

Using multiple correspondence cluster analysis to map the competitive position of airlines

Chieh-Hua Wen ^{a,*}, Wei-Ying Chen ^b

^a Department of Transportation Technology and Management, Feng Chia University, 100 Wenhwa Road, Seatwen, Taichung 40724, Taiwan, ROC

^b Institute of Traffic and Transportation, National Chiao Tung University, 4F, 114 Chung Hsiao W. Road, Sec. 1, Taipei 10012, Taiwan, ROC

A B S T R A C T

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Airlines can use market positioning to identify the major strengths and weaknesses of their services. The empirical analysis examines the international airlines operating on the Taipei–Tokyo and Taipei–Osaka routes. The multiple correspondence analysis results illustrate the relative positions of airlines, service attributes, and travelers' characteristics in a perceptual map. The cluster analysis clearly identifies two groups of airlines that compete on particular services. The findings suggest that each airline can simultaneously adopt strategies to maintain and enhance its current strengths and to strengthen attributes in which it is lacking.

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1. Introduction

The market positioning of a company can be improved by gaining insights on customers' perceptions of competitive products or brands. This study investigates competitive positioning of international air carriers by using a perceptual mapping approach to identify the specific strengths and weaknesses of airline services. Empirical data were collected from air travelers at Taiwan Taoyuan International Airport who had flown from Taipei to Tokyo and to Osaka.

2. Methodology

Airline service quality may influence the selection of an airline and related information can be used for positioning analysis. Wen et al. (2009) and Wen and Yeh (2010), for example, explored airline positioning using 18 service quality variables categorized as onboard amenity (e.g., comfort and spaciousness of seats, cleanliness on board), ground service (e.g., convenience of reservation and ticketing, queues at the check-in counter), flight safety and corporate image (e.g., flight safety record, customer complaint handling), and travel cost and time (e.g., price, convenience of flight schedule) and this study adds seat choice flexibility, reservation flexibility and accuracy, aircraft type, and dealing with lost or damaged luggage.

The study uses multiple correspondence analysis (MCA) to examine corporate positioning of two air routes. This allows simultaneous analysis of more than two categorical variables

(Greenacre, 2006) and produces a perceptual map indicating the relative positions of airlines, service attributes, and air travelers' characteristics, which uncovers travelers' perceptions of and preferences for particular airlines. The result of MCA involves subjective judgments with regard to which objects on the perceptual map ought to be grouped. To resolve this subjectivity and improve the interpretation of the perceptual map, cluster analysis is adopted to group airlines, service attributes, and travelers' characteristics.

3. Analysis

3.1. The data

Data were collected from air passengers who flew from Taipei to Tokyo and from Taipei to Osaka; routes were selected because of their large traffic volumes. Nine airlines operate on the Taipei–Tokyo route (China Airlines, EVA Airways, All Nippon Airways, Japan Asia Airways, Cathay Pacific Airways, American Airlines, Northwest Airlines, United Airlines, and Delta Air Lines) and six between Taipei–Osaka (China Airlines, EVA Airways, All Nippon Airways, Japan Asia Airways, Cathay Pacific Airways, and Northwest Airlines). Although American, Northwest, United, and Delta airlines also operate on these routes, they are excluded because most passengers use these airlines for transit purposes. Thus, only, China Airlines, EVA Airways, All Nippon Airways, Japan Asia Airways, and Cathay Pacific Airways are studied.

The survey instrument has a number of sections. In the first, information on respondents' previous international travel experiences was obtained. In the second, the perceived importance of airline attributes was measured using a seven-point Likert scale.

* Corresponding author. Tel.: +886 4 24517250; fax: +886 4 24520678.
E-mail address: chwen@fcu.edu.tw (C.-H. Wen).

Table 1
MCA result by air route.

Route	Dimension	Eigenvalue	Proportion explained	Cumulative proportion
Taipei–Tokyo	1	0.218	67.5%	67.5%
	2	0.117	19.6%	87.1%
	3	0.078	8.7%	95.8%
	4	0.054	4.2%	100.0%
Taipei–Osaka	1	0.251	66.6%	66.6%
	2	0.135	19.2%	85.8%
	3	0.088	8.2%	94.0%
	4	0.075	6.0%	100.0%

Thirdly, each service attribute was investigated in relation to each of the five airlines. Respondents were required to insert check marks to indicate which airlines, if any, performed well on the service attribute. The respondents could choose any number of airlines for each attribute. Finally, the respondents' background information regarding nationality, gender, age, occupation, education, and income is obtained.

The initial questionnaire included 25 airline service attributes. After the pilot survey, four service attributes with low average rating scores indicating importance were excluded from the final analysis. In April 2009, the main survey was conducted with 647 airline passengers at Taoyuan International Airport. After excluding invalid responses, the final number of respondents was 295 and 217 for the Taipei–Tokyo and Taipei–Osaka routes respectively.

The survey indicates that nearly half of the respondents were Taiwanese; the remaining respondents included foreign travelers from Japan, the US, and Canada. The percentage of male and female travelers was approximately equal. The largest age group in the sample was 26–35 years. Most of the respondents purchased their tickets through a travel agency. More than half of the respondents traveled in the economy class for tourism purposes. The respondents for both routes perceived "flight safety" to be the most important

attribute. They gave high scores to "dealing with loss and damage of luggage", "cleanliness on board", "airline image", and "handling of customer complaints", but rated "frequency of flights", "aircraft type", and "seat choice flexibility" as relatively unimportant.

3.2. Positioning for the Taipei–Tokyo route

MCA was initially used to produce perceptual maps on the basis of the respondents' perceived satisfaction with service attributes. The MCA result for the Taipei–Tokyo route shows that a one-dimensional solution accounts for 67.5% of the total explained variance, with an eigenvalue of 0.218 (Table 1). Further, a two-dimensional solution can add an additional 19.6% of the variance. To add a third dimension would only explain a further 8.7% of the variance; thus, the two-dimensional solution was adopted. A hierarchical cluster analysis, which used the coordinates produced by MCA, was applied to improve the interpretation of MCA. The optimal number of clusters was three. Finally, discriminant analysis was used to validate the cluster analysis result. The correct rate was 97.1%, which indicated a highly reliable result.

The perceptual map generated by MCA is illustrated in Fig. 1. The percentage of variance explained by each attribute can be used to interpret both dimensions. The farther an attribute is from zero in a given dimension, the more important that attribute is in explaining that dimension. The first dimension, "safety and price," is the horizontal dimension of the plane; "flight safety records" and "airline ticket price" are far from zero in this dimension and are therefore the most important aspects of "safety and price." The vertical dimension, "flight attendants' attitudes and seating comfort," has "flight attendants' attitudes" as its highest point and "seating comfort" as its lowest point. Although "flight safety records" was located lower than "seating comfort", it had already been used to explain the first dimension.

The cluster analysis identifies groups of airlines that compete on particular service attributes associated with their groups. The first

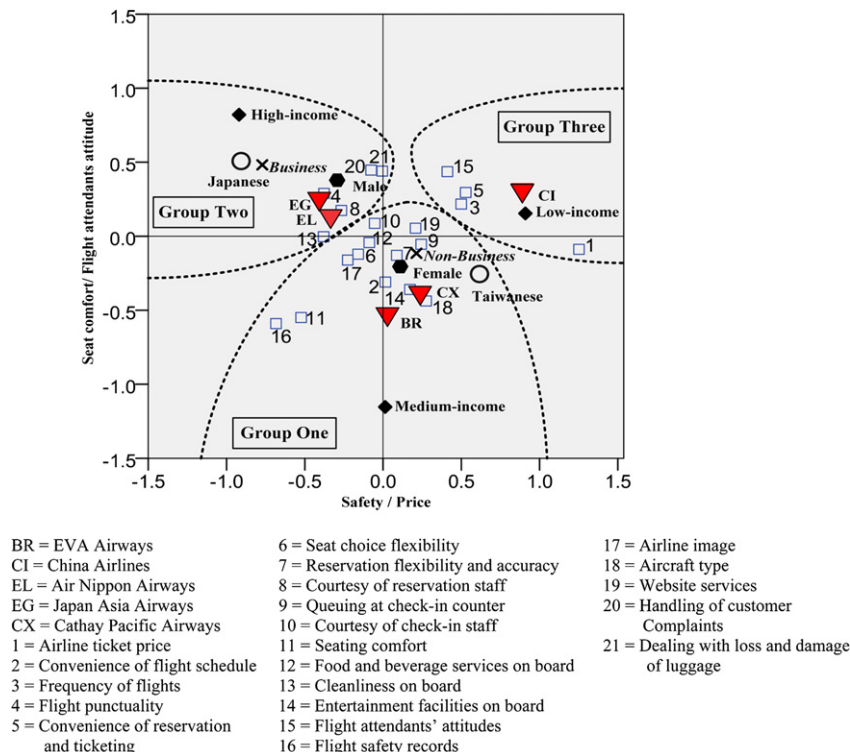


Fig. 1. Airline positioning for the Taipei–Tokyo route.

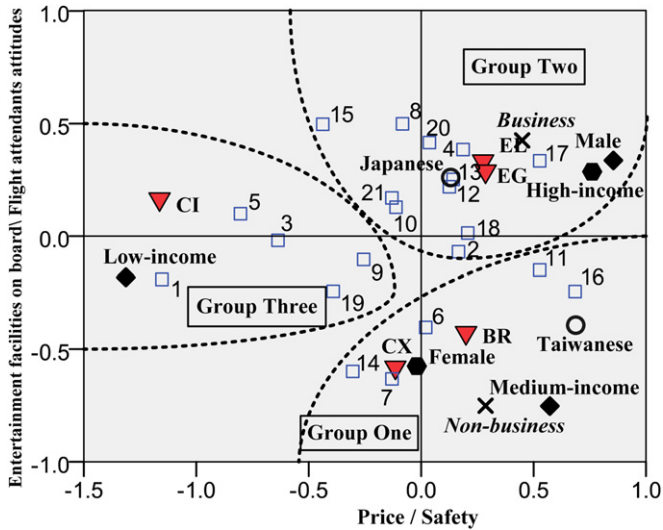


Fig. 2. Airline positioning for the Taipei–Osaka route.

group of airlines comprises EVA and Cathay Pacific Airways. The group that comes a close second comprises two Japanese carriers, Japan Asia Airways and Air Nippon Airways. Every airline is in close competition with the other airline in its group. Passengers in the same cluster expect these companies to deliver similar levels of services. China Airlines has a unique position that differs significantly from other airlines.

EVA and Cathay Pacific Airways outperform other airlines with regard to many service attributes. The dominant attributes of EVA Airways, for example, are “seating comfort” and “flight safety records”. Cathay Pacific Airways performs well on “entertainment facilities on board” and “aircraft type”. This group’s major customers are Taiwanese, females, middle-income, and non-business travelers. In addition to maintaining or enhancing their strengths, both companies can strive to improve relatively poor services, such as “loss and damage of luggage” and “flight attendants’ attitudes”.

Both Japan Airways and Air Nippon Airways are Japanese companies. Japan Airways, in particular, is excellent in terms of “flight punctuality”. Air Nippon Airways demonstrates good performance with “courtesy of reservation staff” and “cleanliness on board”. Both companies also perform well when dealing with special cases, such as “handling of customer complaints” and “dealing with loss and damage of luggage”. These Japanese carriers are preferred by Japanese, high-income, and business travelers. To attract potential customers, these airlines can develop strategies to correct their weaknesses, such as “frequency of flights”, “convenience of reservation and ticketing”, and “airline ticket price”.

China Airlines scored unusually well in terms of “airline ticket price”, “frequency of flights”, “convenience of reservation and ticketing”, and “flight attendants’ attitudes”. Customers who opted for China Airlines were mainly low-income travelers. China Airlines can improve service attributes that their customers regard as weaknesses, such as “flight safety” and “seating comfort”.

3.3. Positioning for the Taipei–Osaka route

The MCA result for the Taipei–Osaka route shows that a one-dimensional solution can explain 66.6% of the total explained

variance and a two-dimensional solution can explain another 19.2% (Table 1). The two-dimensional solution was adopted because the three-dimensional solution would have only explained an additional 8.2% of the variance. Using the coordinates produced by MCA, a hierarchical cluster analysis suggested a three-cluster solution. Discriminant analysis validated the highly reliable results (correct rate was 100%) of the cluster analysis.

Fig. 2 illustrates the MCA perceptual map for the Taipei–Osaka route. The horizontal dimension, “price and safety,” has “airline ticket price” and “flight safety” at its extremes. The vertical dimension, “flight attendants’ attitudes” and “entertainment facilities on board”, has “flight attendants’ attitudes” as its highest point and “entertainment facilities on board” as its lowest point. Cluster analysis placed EVA and Cathay Pacific Airways in one group and Japan and Air Nippon Airways in another. China Airlines had a unique position. The groups for the Taipei–Osaka route have the same membership as the groups for the Taipei–Tokyo route.

The first group comprises EVA and Cathay Pacific Airways, with the majority of customers being Taiwanese, females, middle-income, and non-business travelers. The dominant attributes of EVA Airways are “seat choice flexibility”, “seating comfort”, and “flight safety records”. Cathay Pacific Airways excels in “reservation flexibility and accuracy” and “entertainment facilities on board”. In the second group, two Japanese airlines share numerous attributes in this route and attract Japanese, business executives, males, and high-income travelers. Japan Airways, for example, excelled at “convenience of flight schedule” and “aircraft type”. Air Nippon Airways scored well with respect to “courtesy of reservation staff”, “handling of customer complaints”, and “flight punctuality”. China Airlines performed well with regard to “airline ticket price”, “frequency of flights”, “convenience of reservation and ticketing”, “queuing at check-in counter”, and “website services”. Most customers of China Airlines are low-income travelers.

4. Conclusions

The results of looking at Taipei–Tokyo and Taipei–Osaka international air routes indicate the existence of two multi-airline grouping on each route. Each airline company can adopt two competitive strategies simultaneously: it can strive to maintain and enhance its current strengths, and strengthen the attributes in which it is lacking.

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