programs, and advertising and market positioning. Aksoy *et al.* (2003) learn that Turkish domestic consumers in the selection of airlines would pay much attention to the following eight areas: cabin features and personnel, country of origin and promotion, food and beverage services, in-flight activities, Internet services, punctuality and speed, free alcoholic beverages, and airfares.

Chang and Yeh (2002) confirm that context-dependent service quality attributes are necessary for evaluating airlines' services. To explore airlines' service quality, they propose a fuzzy multicriteria analysis model. They articulate that the fuzzy multicriteria analysis model can effectively accommodate the inherent subjectiveness and imprecision of the collected data. Chen and Chang (2005) further argue that air passengers might have distinct expectations at different stages of air services. They show that it is critical for airlines to master a good understanding of service gaps at these different stages over time. The service gaps include not only ones between passengers' expectations and actual services received at different stages but also those between passengers' expectations and the projections of these expectations of frontline managers and employees. Because of customers' service priorities shift from stage to stage, airlines should offer and

deliver what the customers really want throughout their travel processes.

With the rapid development of the civil aviation in China, scholars in China began to pay attention to the challenges encountered by the Chinese airline service industry. A variety of publications have focused on exploring Chinese civil aviation market characteristics, trend, and structure. For example, based on the analysis of uniqueness of the Chinese civil aviation market, Yu and Chu (2004) explicitly specify the characteristics of the domestic airline service market in China. The domestic air passenger transport market structure and consumers' behavior in China are investigated by Li *et al.* (2010). By randomly collecting surveys from domestic air passengers over 5 years, Li *et al.* provide statistic reports on the changes and evolving trends of Chinese air passenger transport market structure and consumers' behavior during the study period. The analytic results are detailed based on the following eight main factors: safety, flight schedule, airline brands, airfares, services, flight punctuality rates, aircraft models, and frequent flyer programs. Note that the Center of Aviation Safety Technology of the Civil Aviation Administration of China periodically publishes comprehensive and resourceful information on the Chinese civil aviation industry. In the most recent report, they present the current market structure, performance, and characteristics of the overall Chinese air passenger market.

Empirical studies have also been conducted for the purpose of helping airlines look into the detailed needs of air passengers in the Chinese civil aviation market. By collecting surveys from inbound air passengers at Macao International Airport, Chan *et al.* (2009) have employed the SERVQUAL model in completing a comparative study of different competitive advantages between traditional and low-cost airlines. Their findings clearly show that different marketing and service delivery strategies should be applied by different airlines (traditional vs. low-cost) in order for them to respectively and satisfactorily meet their different service quality dimensional needs of customers.

The Yangtz River Delta as the fastest-growing economies in China in recent years is one of the most densely populated regions on earth. By further extending our early study of Chinese airline services (Wang et al., 2014), we conduct exploratory analysis to determine dimensional factors of airline services in the Yangtz River Delta region of China. In addition, by focusing on customer satisfaction, we further our analysis with a focus on identifying dimensional factors that carry stronger discriminatory power based on categorized air passenger groups. We aim to recommend prioritized actions to service providers so that the study can help them address challenges that are commonly confronted by the China civil aviation industry.

Research Design and Methodology

An empirical and descriptive approach is adopted in this study. A brief introduction to the design of the needed questionnaire is discussed first. The process of conducting data collection will be then briefly explained. Structural equation models based on SPSS are applied, focusing on gaining deep understandings of the airline services in the region. Comprehensive analysis and research findings will be provided in Sections 4 and 5.

Questionnaire design

A questionnaire was designed with a focus on collecting data from air passengers in the general China's civil aviation marketplace. The questionnaire design in this study was completed by taking the following two steps:

1) Preparing a preliminary questionnaire. In reference to the rich literature and a publication from the "2008 Passengers' Report of the Civil Aviation in China" provided by the Center of Aviation Safety Technology of the Civil Aviation Administration of China, we designed a preliminary questionnaire. Questions included in the questionnaire are further revised by interviewing with many frequent flyers, aimed at understanding and capturing the real consumers' needs and perceptions in the focused marketplace.
2) Refining the questionnaire through a validity test. The validity of a questionnaire refers to whether the questionnaire that will be used actually measure what a study wants to measure. In order to conduct a validity test, we conducted a preliminary investigation using a small sample. The initial investigation mainly targeted at some groups of air passengers who often travel by plane and have a good understanding of aviation products and services. Through repeating validity and reliability tests, we modified the questionnaire and designed the final questionnaire for this study.

The final questionnaire is radically divided into four parts. Radically, for each volunteer respondent the survey collects his/her most recent itinerary data, assessment of service products and perceived travel experience, perceptions of consumed airline service quality, and certain basic personal profile data. A brief introduction to the four categories of data is provided as follows:

- Travel itinerary information - Respondents are

asked to fill in the name of the airline, departure and destination information, and other itinerary data.

- Service products and travel experience - This part uses a 7-point Likert scale to collect an air passenger's opinion of his/her consumed service products and perceived travel experience. Sixteen questions are listed, including safety, airfare, non-stop & connecting flight, punctuality rate, cabin environment, in-flight service, food & beverage service, ground service, check-in service, arrival & luggage service, flight routes & choices, airline brand, seat & personal space, aircraft model, frequent flyer program, and in-flight entertainment equipment.
- Customer satisfaction & royalty - This part also uses a 7-point Likert scale to collect an air passenger's opinion on the overall perception of his/her most recently consumed airline service.
- Customer profiles - The final part of the survey focuses on collecting some basic information of the respondents, including gender, age, education and income levels. This part of the survey helps us categorize consumers, which allows us to explore customer behavior based on personal attributes.

Data collection

The respondents were randomly selected at the Nanjing Lukou International Airport, which has service to 54 domestic cities and over 20 international destinations, in support of over 130 flight routes in total. The annual passenger throughput at the Nanjing Lukou International Airport passed 14 million passengers in 2012. For customers' convenience and the purpose of improving our survey return rate, two ways, paper and electronic based surveys, were utilized for air passengers. Paper-based surveys were provided at the Airport. Although we handed out paper-based forms to air passengers who promised to return the filled form by mail, we managed to provide an alternative for some air passengers who were in hurry and preferred to fill in the survey electronically.

We handed out 400 paper-based forms. In addition, 60 air passengers preferred to fill in the survey electronically. In total, we had 335 responses. We found that 41 responses were invalid due to the irregularity with their returns, for instance missing significant number of answers to the questions. In addition, 14 returns were removed because the respondents took foreign airlines that were purposely excluded in this study. Hence, the final number of valid responses is 280, including 51 electronic returns and 229 paper-based responses. The effective survey return rate is 60.86%. Note that during the period of data collection, we talked to air passengers at the airport first. Only when he/she indicated that he/she was interested in the study, then a formal survey request, either paper or electronic-based, was issued. As a result, the quality of the conducted survey in light of the completion of individual responses was high.

Descriptive Statistic Analysis

In this study, the age distribution of the respondents was mainly concentrated at groups of 21-30 years old and 31-40 years old, accounting for 81.7%. As for the gender of respondents, the number of men was slightly more than the number of women, which was indeed consistent with the current population structure in China. The majority of the respondents had either vocational training or college degrees, which accounted for 93.2% of the collected data. Annual household incomes of the respondents were mainly concentrated in the range of 50 - 150 thousands Chinese Yuan. The trip purpose of the respondents was mainly for businesses, accounting for 42.9%. Tourists accounted for 28.9% of the collected data. Travel frequency was mainly centered at a range between one and five times a year, which accounted for 74.3%. In terms of expenditure sources, private sources at respondent's own expense accounted for 50.7%, while public sources accounted for 38.2%. Interestingly, the findings in the collected data were quite similar to the findings in the 2013 civil aviation passenger statistic figures published by the Center of Aviation Safety Technology of the Civil Aviation Administration of China. Note that one exception that was found in this study was that the gap over the years between the personal and public expense gradually increases when compared to the published data provided by the Center of Aviation Safety Technology of the Civil Aviation Administration of China. This could reflect the fact that personal incomes in China are considerably increasing year by year.

By mean value we sorted the list of variables associated with the service products and travel experience perceived by the respondents. Table 1 presents the results of the sorted variables in a descending order. From the table, we can find that the mean values of the sixteen factors all are greater than 4. This clearly indicates that these considered factors in this study are important variables that were well appreciated by the consumers.

Table 1: Sorted Variables Concerning Service Quality Perceived By Respondents

Customer Need	N	Mean	St. D.
Flight Safety	280	6.39	.893
Direct Flight	280	5.99	1.155
Punctuality Rate	280	5.78	1.097
Cabin Environment	280	5.71	1.076
In-flight Service	280	5.67	1.043
Check-in Service	280	5.52	1.139
Food & Beverage Service	280	5.48	1.212
Airfare	280	5.44	1.368
Ground Service	280	5.36	1.301
Arrival & Luggage	280	5.29	1.437
Flight Routes & Choices	280	5.11	1.494
Airline Brand	280	4.85	1.523
Seat & Personal Space	280	4.82	1.283
Aircraft Model	280	4.70	1.464
Frequent Flyer Program	280	4.56	1.482
In-flight Entertainment Equipment	280	4.32	1.458

Surely everyone agreed that airfares should be a significant factor when air passengers choose airline services. But the airfare ranked in the middle of the list in this collected data. Surprisingly, the in-flight entertainment equipment was considered as the least important factor when associated with the perceived service quality. The order of the variables in Table 1 is somewhat different from the report published by the Center of Aviation Safety Technology of the Civil Aviation Administration of China. However, the overall findings in the collected data are again quite similar to the outcomes provided in the corresponding 2013 civil aviation passenger statistic data.

Table 2 shows the descriptive statistics of customer satisfaction from this study. The survey reveals that the customer satisfactions distribute mainly in the range between 4 and 6, with the mean of 5.16 and standard deviation of 1.123. Although it does not make sense to compare different studies conducted in different marketplaces (Aksoy et al., 2003), intuitively we see that Chinese airlines' services should keep improving their customer satisfaction by addressing these concerns raised by the air passengers. This is particularly critical for Chinese airlines to make their services competitive when they extend their services to the international marketplaces.

Table 2: Descriptive Analysis of Customer Satisfaction

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
1 Not satisfied at all	3	1.1	1.1	1.1
2 Dissatisfied	2	.7	.7	1.8
3 Somewhat dissatisfied	12	4.3	4.3	6.1
4 Neutral	50	17.9	17.9	23.9
5 Somewhat satisfied	105	37.5	37.5	61.4
6 Satisfied	79	28.2	28.2	89.6
7 Very satisfied	29	10.4	10.4	100.0
Sum	280	100.0	100.0	
Mean		5.16		
St. D.		1.123		

Exploratory Analysis and Critical Findings

Exploratory analysis of the targeted airline services

In order to explore the internal structure relationship among the sixteen factors in this study, we have to measure their internal consistency. We ran the Cronbach α coefficient test using IBM SPSS. The result showed that the Cronbach α coefficient was 0.853, which was much greater than 0.70. With such a coefficient of reliability, we confirmed that the collected data in this study could be reasonably employed in support of exploratory factor analysis. Through conducting the Kaiser-Myer-Olkin (KMO) and Bartlett's Test of Sphericity, we measured the strength of the relationship among variables. The tests showed that the value of KMO test was 0.776, which was also higher than the acceptable baseline value of 0.7. As for the Bartlett's test, the p-value was less than 0.001 (χ^2 =781.838), indicating that factor analysis could be well carried out.

Exploratory factor analysis was then applied to analyzing the collected data set. By extracting the common factors, we got the initial loading matrix for the data set. As we knew that there exists a strong correlation among those sixteen variables, we applied the Promax rotation algorithm to generate the final correlation matrix to analyze the principal factors, yielding the final five factors' loading matrix. The five extracted common factors accumulatively explained 72.331% of the total variance. It is in line with the general standard of sociology cumulative contribution rate of 63%. The rotated factor pattern matrix can be found in Table 3.

Table 3: The Pattern Matrix of the Collected Data

Variables	component				
	1	2	3	4	5
In-flight Service	.837				
Food and Beverage Service	.825				
Cabin Environment	.761				
Seat & Personal Space	.703				
Direct Flight		.860			
Flight Safety		.794			
Ground Service		.687			
Check-in Service			.909		
Punctuality Rate			.823		
Arrival & Luggage			.652		
Flight Routes & Choices			.572		
Aircraft Model				.715	
Frequent Flyer Program				.688	
Airline Brand				.567	
In-flight Entertainment Equipment				.532	
Airfare					.927
Extraction method: Principal Component. Rotation method: Promax					

Common Factor 1: Including in-flight service, the quality of food and beverage, cabin environmental comfort, seat & personal space. The combination of these variables mainly reflects the service quality of an airline service that is perceived by customers during flight. This common factor can be termed as "In-flight Comfort".

Common Factor 2: including direct flights, flight safety, and ground services. The combination of these three variables truly reflects customers' core need as they are directly related to travel convenience and security. Thus we call this common factor as "Flight Core Benefit".

Common Factor 3: including check-in service, punctuality rate, arrival & luggage service, and flight routes & choices. These variables are considerably related to customers' travel time variability and scheduling. We can name this common factor as "Travel Service and Flexibility".

Common Factor 4: including aircraft models, frequent flyer programs, airline brands, and in-flight entertainment equipment. Aircraft models and in-flight entertainment equipment are essentially the travel equipment perceived by customers. Brands and frequent flyer programs surely describe how the long term relationship between airlines and customers

might be built. We call this common factor as "Equipment and Relational Benefit".

Common Factor 5: including only airfares. This singular variable reflects customers' consideration of their trip affordability. It can be simply named as "Price".

The total explanation rate of the five dimensions that had contributed to the defined service quality in this study is 72.331%. On these five dimensions, except the "Price" dimension that is a single factor, the other four dimensions have more than three explanatory variables. Therefore, through conducting the reliability analysis for these four dimensions, we have had the Cronbach coefficients that respectively are 0.891, 0.853, 0.804 and 0.781. The reliability analysis exhibits that the reliability of these dimensions fully meets the needed statistical requirements for factor analysis.

Discriminant analysis by service dimensions

Regardless of what a service firm's products and services are, the level of customer satisfaction that the service firm can retain is often regarded as a key indicator of its success. Service firms must continuously satisfy their customers for long-term competitiveness. As the price and customer satisfaction so far are both measured by single items, we conduct discriminant analysis to identify key service dimensions.

As the Box's M value of 0.203 is greater than 0.05, we can not reject H0 that assumes overall covariance are equal, discriminant analysis is appropriate to use. We classify customer satisfaction into three groups, the first group with scores smaller than 4 (i.e., a group of dissatisfied customers), the second group with scores equal to 4 ((i.e., a group of neutral customers), and the third group with scores greater than 4 (i.e., a group of satisfied customers). In this discriminant analysis, the dependent variable is customer satisfaction classified into three groups, while the independent variables are 5 dimensional factors' scores discussed earlier. Table 4 is the analytical result, which illustrates two discriminant functions for each group.

Table 4: Structure Matrix of Airline Services

Structure matrix	Function	
	1	2
Price	.714*	-.233
Travel Service and Flexibility	.590*	.016
Equipment and Relational benefit	.143*	.457
Flight Core Benefit	-.064	.683*
In-flight Comfort	.244	.353*

Note: * indicates that the respective variable is significant at 0.05 level.

The order of entry into discriminant analysis in Table 4 essentially shows the relative importance of these five dimensional factors. The first function is statistically significant in terms of Wilk's Lambda test, and the variance accounting for the conducted discriminant analysis is 77.1%. The result points out that price, travel service and flexibility, and equipment and relational benefit have the stronger discriminatory power if Chinese air passengers are analyzed by classifying them into three satisfaction groups. The result is partially similar to ones found in the study about domestic airline market by Aksoy et al. (2003), in which price as the first entry dimension and travel service and flexibility as the second one had the stronger discriminatory power. Interestingly, equipment and relational benefit plays a critical role in retaining high level of customer satisfaction in China.

Conclusion and Discussion

Offering and delivering quality services to air passengers requires good understandings of customers' needs and their changing expectations. The objective of this research was to understand customers' expectations of airline services, determine essential service dimensions, and identify key dimensions impacting customer satisfaction throughout their entire travel experiences.

We first determined that Chinese air passengers' expectations span across 16 service areas. We then designed a questionnaire focusing on how air

passengers perceived their received services and what their opinions on these service areas were after they completed their trips. After we collected survey responses at one of main airports in China, we conducted exploratory analysis that showed 5 dimensional factors of airline services in the Yangtz River Delta region of China. Five dimensional factors are In-flight Comfort, Flight Core Benefit, Travel Service and Flexibility Price, Equipment and Relational Benefit, and Price. Further analysis indicated that Price, Travel Service and Flexibility Price, and Relational Benefit have stronger discriminatory power when air passengers were categorized into three satisfaction groups.

This paper provides some basic understandings of current Chinese airline services, which surely has valuable implications for Chinese airlines. For instance, airlines could enhance their dynamic pricing strategies. Appropriately pricing is a critical way to improve an airline's profit, but it also significantly impacts customer satisfaction. Chinese airlines should put more efforts on executing effective dynamic pricing as differential pricing and segmentation is widely adopted in many other service sectors. In addition, as air passengers have higher expectation for route choices and time flexibility when they travel by air, Chinese airlines should further optimize their flight schedules to better meet air passengers' needs. This becomes more critical than ever before as high-speed trains become much more convenient transport means among megacities in China.

Note that this study has certain limitations. First, as the surveys in this study were solely conducted at the Nanjing Lukou International Airport, the analytical results are surely limited. To fully understand airlines service across the Yangtz River Delta region, collecting responses from air passengers who arrive at Shanghai and Hangzhou Airports are necessary. If an airline in China would like to apply the findings to help improve its operations, customer data should be further enriched by collecting more responses from all main airports in China. Secondly, the research was completed from the customers' perspective. We should also study the identified problems from the employees' perspective. These areas become the natural choices of our future investigations.

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