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Explore airlines' brand niches through measuring passengers' repurchase motivation—an application of Rasch measurement

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ABSTRACT

This study develops a method of measuring airline repurchase motivation exploring service items affecting repurchase, and aiding airlines to self-evaluate their service marketing. An empirical study is conducted involving interviewing 1457 repeat patrons of four major airlines that fly between Taipei and Hong Kong. Rasch measurements converting raw ordinal responses into interval scale values was applied to identify the relatively strong and weak service items for each airline.

1. Introduction

Passenger retention can significantly influence airline profitability (Wong and Chung, 2007). Repeat patrons not only represent a stable source of revenues, but also generate positive word-of-mouth and cost less to maintain as a clientele base (Rust and Zahorik, 1993; Petrick, 2004). As a consequence, retaining customers can become a priority for business operations.

In studies concerning customer retention management, business operations that minimize customer turnover by protecting products and markets from competitive inroads are deemed to have be a "defensive marketing strategy" (Zeithaml and Bitner, 2000). Brand loyalty and customer retention often symbolize the commercial relationship of a long-term association between customer and service provider (Gerpott et al., 2001). Whilst the term "brand loyalty" is extensively discussed in marketing, customer retention itself has rarely been studied.[1] Despite brand loyalty and customer retention possessing a somewhat different focus, in practice they are commonly applied as defensive marketing strategies to retain customers.

Most studies of brand loyalty and customer retention have employed structural equation modeling (SEM) to examine causes and effects between observed variables and their underlying latent constructs. Even though SEM can effectively estimate correlations and offer a measurement model to indicate consistency between manifest variables and latent variables, it is limited in its analysis to identify the impact of every variable and aid further evaluation.

Here, a method is developed that can simultaneously consider the viewpoints of people and service items. Airlines can then use this method to measure repurchase motivation, explore service characteristics that influence repurchase motivation, and self-evaluate strengths and weaknesses in service marketing.

2. Approach to measuring repeat customer purchase motivation

Repurchase motivation is essentially a behavioral trait that describes an unobservable and immeasurable characteristic, and in psychometrics it is called as "latent trait" (Embretson and Reise, 2000). A direct and positive relationship between customer satisfaction and repurchase motivation is supported by a variety of product and service studies (Selnes, 1998; Hellier et al., 2003). The potential of a customer to repurchase a specific brand can be regarded as a latent trait, generated by the experiences and satisfaction gained from previous consumption.

Every repeat passenger n has a unique repurchase motivation θ_n for an airline. This latent trait could be revealed by answers to those items representing service attributes provided by the airline. Theoretically, a respondent who has high motivation to repurchase the services of a given airline will have higher scores on a larger number of questionnaire items than a respondent with low-repurchase motivation will. The performance of each service item for an airline can be regarded as an inherent resistance against repurchase. It can also be assumed that each service item i has a unique resistance parameter b_i for each airline. The items with lower resistance parameters are those service items, which

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[1] Exceptions include Rust and Zahorik (1993), Colgate et al. (1996), Thorsten and Alexander (1997).

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are highly appreciated by customers and will be inherently attractive in inducing repurchase behavior.

The difference between a 'person parameter' (repurchase motivation)θ_n, and the item parameter b_i, will determine customer n's satisfaction with item i. The responses obtained from the questionnaire will therefore provide a set of information that can be used to establish the relationship between customer satisfaction and the value $\theta_n - b_i$.

Answers to the designed items might not be simple as "yes or no". A well-designed questionnaire should provide the opportunity for respondents to express the degree of agreement to the designed items. Thus, items designed to measure repurchase motivation should be answered with an ordinal scale that has several levels representing possible degree of judgment. A technique is then required to transfer these ordinal responses into interval scales to provide a comparative basis for further statistical inference and discussions.

The Rasch (1980) measurement, that can convert ordinal responses into an interval logit scale, is one approach to measuring respondents' latent trait. The Rasch model assumes that answers to a set of items can be explained by two parameters; the repurchase motivation of a subject (latent trait), and the inherent resistance of the item to being repurchased. Both parameters are located on a linear, one-dimensional continuum.

To simplify we initially consider only dichotomous responses; e.g. "Is this attribute item the dominant reason you are repurchasing the services of this company?" A score of 1 is assigned to the response "yes", while a score of 0 is assigned to the response "no". The probability that a respondent (n) will respond "yes" for item i is expressed as

$$P(1|\theta_n, b_i) = \frac{e^{\theta_n - b_i}}{1 + e^{\theta_n - b_i}} \tag{1}$$

and the probability that the response is "no" is expressed as:

$$P(0|\theta_n, b_i) = 1 - P(1|\theta_n, b_i) = \frac{1}{1 + e^{\theta_n - b_i}}. \tag{2}$$

Therefore, the odds ratio that a respondent n can achieve the item i is

$$\frac{P(1|\theta_n, b_i)}{P(0|\theta_n, b_i)} = e^{\theta_n - b_i}, \tag{3}$$

giving the logit specification;

$$\ln \frac{P(1|\theta_n, b_i)}{P(0|\theta_n, b_i)} = \theta_n - b_i. \tag{4}$$

that isolates the parameters of interest.

In addition to dichotomous responses, the Rasch model can be modified to be applicable to polytomous rating-scale instruments, such as the five-point Likert scale (Andrich, 1978). The modified Rasch model decomposes a polytomous response into several dichotomous responses, and formulates one multinomial-choice problem into several binary-choice problems. That is, it assigns b_{ix} as the value of the item parameter for the rating category x to item i, and assumes that Eq. (1) refers to the probability of subject n responding with rating category x rather than $x-1$ to item i. Thus, we can model the log odds of the probability that a person responds in category x for item i, compared with category $x-1$, as a linear function of the person parameter θ_n and the relative parameter of category x, namely b_{ix}, for item i:

$$\ln\left(\frac{P_{nix}}{P_{ni(x-1)}}\right) = \theta_n - b_{ix}. \tag{5}$$

Following Andrich's modification of the Rasch model for a polytomous response, the "rating-scales model" and "partial-credit model" have been widely used for assessing the values of item and person parameters. The rating-scales model is used for instruments in which the definition of the rating scale is identical for all items, whilst the partial-credit model is employed when the definition of the rating scale differs from one item to another. The partial-credit model differs from the rating-scales model in the possession of its own threshold parameters F_{ix} for each category x (Wright, 1977). This is achieved by a reparameterization of Eq. (5):

$$b_{ix} = b_i + F_{ix}, \tag{6}$$

the partial-credit model can be demonstrated as

$$\ln\left(\frac{P_{nix}}{P_{ni(x-1)}}\right) = \theta_n - b_i - F_{ix}. \tag{7}$$

The partial-credit model (Masters, 1982) is used for items where credit is given for partially correct answers, there is a hierarchy of cognitive demand on the respondents for each item, each item requires a sequence of tasks to be completed, or there is a batch of ordered response items with individual thresholds for each item. In assessing passenger repurchase motivation θ_n, since one cannot assume the item rating scales are identical, and the partial-credit model is used.

3. Empirical analysis

The Civil Aeronautics Administration of Taiwan estimates that about 8.2 million passengers were carried on 34,854 flights between Taiwan and Hong Kong in 2006. Despite the increasing economic and cultural interaction between Taiwan and China, air passengers are still under certain political restrictions. Aircraft are not allowed to directly connect cities between Taiwan and China; thus, Hong Kong and Macao have become transfer points. This situation provides an opportunity for airlines to profit from the additional travel to and from these cities (Ling et al., 2005) and the link between Taipei and Hong Kong has become one of the world's most profitable routes. To attract business the airlines product differentiate in terms of such things as cabin arrangements, employee trainings, and the meals provided to strengthen customer loyalty.

Oliver (1999) has suggested that customer satisfaction developed by service/product usage is a necessary step in developing loyalty. The "Critical incident technique" (CIT) was applied to determine the events affecting air passengers' satisfaction in service encounters between them and service providers.[2] Face-to-face interviews and open-ended questions were used to collect, analyze, and screen the events for questionnaire design. Although there is no designated standard for the required sample size when applying CIT, previous studies (Urquhart et al., 2003; Serenko, 2006) have suggested that if the research target and activity are simple and clear then 50–100 observations would be sufficient.

Four major airlines with market shares of 34%, 31%, 14%, and 12% flying between Hong Kong and Taipei were chosen for analysis. Passengers at check-in were asked questions, including: when you used an airline, were there any events they found particularly satisfying or dissatisfying and influenced your decision to continue travelling with the airline and whether they could describe the emotions generated by those encounters, describe the dialogue of the service staff, and whether the encounters satisfied them or not?

During interviews, whilst some respondents had difficulty in recalling their most satisfied or dissatisfied moments, most could provide at least one example of being satisfied or dissatisfied and

[2] CIT analysis has been used in numerous context, including service management (Chell and Pittaway, 1998; Gremler, 2004), self-service technologies (Meuter et al., 2003), and tourism management (Callan, 1998).

Table 1
Sample sizes of satisfying and dissatisfying episodes

Company	Number of returned questionnaires		Number of effective questionnaires	
	Satisfying episodes	Dissatisfying episodes	Satisfying episodes	Dissatisfying episodes
Airline A	100	100	93	71
Airline B	100	100	84	66
Airline C	100	100	72	88
Airline D	100	100	87	72

a few respondents could provide examples of both satisfied. The survey continued until 100 satisfying and 100 dissatisfying episodes for each airline episodes were attained. In total, 336 cases of satisfying episodes and 297 cases of dissatisfying episodes were collected after deleting unclear and incomplete answers (Table 1). For anonymity consideration, the airlines are designated as A, B, C, and D.

While the events encountered by passengers were diverse there were some commonalities. A degree of manipulation was needed to identify those events that affect customer desire to repurchase travel services. Before starting to group critical events, three panelists who are familiar with the Taipei–Hong Kong market were invited to review the collected events and asked to sort out the initial principle for data classification according to the commonality of characteristics present. It was concluded that setting, service staff, and performance should form the three broad areas for data classification.[3] Events were then assigned:

1. *Setting*: Items related to the space and facilities for the delivery of service, including the facility layout, facilities provided, and service environment cleanliness.
2. *Service staff*: Items related to those who interact with passengers and contribute to service delivery, including clothing and appearance, attitude and behavior, their ability to serve the passengers, and their commitment to passengers.
3. *Performance*: Those items which relate to the quality of service, including the price of airline transport, timeliness, on-time reliability, and service processes and system design.

The panelists did data classification in three stages. In the first, each was asked to assign the collected events to one of the groups. The events within each group were then further clustered into subgroups according to their characteristics. In the final stage, the subgroups were pooled and analyzed, and discrepancies between panelists' classifications were discussed and modified. Of the items influential to passenger satisfaction, the 18 identified were given a title with four assigned "setting", six items to "service staff", and eight items to "performance".[4]

A questionnaire was designed to determine whether the 18 factors seen as possibly affecting customer satisfaction were those driving repeat patronage. The content validity ratio (CVR) developed by Lawshe (1975) was applied to evaluate the appropriateness of the questionnaire and screen the items. Twelve experts evaluated each designed item by responding to the question: "Is the investigation target measured by this item essential, useful but not essential, or not necessary to the performance of the construct?" The evaluation results were then used to evaluate the content validity (via the content validity ratio) for each of the items. The results imply that all 18 items in Table 2 are acceptable.

A face-to-face survey was conducted at the exit lobby of Taoyuan Airport in middle-May, 2007. As passengers would be analyzed separately, the sampling was conducted based on the Hong Kong–Taipei flight schedule of each airline. For each flight included, the number of passengers to be sampled was estimated and passengers selected when passing the exit lobby. The interviewers invited passengers to participate in the survey. On-site monitoring was used to check that the rules were followed to avoid deviation from this. Passengers were asked if they had flown between Taipei and Hong Kong more than six times in the previous 6 months, and whether they would continue using the airline. If the answers to both questions were yes, the passengers were asked to complete the questionnaire. The following information was collected from the survey:

1. General description of passengers' socioeconomic characteristics.
2. Trip characteristics, including: the airline most frequently travelled with between Taipei and Hong Kong, the class most frequently chosen when flying between Taipei and Hong Kong, the number of flights taken between Hong Kong and Taiwan with the airline in the past 6 months, and the major purpose of Taipei–Hong Kong flights.
3. Service quality survey: the sampled passengers were asked to indicate on a five-point Likert scale responses to statements concerning 18 service items when selecting an airline.

Returned questionnaires totaled 1672, including 63 passengers in first, 152 in business, and 1457 in economy class. To avoid bias caused by the relatively low responses of first and business class passengers, only questionnaires completed by those who flew economy class were considered giving 1457 usable questionnaires. These comprised of 397 for Airline A, 403 for B, 365 for C, and 292 for D.

WINSTEPS (Linacre and Wright, 1999), an iterative program, is used to determine the reliability and log odd values of the item and person measures, as well as the appropriateness of the Rasch

Table 2
Content of the questionnaire

Group	Item	Item description
Setting	V01	Providing the entertainment facility in boarding gate area, VIP lounge and cabins
	V02	Providing the auxiliary facility for the handicapped, seniors, or passengers with children
	V03	Space disposition of service environment
	V04	Environmental cleanness of the service place
Service staff	V05	Service staff have friendly intonation and presence
	V06	Service staff can sympathize with the passengers and meet their needs
	V07	Outfit and appearance of service staff
	V08	Service staff's problem-shooting profession
	V09	Service staff's commitment to customers
	V10	Service for travelers with disabilities
Performance	V11	Flight safety image
	V12	Low ticket prices
	V13	Providing frequent transit flights to different localities in China
	V14	Providing the delicious in-flight air-meal and drinks
	V15	Properly dealing with unusual events (such as delay or cancellation of flights) and providing immediate service rescue
	V16	The reliability of ground operation time
	V17	Providing the frequent flyers special offers and courtesy
	V18	The speed and smooth of service processes

[3] These are similar to the four service encounter principles (including setting, actors, performance and audience) of the dramaturgical theory suggested by Grove et al. (1992).

[4] Verification of the classifications followed the lines suggested by Weber (1990).

Table 3
Model estimations and fit statistics obtained from Rasch measurement

Airline	Item measure				Person measure			
	A	B	C	D	A	B	C	D
Number of Observations	18	18	18	18	397	403	365	292
Mean of Measure	0.00	0.00	0.00	0.00	0.22	0.16	-0.85	−0.30
Mean of Model Standard Error	0.07	0.07	0.07	0.08	0.31	0.34	0.32	0.29
Mean of Infit Zstd	0.00	−0.10	0.00	0.00	−0.30	−0.30	−0.10	−0.20
Mean of Outfit Zstd	0.10	−0.30	−0.20	−0.20	−0.20	−0.30	−0.10	−0.20
Reliability	0.99	0.98	0.99	0.96	0.76	0.68	0.65	0.72

Table 4
The estimates of item parameters for the four major airlines

	Airline A			Airline B							Airline C					Airline C					Airline D				
		Infit		Outfit			Infit		Outfit			Infit		Outfit			Infit		Outfit			Infit		Outfit	
Item	b_i	Mnsq	Zstd	Mnsq	Zstd	b_i	Mnsq	Zstd	Mnsq	Zstd	b_i	Mnsq	Zstd	Mnsq	Zstd	b_i	Mnsq	Zstd	Mnsq	Zstd	b_i	Mnsq	Zstd	Mnsq	Zstd
V01	0.26	1.04	0.50	1.03	0.40	−0.37	0.90	−1.70	0.90	−1.80	0.20	0.95	−0.50	0.95	−0.50	0.35	1.06	0.80	1.06	0.80					
V02	0.35	0.99	−0.10	0.98	−0.20	−0.57	0.94	−1.00	0.92	−1.30	0.16	0.92	−1.00	0.89	−1.20	0.15	1.02	0.20	1.02	0.20					
V03	1.37	1.00	0.10	1.01	0.10	−0.76	1.03	0.50	1.00	0.00	−0.08	0.91	−1.40	0.91	−1.40	0.55	0.94	−0.60	0.95	−0.60					
V04	0.25	1.05	0.80	0.97	−0.40	−1.30	0.98	−0.20	0.97	−0.30	0.04	0.95	−0.60	0.91	−1.00	0.06	0.92	−1.00	0.88	−1.30					
V05	−0.57	1.04	0.50	1.06	0.90	0.29	1.02	0.40	1.01	0.20	0.38	0.97	−0.20	0.96	−0.30	0.02	1.01	0.10	0.92	−0.90					
V06	−0.57	0.90	−1.40	0.91	−1.20	−0.02	0.99	−0.10	0.99	−0.10	0.25	1.12	1.20	1.11	1.10	−0.19	0.93	−0.90	0.89	−1.30					
V07	−0.02	0.95	−0.50	0.92	−0.80	0.29	1.02	0.30	0.98	−0.20	0.37	1.13	1.40	1.07	0.80	0.14	1.02	0.30	1.01	0.20					
V08	−0.76	0.88	−1.80	0.87	−1.90	0.18	0.99	−0.10	0.96	−0.40	0.22	0.97	−0.30	0.94	−0.80	−0.46	1.03	0.50	1.04	0.60					
V09	−0.53	0.94	−0.80	0.97	−0.30	0.12	0.98	−0.20	0.94	−0.80	0.10	1.06	0.60	1.02	0.20	−0.12	0.96	-0.40	0.93	−0.90					
V10	−0.04	1.01	0.20	1.00	0.00	-0.08	0.93	−1.00	0.89	−1.50	−0.15	1.04	0.50	1.00	0.00	0.15	0.97	−0.30	0.94	−0.70					
V11	1.41	0.94	−0.80	0.94	−0.80	−0.43	0.90	−1.80	0.89	−1.90	0.23	0.95	−0.60	0.95	−0.60	−0.90	1.08	1.20	1.13	1.80					
V12	0.31	1.03	0.50	1.01	0.20	0.88	1.08	1.00	1.13	1.50	−1.26	1.05	0.80	1.06	1.10	0.17	1.09	1.10	1.13	1.40					
V13	1.51	1.13	1.90	1.17	1.90	0.16	0.98	−0.30	0.98	−0.30	−2.34	1.03	0.40	1.07	1.00	0.74	1.04	0.60	1.04	0.60					
V14	−0.63	0.97	−0.50	0.97	−0.40	0.24	1.14	1.50	1.09	1.00	1.06	0.97	−0.50	0.95	−0.70	−0.61	0.99	−0.10	0.99	−0.10					
V15	0.15	1.05	0.70	1.10	1.10	0.20	1.01	0.20	1.02	0.20	0.00	0.94	−0.90	0.94	−1.00	−0.23	0.86	−1.70	0.84	−1.90					
V16	−0.94	1.01	0.10	1.07	1.00	0.19	0.93	−0.90	0.89	−1.50	-0.10	1.14	1.90	1.12	1.70	0.05	1.07	0.90	1.04	0.50					
V17	−1.00	1.11	1.60	1.13	1.90	0.42	1.08	0.90	1.06	0.70	0.63	0.92	−1.10	0.86	−1.80	−0.03	0.97	-0.40	0.93	−0.80					
V18	−0.55	0.94	−0.80	0.98	−0.30	0.56	1.03	0.50	1.02	0.30	0.29	1.02	0.30	0.96	−0.50	0.17	1.01	0.10	0.99	−0.10					

assumptions.[5] The results are shown in Table 3. The measurement fixed the average measure of all item parameters at zero to provide a basis for the relative measurements on an interval scale. We find the average values of the person parameter for airlines A and B are greater than zero log-odds, indicating that the airlines' repeat clientele have a relatively high purchase motivation, and factors hindering repurchase behavior were relatively limited. Counter to this, the average values of the person parameter for airlines C and D are less than zero, indicates that air their repeat patrons had relatively low purchase motivations and were less satisfied with the overall service performance of these airlines.

Reliability is commonly defined as either the consistency of responses to a set of items, or the consistency of scores from the same instrument. It is also the degree to which scores are free from measurement error. The person and item reliability coefficients can be interpreted similarly to a Cronbach alpha reliability coefficient for the internal consistency of responses to items. All airlines' item measures are highly reliable, and person measures are reasonable and acceptable.

Two quality of fit statistics were estimated by WINSTEPS; the information-weighted fit (Infit) and outlier-sensitive fit (Outfit) (Smith, 1991) with both expressed as normalized residuals in Table 3. The *Z*-standardized fit statistic (Zstd) has previously been used to select items at the 0.05 significance level of confidence. Regarding the airlines models, all Infit and Outfit statistics of the estimated parameters for persons and items are near zero, implying that the overall validity is acceptable for each model.

4. Findings

The estimates of item parameters for airlines are shown in Table 4. The first column shows the estimated parameter b_i's for the *i*th service item; the lower the b_i value, the more a passenger is satisfied by the *i*th service item. It also implies the *i*th service item has lower potential to hinder passengers from repurchasing the service. Using airline A as an example, V13 has the highest b_i value , and thereby it appears to be the most significant obstacle to repurchase behavior. In contrast, V17 has the lowest b_i value and appears to be the most important service item in encouraging repurchase behavior.

The second and third columns for each airline represent the mean square (Mnsq) and Zstd of Infit statistics. The fourth and fifth columns represent Mnsq and Zstd of Outfit statistics. These statistics can be used to examine the validity of each item. Smith et al. (1998) indicated that if an item's Mnsq statistic is between 0.75 and 1.3 or the Zstd statistic is between −2 and 2, the item does not significantly deviate from the Guttman scale assumption of the Rasch model. Thus, from Table 4, the Infit and Outfit statistics of all service indicate attribute items for the four airlines

[5] WINSTEPS helps to deal with polytomous responses by applying the Masters–Andrich modification of the Rasch measurement (Masters, 1982). The estimated parameters and model fit statistics are calibrated via a joint maximum-unconditional-likelihood estimating procedure (Wright, 1996).

meet this criterion. The data therefore appears to fit the Rasch model. The service items that encourage clientele repurchase behavior (those with negative values) are showed in Table 4. The airlines have significantly different 'advantage' items with which they attract repeat clientele; these items can differentiate the brand niche and determine competitive status.

Through the item-person maps produced by the WINSTEPS software, we can compare person parameters with the item parameters (which are subjected to a logarithmic transformation along a logit scale in Fig. 1).

The field on the left of the map indicates the distribution of passengers' repurchase ability; the levels of repurchase motivation being ordered from top to bottom. The field on the right indicates items' negative effect on repurchase motivation. The higher an item is located up the vertical axis, the more it reduces passengers' desire to repurchase.

As passenger and item parameters are relative, the average value of all item parameters are anchored as zero and thereby provide a comparative basis. The item–person maps can be used to determine how many passengers are relatively satisfied with certain service items. If the passenger and item are located at the same level on the item–person map, the probability of the passenger being satisfied with the item is 0.5. If most passengers are located at higher positions than a service item on the item–person map, the item hinders repurchase behavior less. For example, few passengers of airline B thought the environmental cleanness of the service place would represent a barrier to repurchase. In contrast, most passengers perceived that low-ticket prices were relatively difficult to satisfy and that the item is likely to reduce repurchase behavior towards airline B. From Fig. 1, a number market messages from the item–person maps of these four major airlines emerge:

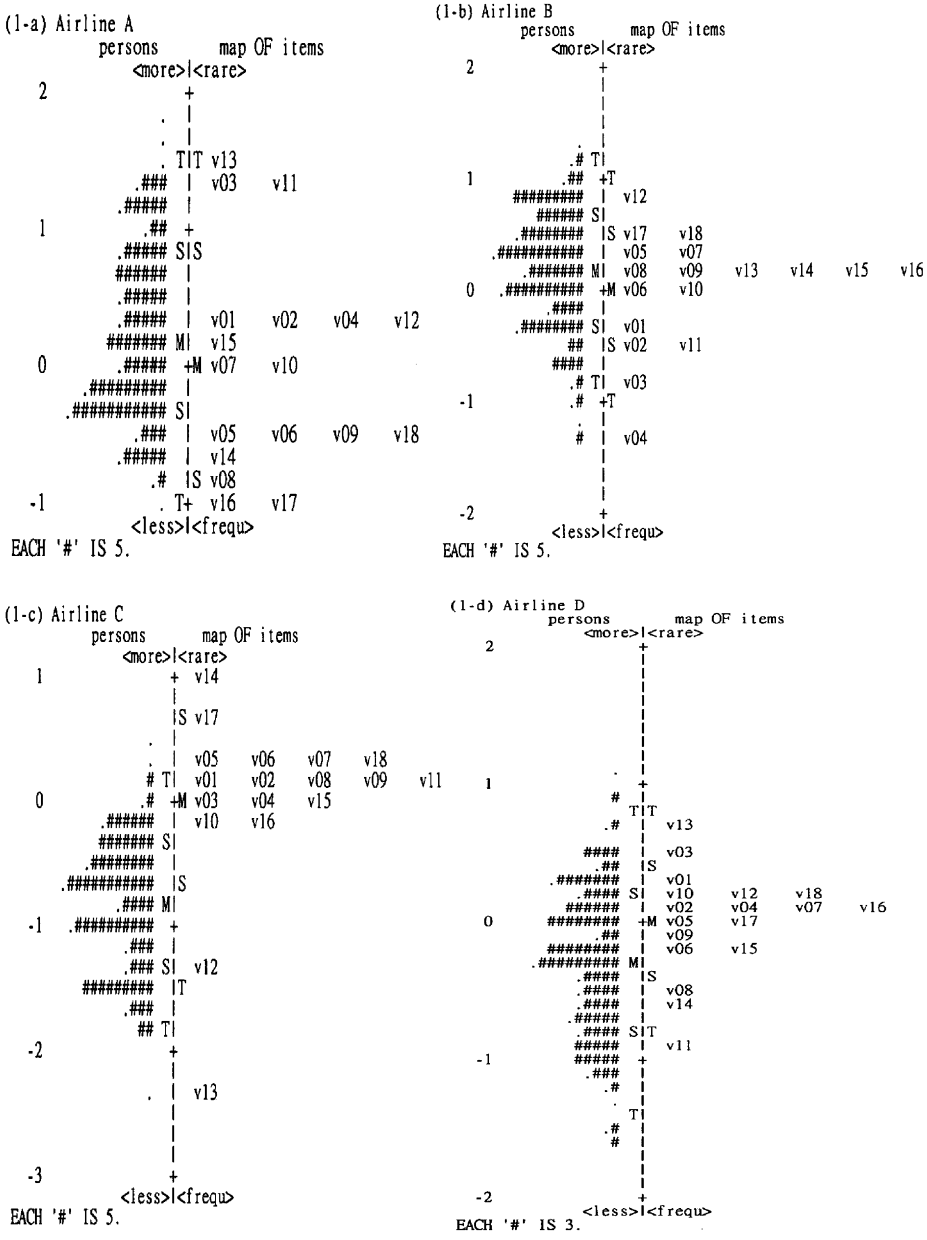

Fig. 1. Item–person maps for four major airlines.

- *Airline A*: There are 10 service items with negative log odds values. Amongst these, eight (V05, V06, V08, V09, V14, V16, V17 and V18) are located far below those of most passengers. These eight service items are the key factors in attracting passengers to repurchase the service. There is a concentration on the "service staff" and "performance" groups. By way of contrast, three service items of airline A are located in higher positions than almost all passengers'. These items hindering service repurchase are space disposition of service environment, flight safety image, and providing frequent transit flights to different localities in China.
- *Airline B*: Amongst the seven 'advantage' service items with negative log odd values, five (V01, V02, V03, V04 and V11) are located significantly lower for most passengers. These items are the key factors in encouraging repurchase behavior, and are concentrated in the "Setting" group. Airline B has been devoted to improving cabin design, lighting, and entertainment systems (i.e., V01–V04), and has gained customer loyalty in these areas. In addition, customers appreciate the "flight safety image" of this company. However, the ticket fare is a significant 'disadvantage' service item.
- *Airline C*: Amongst the four 'advantage' service items with negative log odd values, only low ticket prices and providing frequent transit flights to different localities in China are located significantly lower for most passengers'. On the other hand, all service items with positive values are found to located higher on the item-person map than most passengers indicating that nearly all service items were found unsatisfactory by the passengers of C. Airline C therefore appears positioned as low-cost service provider.
- *Airline D*: Airline D exhibits particularly high performance in terms of its flight safety image, providing good in-flight airmeal and drinks, and its service staff's problem-solving ability. "Flight safety image" in particular is found to significantly contribute to customer repurchase desires. In contrast, providing frequent transit flights to different localities in China and the space disposition of service environment significantly reduce the repurchase desire.

Fig. 2 provides a more comprehensive picture of the Taipei–Hong Kong air transport market by plotting the distribution of all 18 items' parameters for the airlines. If we treat the zero log odds of an item parameter in Fig. 2 as the benchmark, we find that the service items belonging to "setting" and "performance" appear to have more variation in logit values than those belonging to the "service staff" group. This may imply that items belonging to both "setting" and "performance" groups have more potential for the creation of an airline's brand niche and enhance passenger loyalty. However, the logit values of the six service items belonging to the group "service staff" are mainly concentrated within the interval −0.76 and 0.38 log odds impling that the variation of log odds values for any service item belonging to the "service staff" group has less influence on passenger satisfaction and loyalty than service items belonging to the other groups. From another perspective, these six items from V05 to V10 might have unexplored marketing potential that deserves attention.

The Rasch model also allows estimation of the repurchase motivation, θ_n, of each respondent. Prior to assessing demographically dissimilar respondents' motivation to repurchase a brand, whether the respondent's responses could fit the Guttman assumption of Rasch measurement is examined. Doing this 13.4% of the respondents because their estimated repurchase motivation is outside the ± 2 Zstd tolerance limits of Infit/Outfit statistics (Smith, 1991). Independent-sample *t*-tests and one-way ANOVA are used to determine if demographic characteristics are a significant determinant of repurchase motivation. The statistical significance of the mean differences amongst groups for each demographic characteristic was further tested by the Duncan post-hoc-comparison method (Table 5). These included:

- *Airline A*: Customers, mainly aged 31–50 years, Taiwanese, Chinese, Hong Kong citizens, and Macanese, business travelers and tourists, and passengers with annual income above $25,000 are found to be loyal to the company.
- *Airline B*: Customers in the age range 31–60 years, Taiwanese, Chinese and people from Hong Kong and Macanese, and passengers with an annual income over $25,000 are found to be loyal customers.
- *Airline C*: Customers aged 60 years and over and less than 20 years, Chinese, and people from Hong Kong, Macanese and Southeastern Asian, tourists and those traveling cross-strait to

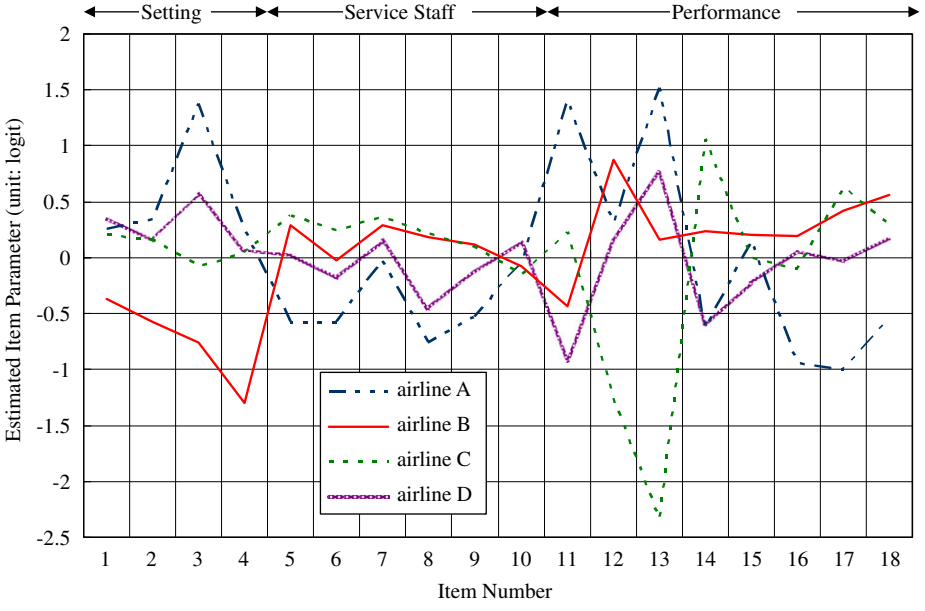

Fig. 2. Niche benchmarks for airlines.

Table 5
Differences of repurchase motivation amongst demographically segmented respondents

Demographic characteristics	Airline A		Airline B		Airline C		Airline D	
	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
Gender								
a. male	0.24	ND	0.19	ND	−0.88	ND	−0.26	ND
b. female	0.20		0.14		−0.86		−0.26	
Age								
a. Under 20	0.09	$c>b>a>d=$ e	−0.53	$c>b=$ d $>e>a$	0.05	$e>a>d>$ b $=$ c	0.00	$b=c>$ a $>d>e$
b. 31–40	0.41		0.32		−2.02		0.45	
c. 41–50	1.00		0.93		−1.94		0.52	
d. 51–60	−0.19		0.28		−0.65		−0.92	
e. above 60	−0.21		−0.17		0.21		−1.35	
Nationality								
a. Taiwan	1.23	$a>b>$ c $>d=e=f$	0.42	$a=b>$ d $>c=f>$ e	−0.62	$b=$ c $>a=$ d $>$ e $>$ f	0.15	$a=$ b $>$ c $>$ d $=$ e $=$ f
b. China/Hong Kong/Macau	0.45		0.48		0.02		0.12	
c. Southeast Asia	−0.05		0.01		−0.01		−0.26	
d. Northeast Asia	−0.16		0.12		−0.64		−0.41	
e. Europe	−0.17		−0.14		−1.10		−0.42	
f. US/Canada	−0.20		−0.07		−1.98		−0.46	
Purpose of travel								
a. Sightseeing	0.59	$b>a>$ c	0.17	ND	−0.30	$a=c>$ b	−0.22	ND
b. Business	1.42		0.20		−1.96		−0.28	
c. Visiting family	−1.28		0.15		−0.32		−0.25	
Education								
a. High school	0.24	ND	0.20	ND	−0.85	ND	−0.23	ND
b. College	0.21		0.17		−0.86		-0.24	
c. Master/PH.D	0.20		0.15		−0.90		-0.28	
Annual income								
a. Under 7000	−0.17	$d>b=c>$ a	−0.35	$d>b=c>a$	0.12	$a>b=c=d$	−0.30	ND
b. 7000-15,000	0.20		0.19		−1.12		−0.22	
c. 15,001–25,000	0.25		0.21		−1.25		−0.28	
d. Above 25,000	0.60		0.61		−1.23		−0.23	

Note: (1) ND represents no significant difference when $\alpha = 0.05$; (2) Mean: mean of estimated repurchase motivation.

visit relatives, and passengers with an annual income below $7000 are loyal to this company.

- *Airline D*: Customers in the age range 31–50 years, Taiwanese, Chinese, and people from Hong Kong and Macanese tend to be loyal to this company.

No significant difference of repurchase motivation was found for gender and education.

5. Conclusions

Many airlines are now trying building unique brand strength to attract customers. The segmenting boundary of the Taipei–Hong Kong route was significant and reasonably easy to differentiate. The four airlines examined had a sufficiently objective environment in which to develop favorable strategies and unique brands that complement their competitive advantages. Airline A focuses on customer service, as illustrated by their slogan "customers always come first", airline B takes a lead on "setting", airline C differentiates itself through low price and by establishing frequent schedules to China, and airline D has created a competitive advantage based on the quality of air-meals and flight safety.

In terms of weaknesses, airline A has room for improvement in terms of "providing frequent transit flights to different localities in China", "flight safety image", and "space disposition of service environment" while airline B has problem with its "low ticket prices", "the speed and flow of service processes", as well as "providing the frequent flyers special offers and courtesy"; airline C could expend more effort in "providing the delicious in-flight air-meal and drinks" and "providing the frequent flyers special offers and courtesy"; and repeat passengers of airline D appear to expect improvement in "providing frequent transit flights to different localities in China" and "space disposition of service environment". Measures of repurchase motivation indicate that although every airline has its own loyal repeat passengers under existing conditions, their preferences are somewhat different. Airline A has the greatest customer loyalty, followed by B, D and C.

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