AIRLINES' COMPETITIVE POSITIONING USING MULTIPLE CORRESPONDENCE CLUSTER ANALYSIS

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ABSTRACT

The recent recession of the world economy has substantially decreased the number of international air travellers and has forced many airline companies to cease business operations. Airline companies can use market positioning to identify major strengths and weaknesses within their services. This paper integrates multiple correspondence analysis with cluster analysis to study airline positioning. The multiple correspondence analysis illustrates the relative positions of airlines, service attributes, and travellers' characteristics in a perceptual map. The cluster analysis clearly identifies groups of airlines that compete on particular service attributes associated with these groups. This study empirically examines the international airlines serving the Taipei-Tokyo and Taipei-Osaka routes and collects data from air travellers with diverse cultural backgrounds. The competitive positions of five airlines can be shown on a two-dimensional map. Two Japanese carriers, Japan Asia and Air Nippon Airways, are close to each other on the perceptual map; these companies mostly attract Japanese, male, high-income, and business travellers. Another pair of competitors includes Eva and Cathay Pacific Airways; most of their customers are Taiwanese, female, middle-income, and non-business travellers. China Airlines has a unique position on the map, because it has set a lower ticket price than other airlines; its core customers are low-income travellers. These results suggest managerial strategies that confer distinct competitive advantages for this market.

Keywords: airline; service quality; multiple correspondence analysis; cluster analysis

1. INTRODUCTION

A recent global recession, a shrinking market, and intense competition threaten the survival of airline companies. To maintain ridership, revenue, and profits, each air carrier must position its brand according to its unique strengths, weaknesses, and situation. Market positioning can gain insights on customers' perceptions of competitive products or brands. For airlines, proper marketing and operational strategies should be developed and implemented to serve the market more effectively than competitors.

Positioning analysis has had extensive applications to the field of marketing research, and has recently received considerable attention from airlines (*e.g.*, Gursoy *et al.*, 2005; Surovitskikh and Lubbe, 2008; Wen *et al.*, 2009; Wen and Yeh, 2010). Positioning analysis often uses a perceptual map to identify the relative positions of competitive products or brands. Correspondence analysis (CA) is one of the most commonly used mapping techniques because its data requirement is convenient and interpretation is fairly straightforward. Although simple CA can analyze the relationship between two categorical variables, (*e.g.*, airline and service attributes), it cannot accommodate multiple categorical variables, (*e.g.*, travellers' socioeconomic and trip characteristics), that may be associated with travellers' airline choices. Multiple correspondence analysis (MCA) is a generalization of simple CA that can explore multiple categorical variables simultaneously. However, both simple CA and MCA involve subjective judgments with regard to which objects on the map ought to be considered as groups. This subjectivity can be palliated by cluster analysis, which can group objects explicitly to improve the interpretation and behavioural understanding of the perceptual map.

The objective of this paper is to combine MCA and cluster analysis to investigate competitive positioning for international air carriers. Empirical data was collected from air travellers who had flown from Taipei to Tokyo and from Taipei to Osaka in the Taiwan Taoyuan International Airport. SPSS V17.0 was used for MCA and cluster analysis. The results identify the specific strengths and weaknesses of the five relevant air carriers.

2. METHODOLOGY

2.1. Airline service quality

Air travellers' perceptions of service attributes may influence their selection of an airline; studies of consumer perceptions can inform corporate plans for positioning. Recently, Wen *et al.* (2009) explored international airlines' service quality variables and categorized 18 service into four underlying factors: 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).

Airlines can use market positioning to identify major strengths and weaknesses within their services.

While the aforementioned studies identified numerous service attributes, compared to earlier articles (*e.g.*, Alamdari, 1999; Chang and Yeh, 2002; Park *et al.*, 2004), this study adds four attributes: seat choice flexibility, reservation flexibility and accuracy, aircraft type, and dealing with lost or damaged luggage. Table 1 presents a summary of service attributes used in the present study.

2.2. Multiple correspondence analysis

Corporate positioning often uses perceptual mapping to analyze products or services (Kohli and Leuthesser, 1993). Multivariate statistical methods, such as CA and multidimensional scaling, can be applied to produce perceptual maps for positioning (Myers, 1996). Although the two approaches can produce similar perceptual maps, CA has advantages over multidimensional scaling. Data collection for CA is fairly simple and fast because the researcher only needs to place a check mark by each attribute to specify whether the attribute can describe a specific product or service; respondents do not need to rate each attribute. For simple CA, a cross-tabulation of the two categorical variables (*i.e.*, a two-way contingency table) produces a perceptual map (Greenacre, 1984).

The present study does not use simple CA, because, while simple CA could have revealed relationships between airlines, between service attributes, and between airlines and service attributes, simple CA can only cope with two categorical variables. The present study does use MCA, also known as homogeneity analysis, because MCA allows simultaneous analysis of more than two categorical variables (Greenacre, 2006). The data input for MCA is a multi-way contingency table of multiple categorical variables. The perceptual map produced by MCA can indicate the relative positions of airlines, service attributes, and air travellers' characteristics, which may be associated with travellers' perceptions of and preferences for particular airlines.

2.3. Cluster analysis and discriminant analysis

MCA allows simultaneous exploration of multiple categorical variables; MCA can display objects in a perceptual map. Such a map can only be interpreted after some judgement has been made concerning which objects can be grouped together. Cluster analysis can unambiguously categorize objects without the need for subjective judgements (Lebart, 1994; Marshall and Bell, 2003; Calisir and Gumussoy, 2008). Thus, this research has adopted cluster analysis to identify which airlines compete with each other, and which service attributes distinguish them.

Cluster analysis is a classification technique that can group objects according to their characteristics. This approach maximizes both the homogeneity of objects within a cluster and the heterogeneity between the clusters. Two main types of clustering methods are extensively used: hierarchical methods and non-hierarchical methods (Hair *et al.*, 2006). The

hierarchical clustering method was chosen in our study for its ability to work effectively with qualitative variables.

Hierarchical clustering must use a clustering procedure. Four commonly used clustering procedures are single linkage, complete linkage, average linkage, and Ward's method (Punj and Stewart, 1983). This study applies Ward's method which is the most frequently used hierarchical clustering procedure because it has a tendency to produce clusters of approximately equal size (Myers and Mullet, 2003). The result of Ward's method produces a hierarchical map; a dendrogram specifies the best cut of that map at a particular height for determining the number of clusters; the largest change in fusion levels corresponds to the best cut (Everitt *et al.*, 2001).

Discriminant analysis resembles regression analysis in that it uses a group of independent variables to predict dependent variables. This study validates its cluster analysis by discriminant analysis.

3. EMPIRICAL RESULTS

3.1. Data collection

The survey instrument for this study had four sections. The first section obtained information regarding respondents' previous international travel experiences. The second section measured the perceived importance of airline attributes, using a 7-point Likert scale with a range from 1 (least important) to 7 (most important). The third section asked about each of the service attributes in relation to each of the 5 airlines; for each service attribute, there were five spaces with names of the airlines. Respondents were required to put check-marks to indicate which airlines, if any, performed well on the service attribute. The respondents can choose any number of airlines for each attribute. The fourth section obtained the background information of respondents (*i.e.*, nationality, gender, age, occupation, education, income, and marital status).

Empirical data was collected from air passengers who had flown from Taipei to Tokyo and from Taipei to Osaka. The Taipei-Tokyo and Taipei-Osaka routes were selected for their large number of air passengers. The Taipei to Tokyo route has 9 airlines: China Airlines, EVA airways, All Nippon Airways, Japan Asia Airways, Cathay Pacific Airways, American Airlines, Northwest Airlines, United Airlines, and Delta Airlines. The Taipei-Osaka route has 6 airlines: China Airlines, EVA airways, All Nippon Airways, Japan Asia Airways, Cathay Pacific Airways, and Northwest Airlines. Although American, Northwest, United, and Delta Airlines also service these routes, they have been excluded from this study because most passengers use these airlines for transit purposes. Thus, only five airlines, China Airlines, EVA airways, All Nippon Airways, Japan Asia Airways, and Cathay Pacific Airways, were chosen for study.

In April 2009 at Taoyuan International Airport, 72 travellers from and to Tokyo were asked about 25 service attributes. That initial survey showed that four service attributes had low

average importance rating scores; those attributes were excluded from the final study. The final survey form included the 21 airline service attributes listed in Table 1. Before the end of April 2009, a formal survey was conducted with 647 airline passengers. 352 questionnaires were given to travellers from Taipei to Tokyo; final analysis was based on 295 valid questionnaires (*i.e.*, a response rate of 83%). 257 questionnaires were given to travellers from Taipei to Osaka; 217 returned forms were valid (*i.e.*, the response rate was 84%).

3.2. Data analyses

Tables 2 and 3 summarize the socioeconomic and trip profiles for the Taipei-Tokyo route. 51.2% of respondents were Taiwanese (51.2%); the remaining 48.8% were categorized as foreign (48.8%); foreign respondents included Japanese (96%), Canadian (2%), and U.S. (2%) travellers. 52.9% of all respondents were male. The largest age group in the sample was the "26 to 35 years old" group (37.6%). Occupations were concentrated in business and service industries (47.5%). 71.5% of the respondents had a college education. 33.6% of the respondents reported personal monthly incomes over US$2,700. The marital status of most respondents was "married" (54.9%). Most had already travelled to Tokyo 1-3 times (75.6%), and 66.1% of all respondents had purchased their tickets through a travel agency. Most passengers were economy-class customers (91.2%). 64.1% of respondents travelled this route for tourism. 44.4% of respondents travelled with a tour group; 55.6% were self-service travellers who did not rely on any tour group.

Tables 4 and 5 summarize the socioeconomic and trip profiles for the Taipei-Osaka route. Non-Taiwanese respondents included travellers from Japan (99%) and U.S. (1%); 51.6% of all respondents were from Taiwan. 51.2% of Taipei-Osaka travellers were male; the most populous age group was the "26 to 35 years old" (34.4%) group. Most respondents worked in business or service industries (44.7%), and 72.6% possessed a college education. 34.5% of the respondents reported personal monthly incomes of US$300-900. The marital status of most was "married" (51.6%). Most had already travelled to Osaka 1-3 times (89.3%), and 63.3% of the respondents had purchased their tickets through a travel agency. Most passengers were economy-class customers (93.5%). 74.4% of respondents travelled this route for tourism, and 51.6% were self-service travellers who chose to travel alone.

Table 6 reports the means and ranks of 21 service attributes in the Taipei-Tokyo route. The scores used a 7-point Likert scale that ranged from 1 (least important) to 7 (most important). The attributes were ranked from 1 to 21 (greatest to least importance). Taiwan and non-Taiwanese respondents both perceived flight safety (V16) to be the most important attribute. Taiwanese travellers gave high scores to cleanliness on board (V13) and airline image (V17). Non-Taiwanese travellers paid more attention to services, such as cleanliness on board (V13), handling of customer complaints (V20), and dealing with loss and damage of luggage (V21). However, non-Taiwanese travellers rated airline ticket price (V1) and convenience of flight schedule (V2) as relatively important.

Table 7 reports the means and ranks of 21 service attributes in the Taipei-Osaka route. Both Taiwanese and non-Taiwanese travellers on this route regarded flight safety (V16) as the

most important attribute. Taiwanese travellers gave high scores to handling of customer complaints (V20) and dealing with loss and damage of luggage (V21). Non-Taiwanese travellers were interested in airline image (V17), but otherwise many of their priorities resembled those of Taiwanese travellers.

3.3. Multiple correspondence cluster analysis

3.3.1 The Taipei-Tokyo route

Table 8 shows that a one-dimensional solution accounts for 67.5% of the total explained variance (proportion of inertia), and a two-dimensional solution can account for a further 19.6%; thus two dimensions suffice for 87.1% of the total explained variance, with a singular value of 0.117. To add a third dimension would only explain a further 8.7% of inertia; thus, the two-dimensional solution was adopted. To improve the interpretation of MCA, a hierarchical cluster analysis, which used the X and Y coordinates produced by MCA, was applied. The optimal number of clusters was three. Finally, discriminant analysis was used to validate the result of cluster analysis. The correct rate was 97.1%, which indicated a highly reliable result.

The perceptual map generated by MCA is illustrated in Figure 1. The percentage of variance explained by each attribute can be used to interpret the two dimensions. The farther an attribute is from zero in a given dimension, the more important that attribute is to the explanation of that dimension. The first dimension, "safety and price," is the horizontal dimension of the plane; flight safety records (V16) and airline ticket price (V1) are far from zero in this dimension, and therefore are the most important aspects of "safety and price." The vertical dimension, "flight attendants' attitudes and seating comfort," has flight attendants' attitudes (V15) as its highest point, and seating comfort (V11) as its lowest point. Although the location of V16 was lower than V11, V16 had already been used to explain the first dimension.

The cluster analysis identifies groups of airlines that compete on particular service attributes associated with these groups. The first group of airlines is comprised of Eva and Cathay Pacific Airways (BR and CX). The second closely competitive group is a pair of Japanese carriers, Japan Asia Airways and Air Nippon Airways (EG and EL). Each airline in a group competes closely against the other airlines in its group. Passengers in the same cluster consider that these companies deliver similar levels of services. China Airlines (CI) has a unique position, far away from other airlines.

The dominant attributes of Eva Airways are seating comfort (V11) and flight safety records (V16). Cathay Pacific Airways performs well on entertainment facilities on board (V14) and aircraft type (V18). The major customers of this group are Taiwanese, female, middle-income and non-business travellers. Japan Airways and Air Nippon Airways are both Japanese companies. Japan Airways is excellent in terms of flight punctuality (V4) and attracts males and business travellers. Air Nippon Airways demonstrates good performance with courtesy of reservation staff (V8) and cleanliness on board (V13). These two air companies perform well

in dealing with special cases, such as handling of customer complaints (V20) and dealing with loss and damage of luggage (V21). These Japanese carriers are preferred by Japanese travellers, high-income travellers, and business customers. China Airlines scored unusually well in airline ticket price (V1), frequency of flights (V3), convenience of reservation and ticketing (V5), and flight attendants' attitudes (V15). Customers who take China Airlines were mainly low-income travellers.

3.3.2 The Taipei-Osaka route

Table 9 showed that a one-dimensional solution can explain 66.6% of the total explained variance (proportion of inertia), and a two-dimensional solution can explain another 19.2%, with a singular value of 0.135. The two-dimensional solution was adopted because the three-dimensional solution's inertia would have only explained an additional 8.2%.

Using the coordinates produced by MCA, a hierarchical cluster analysis suggested a three-cluster solution. Discriminant analysis validated the results of the cluster analysis. The correct rate was 100%, indicating a highly reliable result. Figure 2 illustrates the MCA perceptual map for the Taipei-Osaka route. The horizontal dimension, "price and safety," has V1 and V16 as its extremes. The vertical dimension, "flight attendants' attitudes and entertainment facilities on board," has flight attendants' attitudes (V15) as its highest point, and entertainment facilities on board (V14) as its lowest point.

Cluster analysis put Eva and Cathay Pacific Airways in one group, and Japan and Air Nippon Airways in another group. 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. In the first group, the dominant attributes of Eva Airways are seat choice flexibility (V6), seating comfort (V11), and flight safety records (V16). Cathay Pacific Airways excels in reservation flexibility and accuracy (V7) and entertainment facilities on board (V14), with the majority of customers being Taiwanese, female, middle-income, and non-business travellers.

In the second group, Japan Airways excelled at convenience of flight schedule (V2) and aircraft type (V18). Air Nippon Airways scored well with respect to courtesy of reservation staff (V8) and handling of customer complaints (V20). Both were adept at special traits, such as food and beverage services on board (V12) and cleanliness on board (V13). Additionally, both airlines attracted business travellers with excellent flight punctuality (V4); male and high-income travellers also preferred these companies.

China Airlines performed well with regard to airline ticket price (V1), frequency of flights (V3), convenience of reservation and ticketing (V5), queuing at check-in counter (V9), and website services (V19). Most of China Airlines' customers are low-income travellers.

3.4. MANAGERIAL IMPLICATIONS

This study explains the Taipei-Tokyo and Taipei-Osaka markets by a combination of MCA and cluster analysis. Simple CA cannot relate travellers' characteristics and their airline

preferences. MCA can explain the relationships between airlines, attributes, customer socioeconomic characteristics, and trip characteristics.

Most perceptual maps produced by MCA require subjective interpretations of the relationships between objects. This study has applied hierarchical cluster analysis to classify five airlines as three clear-cut groups with explicitly delineated service characteristics: Eva and Cathay Pacific Airways are in one group, Japan and Air Nippon Airways are in a second group, and China Airlines is in a third group. In all three market niches, each company has two methods of competition: the company can seek to maintain and enhance its current strengths, and the company can seek to strengthen attributes that are currently weak. These two strategies can be pursued simultaneously.

Table 10 summarizes the airline strengths and customer traits by the two routes. Eva Airways performs well on both routes with regard to seat choice flexibility (V6), seating comfort (V11), and flight safety records (V16). Cathay Pacific Airways excels in reservation flexibility and accuracy (V7) and entertainment facilities on board (V14); most Cathay Pacific Airways customers are from the Taiwanese, female, middle-income, and non-business categories. Eva Airways outperforms Cathay Pacific Airways in seating comfort (V11) and flight safety records (V16) on the Taipei-Tokyo route; Eva Airways attracts Taiwanese, female, middle-income, and non-business travellers. Both airlines offer good seating comfort (V11), and should either maintain or enhance this strength. Both companies should seek to improve relatively poor services, such as dealing with loss and damage of luggage (V21) and flight attendants' attitudes (V15).

Air Nippon Airways has good performance on courtesy of reservation staff (V8), cleanliness on board (V13), handling of customer complaints (V20), and dealing with loss and damage of luggage (V21). Japan Airways performs well on flight punctuality (V4), handling of customer complaints (V20), and dealing with loss and damage of luggage (V21). These two airlines attract Japanese, male, high-income and business travellers. These airlines can seek to maintain and to improve their strengths, such as flight punctuality (V4); they can seek to correct their weaknesses, such as frequency of flights (V3), convenience of reservation and ticketing (V5), and airline ticket price (V1).

China Airlines has unique strengths, including airline ticket price (V1), frequency of flights (V3), and convenience of reservation and ticketing (V5). Customers who take China Airlines are mainly low-income travellers. China Airlines can seek to improve service attributes that their customers regard as weaknesses, such as flight safety (V16) and seating comfort (V11).

4. CONCLUSIONS

This research collected data on the Taipei-Tokyo and Taipei-Osaka international air routes and used 21 service attributes to compare the relative positions of air carriers. MCA was applied to create perceptual maps on which airlines were grouped according to their key strengths and weaknesses. This study combined MCA and cluster analysis to explore the

relationships among airlines, as well as their service attributes and the characteristics of their customers. The results from the analysis produced two multi-airline groups: Eva and Cathay Pacific Airways comprised one group; Japan and Air Nippon Airways comprised the other group. China Airlines occupied a unique position, far removed from the other airlines. The managerial implications of these three market niches were explained with regard to the five relevant companies.

This research collected data on only two international air routes, and inferences drawn from this data cannot readily be generalized to other routes. Different international air routes may have distinct marketing characteristics. Future research may apply our methodology to a larger number of air routes.

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Table 1 – Airlines service attributes

Attributes	**Alamdari (1999)**	**Chang and Yeh (2002)**	**Park (2004)**	**Wen *et al.* (2009)**
1. Airline ticket price	◆	◆	◆	◆
2. Convenience of flight schedule	◆	◆	◆	◆
3. Frequency of flights				◆
4. Flight punctuality	◆	◆	◆	◆
5. Convenience of reservation and ticketing			◆	◆
6. Seat choice flexibility			◆	
7. Reservation flexibility and accuracy			◆	
8. Courtesy of reservation staff			◆	◆
9. Queuing at check-in counter			◆	◆
10. Courtesy of check-in staff		◆	◆	◆
11. Seating comfort	◆	◆	◆	◆
12. Food and beverage services on board		◆	◆	◆
13. Cleanliness on board		◆		◆
14. Entertainment facilities on board	◆		◆	◆
15. Flight attendants' attitudes	◆	◆	◆	◆
16. Flight safety records	◆	◆	◆	◆
17. Airline image	◆		◆	◆
18. Aircraft type	◆			
19. Website services				◆
20. Handling of customer complaints		◆	◆	◆
21. Dealing with loss and damage of luggage		◆	◆	

Table 2 – Socio-economic profiles of the respondents in Taipei-Tokyo route

Socio-economic characteristics	Percent
Nationality	
Taiwanese	51.2
Non-Taiwanese	48.8
Gender	
Male	52.9
Female	47.1
Age	
Under 25	18.0
26-35	37.6
36-45	18.0
46-55	12.5
56-65	11.9
Over 66	2.0
Occupation	
Business/service	47.5
Student	12.5
Government employee	7.5
Self-employed	11.2
House wife	8.5
Retired	1.0
Other	12.8
Education background	
6 years	0.7
9 years	2.4
12 years	13.9
College (12+ years)	71.5
Graduate (16+ years)	11.5
Monthly income	
Less than US$300	14.2
US$300-900	17.3
US$900-1500	13.9
US$1,500-2,100	10.5
US$2,100-2,700	10.5
More than US$2,700	33.6
Marital status	
Single	45.1
Married	54.9

Table 3 – Trip profiles of the respondents in Taipei-Tokyo route

Trip characteristics	Percent
How many times have you been to Taipei/Tokyo?	
1-3 times	75.6
4-6 times	10.2
7-9 times	3.7
More than 10 times	10.5
What was the purpose of your most recent Taipei-Tokyo trip?	
Business	29.5
Sightseeing	64.1
Visiting family/friends	2.4
Other	4.0
How did you tour Taipei/Tokyo?	
With a tour group	
Self-service travel	44.4
What class was your seat on the plane?	55.6
First class	
Business class	0.7
Economy	8.1
How did you purchase the airline ticket?	91.2
Online	
Travel agent	21.4
Other	66.1
	12.5

Table 4 – Socio-economic profiles of the respondents in Taipei-Osaka route

Socio-economic characteristics	Percent
Nationality	
Taiwanese	51.6
Non-Taiwanese	48.4
Gender	
Male	51.2
Female	48.8
Age	
Under 25	26.0
26-35	34.4
36-45	17.2
46-55	12.1
56-65	8.8
Over 66	1.5
Occupation	
Business/service	44.7
Student	20.0
Government Employee	6.0
Self-employed	7.4
House Wife	8.4
Retired	2.8
Other	9.7
Education background	
9 years	2.8
12 years	8.8
College (12+ years)	72.6
Graduate (16+ years)	15.8
Monthly income	
Less than US$300	17.7
US$300-900	34.5
US$900-1500	21.0
US$1,500-2,100	15.8
US$2,100-2,700	5.6
More than US$2,700	1.4
Marital status	
Single	48.4
Married	51.6

Table 5 – Trip profiles of the respondents in Taipei-Osaka route

Trip characteristics	Percent
How many times have you been to Taipei/Osaka?	
1-3 times	89.3
4-6 times	7.0
7-9 times	0.5
More than 10 times	3.2
What was the purpose of your most recent Taipei-Osaka trip?	
Business	20.9
Sightseeing	74.4
Visiting family/friends	1.4
Other	3.3
How did you tour Taipei/Osaka?	
With a tour group	
Self-service travel	48.4
What class was your seat on the plane?	51.6
First class	
Business class	1.4
Economy	5.1
How did you purchase the airline ticket?	93.5
Online	
Travel agent	27.0
Other	63.3
	9.7

Table 6 – Mean scores and rank of the service attributes in Taipei-Tokyo route

Attributes	Taiwanese		Non-Taiwanese		Total	
	Mean	**Rank**	**Mean**	**Rank**	**Mean**	**Rank**
1. Airline ticket price	5.60	18	5.58	5	5.59	11
2. Convenience of flight schedule	5.66	16	5.33	9	5.50	13
3. Frequency of flights	4.87	21	4.80	18	4.84	20
4. Flight punctuality	6.13	8	4.96	15	5.56	12
5. Convenience of reservation and ticketing	5.65	17	5.12	13	5.39	16
6. Seat choice flexibility	5.67	15	4.74	19	5.21	18
7. Reservation flexibility and accuracy	5.89	13	4.93	16	5.42	15
8. Courtesy of reservation staff	6.11	9	5.47	6	5.80	8
9. Queuing at check-in counter	6.05	11	5.15	12	5.61	10
10. Courtesy of check-in staff	6.09	10	5.41	8	5.76	9
11. Seating comfort	6.21	6	5.47	6	5.85	6
12. Food and beverage services on board	5.91	12	5.29	10	5.61	10
13. Cleanliness on board	6.32	2	5.69	3	6.01	3
14. Entertainment facilities on board	5.70	14	5.03	14	5.37	17
15. Flight attendants' attitudes	6.17	7	5.44	7	5.81	7
16. Flight safety records	6.78	1	6.14	1	6.47	1
17. Airline image	6.30	3	5.65	4	5.98	4
18. Aircraft type	5.30	20	4.84	17	5.07	19
19. Website services	5.58	19	5.28	11	5.44	14
20. Handling of customer complaints	6.22	5	5.69	3	5.96	5
21. Dealing with loss and damage of luggage	6.29	4	6.00	2	6.15	2

Table 7 – Mean scores and rank of the service attributes in Taipei-Osaka route

Attributes	Taiwanese		Non-Taiwanese		Total	
	Mean	**Rank**	**Mean**	**Rank**	**Mean**	**Rank**
1. Airline ticket price	5.78	12	5.61	8	5.70	11
2. Convenience of flight schedule	5.48	18	5.46	12	5.47	15
3. Frequency of flights	4.60	20	4.91	16	4.75	20
4. Flight punctuality	5.95	10	5.35	14	5.66	12
5. Convenience of reservation and ticketing	5.71	14	5.47	11	5.60	13
6. Seat choice flexibility	5.52	17	4.88	19	5.21	18
7. Reservation flexibility and accuracy	5.77	13	4.90	17	5.35	17
8. Courtesy of reservation staff	6.01	9	5.43	13	5.80	9
9. Queuing at check-in counter	5.94	11	5.53	10	5.74	10
10. Courtesy of check-in staff	6.12	7	5.59	9	5.86	8
11. Seating comfort	6.11	8	5.73	6	5.93	7
12. Food and beverage services on board	5.78	12	5.61	8	5.70	11
13. Cleanliness on board	6.36	4	5.82	5	6.10	5
14. Entertainment facilities on board	5.56	16	5.29	15	5.43	16
15. Flight attendants' attitudes	6.25	6	5.70	7	5.99	6
16. Flight safety records	6.79	1	6.93	1	6.86	1
17. Airline image	6.26	5	6.08	3	6.17	4
18. Aircraft type	5.41	19	4.89	18	5.16	19
19. Website services	5.66	15	5.43	13	5.55	14
20. Handling of customer complaints	6.44	3	6.03	4	6.24	3
21. Dealing with loss and damage of luggage	6.48	2	6.37	2	6.43	2

Table 8 – Proportions of inertia according to MCA for Taipei-Tokyo route

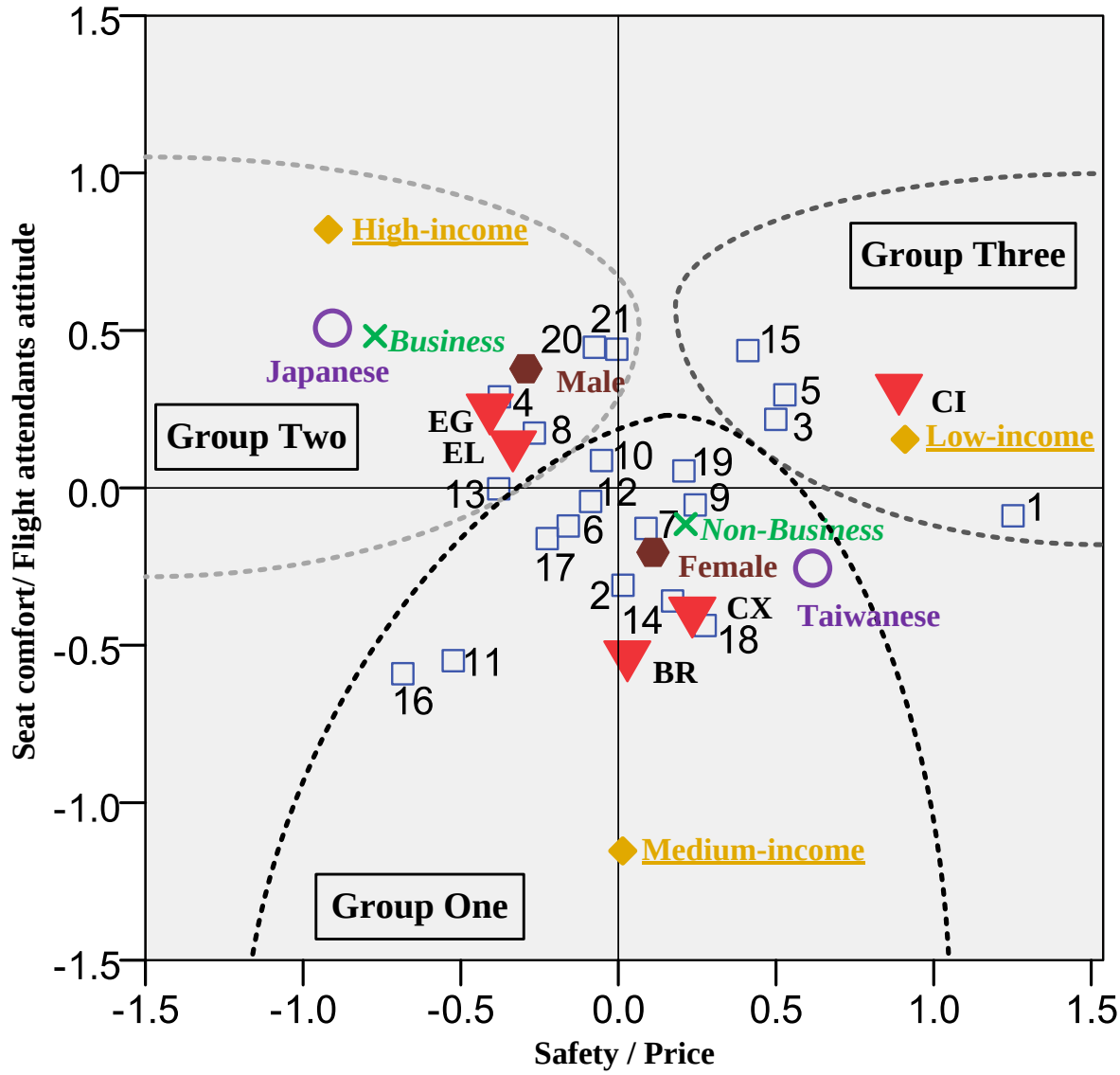
Dimension	Singular value	Accounted for proportion of inertia (%)	Cumulative proportion of inertia (%)
1	0.218	67.5	67.5
2	0.117	19.6	87.1
3	0.078	8.7	95.8
4	0.054	4.2	100.0

Table 9 – Proportions of inertia according to MCA for Taipei-Osaka route

Dimension	Singular value	Accounted for proportion of inertia (%)	Cumulative proportion of inertia (%)
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

Table 10 – Comparison of service attributes and travellers' characteristics on two routes

Airlines	**Taipei-Tokyo**	**Taipei-Osaka**
Eva Airways	Convenience of flight schedule (V2) Seat choice flexibility (V6) Reservation flexibility and accuracy (V7) Queuing at check-in counter (V9) Courtesy of counter-in staff (V10) Seating comfort (V11) Food and beverage services on board (V12) Flight safety records (V16) Airline image (V17) Website services (V19) **Taiwanese, female, middle-income, non-business**	Seat choice flexibility (V6) Seating comfort (V11) Flight safety records (V16) **Taiwanese, female, middle-income, non-business**
China Airlines	Airline ticket price (V1) Frequency of flights (V3) Convenience of reservation and ticketing (V5) Flight attendants' attitudes (V15) **Low-income**	Airline ticket price (V1) Frequency of flights (V3) Convenience of reservation and ticketing (V5) Queuing at check-in counter (V9) Website services (V19) **Low-income**
Air Nippon Airways	Courtesy of reservation staff (V8) Cleanliness on board (V13) Handling of customer complaints (V20) Dealing with loss and damage of luggage (V21) **Japanese, male, high-income, business**	Convenience of flight schedule (V2) Flight on-time performance (V4) Courtesy of reservation staff (V8) Courtesy of check-in staff (V10) Cleanliness on board (V13) Airline image (V17) Aircraft type (V18) Handling of customer complaints (V20) Dealing with loss and damage of luggage (V21) **Japanese, male, high-income, business**
Japan Asia Airways	Flight on-time performance (V4) Handling of customer complaints (V20) Dealing with loss and damage of luggage (V21) **Japanese, male, high-income, business**	Convenience of flight schedule (V2) Flight on-time performance (V4) Courtesy of reservation staff (V8) Courtesy of check-in staff (V10) Food and beverage services on board (V12) Cleanliness on board (V13) Airline image (V17) Aircraft type (V18) Handling of customer complaints (V20) Dealing with loss and damage of luggage (21) **Japanese, male, high-income, business**
Cathay Pacific Airways	Convenience of flight schedule (V2) Seat choice flexibility (V6) Reservation flexibility and accuracy (V7) Queuing at check-in counter (V9) Courtesy of check-in staff (V10) Food and beverage services on board (V12) Entertainment facilities on board (V14) Airline image (V17) Aircraft type (V18) Website services (V19) **Taiwanese, female, middle-income, non-business**	Reservation flexibility and accuracy (V7) Seating comfort (V11) Entertainment facilities on board(V14) Flight safety records (V16) **Taiwanese, female, middle-income, non-business**



BR = Eva Airways
CI = China Airlines
EL = Air Nippon Airways
EG = Japan Asia Airways
CX = Cathay Pacific Airways
1 = Airline ticket price
2 = Convenience of flight schedule
3 = Frequency of flights
4 = Flight punctuality
5 = Convenience of reservation and ticketing
6 = Seat choice flexibility
7 = Reservation flexibility and accuracy
8 = Courtesy of reservation staff
9 = Queuing at check-in counter
10 = Courtesy of check-in staff
11 = Seating comfort
12 = Food and beverage services on board
13 = Cleanliness on board
14 = Entertainment facilities on board
15 = Flight attendants' attitudes
16 = Flight safety records
17 = Airline image
18 = Aircraft type
19 = Website services
20 = Handling of customer Complaints
21 = Dealing with loss and damage of luggage

Fig. 1. Airline positioning by MCA with cluster analysis for Taipei-Tokyo route

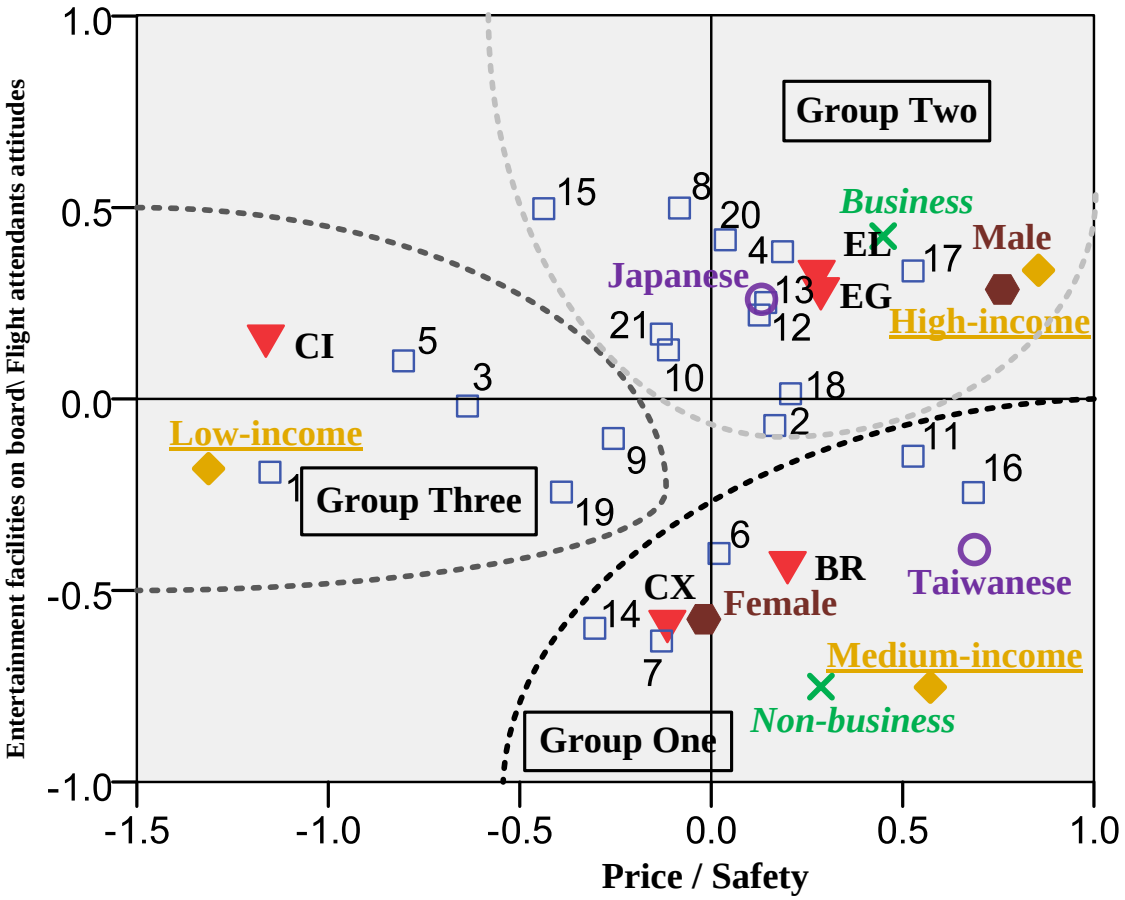


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Fig. 2. Airline positioning by MCA with cluster analysis for Taipei-Osaka route