IMPACT OF FREQUENT FLYER PROGRAMS ON THE DEMAND FOR AIR TRAVEL

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ABSTRACT

Liberalization of the airline industry has lead to increased competition among the carriers for an expanding market of air travelers. This paper aims to identify the factors that affect the airline specific demand. The demand for the air services of Singapore Airlines (SIA) is examined in particular using binary choice models. The most important factor in influencing an individual's choice of SIA is the convenient schedule of SIA relative to other airlines. The other significant variable is membership in the Krisflyer frequent flier program (FFP), which has a small but positive (as compare to schedule convenience) impact on SIA's market. The sample is classified into different market segments: business versus leisure travel, long haul versus short haul travelers, Krisflyer FFP members versus non-Krisflyer FFP members, and FFP members versus non-FFP members. There seems to be an overall variation among the segments in each classification.

INTRODUCTION

As the global airline market inches towards liberalization, the forces of competition has lead to intense and constant realignments of loyalties between airlines, various forms of partnerships arrangements and cooperative schemes, such as code sharing agreements resulting in competitive fares, and changes in frequency of services and other attributes which are aimed at capturing market share and increasing profits. Frequent Flyer Programs (FFPs) is one such innovation introduced to induce and capture loyalty of travelers. FFPs offer free travel and upgrades as

incentives to fly with an airline and is the most popular and successful marketing strategy devised to build customer loyalty and sell the high priced seats. The introduction of FFPs grew by 50% in less than half a decade (Bhagwanani, 2000). There are at least 100 airlines without FFPs but who have forged FFP links with one or more operators, particularly signing with at least one major airline partner. There are to date over 700 such FFP links.

FFPs are designed to achieve a high degree of brand loyalty particularly among business travelers, attract primary demand, effectively discourage new carrier competition, and give airlines direct and efficient communication links with their best individual customers (Brancatelli, 1986; Stephenson & Fox, 1987). The growth in air passengers will depend on the state of the global economy, population growth and the increase in income and wealth of individuals. Airline marketing officials claim that FFPs boost the carrier's business by 20 to 35 percent (Stephenson & Fox). However, traffic volumes can only increase across the board if total airline industry business traffic increases. Since corporate air travel is a derived demand business, it is highly improbable that FFPs will stimulate 20 to 35 percent growth. This is only possible if business travelers made billions of dollars worth of unnecessary air travel.

Unnecessary business trips can happen when a business traveler is a FFP member who gets to choose the airline and redeem the mileage earned on business trips for his or her private use while the company pays the fare. The business person might be better off choosing a regular air service that cost more due to a higher class of services or longer routes but saves on unnecessary travel under a FFP. It is also possible that an increase in traffic and revenue is a result of diverted travelers from other airlines. The relative impact of FFPs on traffic diversion and demand for air travel compared with other factors such as fare changes, a stronger economy, a growing population, and acquisition of another airline, have not been explored. One other interesting issue is whether FFPs are designed to protect (rather than expand) market share, revenues and profit erosion as a result of FFPs of other airlines. One way of ascertaining the impact of an airline's FFP on market-share is to examine the effect of FFPs on airline specific demand and choice. The following sections examine the literature on the demand for air travel and an empirical analysis of the impact of FFPs (its own and other airlines) on the demand for Singapore Airlines (SIA).

THE IMPACT OF FFPS ON AIR TRAVEL

Most surveys of individuals who belong to at least one FFP concerning airlines with FFP reveal that FFPs influence their choice of airline. For

example, Toh and Hu (1988) reported that 67% of FFP members agreed that membership in a FFP influenced their choice of airline. Morrison and Winston's (1989) model of joint airline and route choice using a sample of origin and destination data of individual trips showed that FFPs had a significant effect upon airline and route choice. Nako (1990) also found that FFPs had a significant effect on airline choice. However, FFPs are not the most important factor. The number of flights and the frequency of delays appear to have the strongest effect upon airline choice, followed by the percentage of direct flights, total travel time, FFPs, fares, and, finally, on-time performance. Except for on-time performance, the rankings in order of importance of these factors seem to be consistent with Toh and Hu (1988) findings where schedule convenience, on-time performance, low fare, and overall service by attendants are of greater importance in influencing their choice of airlines than FFPs. Business travelers gave a higher ranking to FFPs (Nako, 1990).

Factors Affecting the Demand for Air Travel

The growth in air traffic is accelerated by the falling price of air transport and an increase in economic activities. Falling airfares and rising personal incomes have also lead to an increase in the demand for leisure trips. Globalization, accelerated economic growth, liberalization of trade and the natural growth in population have had a positive impact on the demand for business travel. The demand for airline services is dependent on the volume of air traffic on a route. Factors affecting demand on specific routes include the relative attractiveness of tourist destinations, the relative price of goods, the relative cost of holidays, the exchange rates and the extent of migration, which can result in increased air travel to visit far-away friends and family. The nature of industrial and commercial activities at an airport's hinterland influences the volume of business traffic. The pattern and growth of demand of any route are affected by the economic and demographic characteristics of the markets at either end of the route.

Supply side factors such as frequency, seat availability, departure and arrival time, and number of en route stops influence the distribution of demand between competing carriers and play a significant role in affecting the airline specific demand. The demand for air travel is a function of the generalized cost of travel, that is, fare and time spent on utilizing the services. A carrier will attract passengers if it can offer a noticeable reduction in the elapsed time. This consists of (a) airport access time, (b) flight time, (c) waiting time and (d) boarding time. Other airline service attributes specific to the carriers that influence passengers' preferences include safety records, airline experience, in-flight service, fleet type and whether the airline is the flag carrier of the traveler's country of origin.

Factors Affecting the Effectiveness of an FFPs

Network coverage of air service provided

A business traveler will find it easier to accumulate FFP mileage if an airline covers most of his business destinations or has good coverage through alliances and partnerships with other airlines.

Airline's market share

Nako (1990) decomposed the effects of FFPs into an airline specific effect (which is measured by a membership variable, whose coefficients are positive and significant) and a hub effect (interactive term). The estimate of the interactive term indicates that an increase in an airline's airport market share by 10% enhances the value of the FFP by US $4.80. The effectiveness of a FFP is enhanced with the rise in the airline's presence in the city in which the participating members resides.

Duration and distance of flights

The effectiveness of a FFP increases with total travel time since travel time is positively correlated with the amount of mileage credit that may be earned on a specific trip. The positive sign of the coefficient of the interaction between fares and FFP membership provides some evidence that FFP members are less fare sensitive than non-FFP members.

Characteristics of an individual FFPs

The characteristics of the airline's services affect the effectiveness of its FFPs. However, FFPs are packaged differently. The success of a FFP grows in line with the number of members it can attract. It is not the absolute benefits but the relative gains compared to that of the other carriers that matter to individual travelers. In designing the awards scheme, one has to keep in mind the targeted group. The structure of the award and benefit system differs from airline to airline due to the difference in characteristics of the target group.

The first structural component lies in the ease in redeeming travel awards, this includes the class of service, the bonus for travel in first and business class, and the type of fares that qualify for point accrual. The second structural differentiator is the partner network inclusive of hotel, car rental and other retail chains. The third element centers on the terms and conditions that determine the flexibility of the reward system which consists of covering the validity of miles, booking procedures, blackout dates, transferability of awards and the capacity provided for award travel. The fourth element of the program is customer service. The last structural

factor is the elite program, catering to that essential customer segment of frequent high-yield travelers.

One rationale behind a FFP is to award free trips to the frequent flyers on seats that would not have otherwise been taken. This is to minimize revenue lost. This argument is weak because many FFP members do use the free tickets for trips they would have paid for. Other FFP members sell their free-ticket coupons to ticket brokers. In each case airlines lose revenue. The above revenue displacement phenomenon is prevalent in open-ended programs where the flyer does not have to use their mileage points by a certain date.

Most studies have focused on estimating the demand for the U.S., North Atlantic and European markets using aggregated data. This study estimates the demand for air travel by air travelers (foreign and local) in Singapore with the aid of disaggregated data. Factors affecting the demand include airfare, income, population, airlines' image, FFPs' quality of service in terms of frequency of flights, and load factors. The studies conclude that market share of the airline has an impact on the effectiveness of the airline's FFP on residents living near to an airport. However, does the FFP in turn affect the airline's market share? If so what is the impact?

FFPS AND AIRLINE CHOICE

Random surveys were conducted between December 18 and December 20, 2000, at several strategic locations in Singapore such as shopping centers, the financial district and popular tourist attractions. There were 192 successfully completed surveys. All respondents must have flown in the past twenty months with SIA within their choice set of airlines. A short haul traveler is defined as one whose origin or destination is any city in Asia, Australia or New Zealand to or from Singapore. If the traveler's origin or destination was further he or she would be classified as a long haul traveler. A business traveler is one who travels for the purpose of work regardless of who pays for the fare. Otherwise, he or she is a leisure traveler.

Descriptive Statistics

About 56% of the respondents are between the ages of 25 to 45 years old and are business travelers compared to only 35% of the leisure travelers who are 35 years old and younger. Business travelers (54%) earn more than S$9,000 a month as compared to leisure travelers (21%). Most business travelers are from the IT (12%) and banking and financial sectors (12.%), electronics (9%), manufacturing (6%), chemical (6%) and shipping (4.6%). Others include real estate, warehousing, food catering, legal, and

advertising. Table 1 shows that the 34% of travelers travel to or from Europe followed by 33% to or from Asia, Australia and New Zealand, Americas, Middle East and South Africa.

Table 1. Origin and Destination of Travelers Responding to FFP and Airline Choice Survey

Region	Percent
North & South America	10
Europe	34
Middle East & South Africa	4
Australia & New Zealand	19
Northeast Asia	14
Southeast Asia	11
West India	9

There were an equal number of long haul business (LB), short haul business (SB), long haul leisure (LL) and short haul leisure (SL) travelers. Over 50% of all business travelers surveyed were based in Singapore. This may be one of the reasons why 71% of the SB travelers chose SIA. Some travelers fly about 9 times a year with SIA. Half (50%) are members of the Krisflyer FFP. The average SB traveler is a member of more than one FFPs (1.7) and gave the highest rating of importance to FFPs (3.4 out of 5.0). The SB traveler sample has the largest proportion of members in the FFPs of other airlines (besides SIA, and Star Alliance and OneWorld carriers) and FFPs of the flag carrier of their own country of origin or residence. About 60% focus on just one FFP.

The highest proportion of LB travelers chose airlines recommended by their companies and fly with the flag carriers of their country of origin or country of residence. This group has the largest proportion of members in FFPs of a Star Alliance carrier (48%) and the flag carrier of their country of origin . A small number belong to FFPs associated with OneWorld carriers (16%). At least 79% of business travelers are FFP members while only 46% of leisure travelers belong to at least one FFP. These percentages are higher than Toh and Hu's (1988) estimate of 72% for business travelers and 23% for leisure travelers.

FFP Membership Profile

Of the 192 respondents, 127 belong to at least one FFP. About 60% of the FFP members earn more than S$84,000 annually while only 20% of non-members exceed this amount. Toh and Hu (1988) found that 72% of FFP members, compared to 34% of non-FPP members, earn more than US$40,000 (S$69,200) per year. A higher proportion of the FFP members

Table 2. Types of Airlines Chosen and Participation in Frequent Flier Programs (FFPs), by Type of Traveler

	Long-haul Business	*Short-haul Business*	*Long-haul Leisure*	*Short-haul Leisure*	*All*
Percent based in Singapore	58	52	13	25	37
Number of trips per year					
on Singapore Airlines	3.06	9.10	1.33	1.06	3.64
Choice of airline					
Singapore Airlines	38	71	50	38	49
Flag carrier of traveler's					
country of origin	44	23	31	28	31
Flag carrier of traveler's					
country of residence	44	50	33	31	40
Carrier recommended by					
employer or travel agent	52	27	29	20	32
Participation in frequent					
flier programs					
Concentrates in					
only one FFP	56	60	35	40	48
Number of FFP					
memberships	1.42	1.73	0.73	1.19	1.27
Importance of FFPs	2.7	3.4	1.7	2.3	2.5
Krisflyer member	35	50	15	19	30
STAR Alliance member	48	33	27	44	38
ONEWORLD member	17	35	19	46	30
Member of other FFPs	35	42	27	29	33

(32%) are either CEOs or owners of business. A higher proportion of FFP members (60%) compared to non-FFP members (31%) travel on business. This is similar to the findings of Toh and Hu. About 79% of business travelers are FFP members while 53% of leisure travelers are FFP members. This is higher than the 72% and 23% in the corresponding group estimated by Toh and Hu.

A higher percentage of FFP members (54%) make short haul trips compared to non-FFP members (47%) and have a higher average number of trips made per year (16; see Table 3). Only 30% of FFP members choose airlines recommended by travel agency or their company while 35% of non-FFP members took the advice. The average airfare of FFP members is S$2,354, which is higher than that of non-FFP members of S$1,835. Toh and Hu (1988) also found that FFP members tend to travel more often short distance (an average of 17 trips per year), pay higher fare and rely less on travel agencies. About 45% of all FFP members fly with the flag carrier of their country of residence as compared to only 29% of the non-members. The higher proportion of FFP members choosing SIA seems to positively

correlate with the higher proportion of FFP members living in Singapore 39% versus 32%, respectively).

Table 3. Characteristics of Travelers, by Frequent Flier Program (FFP) Membership

	FFP members	*Non-FFP members*
Business traveler	59	31
Long-haul traveler	46	63
Number of trips per year	16.02	3.21
Uses carrier recommended by travel agent or employer	31	35
Average price of airfare	S$2353.79	S$1834.71
Uses flag carrier of traveler's country of origin	31	31
Uses flag carrier of traveler's country of residence	45	29
Singapore Airline passenger	32	43
Singapore resident	39	32
Singapore resident and citizen	45	34

About 64% of the FFP members interviewed belong to two or more programs. This is marginally larger than 61% estimated in Toh and Hu's study (1988). About 30% (27% in Toh and Hu) participate in three or more FFPs. However, only 2%, as compared to 17% in Toh and Hu's survey, joined four or more FFPs. This is probably due to more domestic air travelers taking advantage of FFPs of U.S. domestic airlines. On average a FFP member in our sample belongs to 1.92 FFPs. FFP members on average give a rating of 3.81 (out of 5.00) to the importance of FFPs in affecting their choice of airline.

There is a positive correlation index of 0.15 between the number of FFPs enrolled in and the importance of FFPs. A similar correlation is observed between the strategy of concentrating in one FFP and rating the importance of a FFPs. This confirms Toh and Hu's finding that FFP members enroll in multiple programs but concentrate in one. The importance of FFPs will determine how FFP membership affects one's choice of airline. Over 40% of this sample do not belong to any FFP from either the Star Alliance or OneWorld, while 7% join FFPs of both the Star Alliance and OneWorld. A majority of FFP members belong to FFPs of at least one of the major alliance carriers. A large portion of the major alliance FFP members chose to concentrate their mileage among carriers within one alliance. This may

imply that a FFP member of a Star Alliance carrier has a higher likelihood to opt for a SIA flight than one belonging to another alliance.

Table 4. Characteristics of Travelers, by Membership in Frequent Flier Programs (FFPs)

	FFP member	Krisflyer member	FFP member but non-Krisflyer member	Non-Krisflyer member
Type of travel/traveler				
Business traveler	na	70	49	39
Long haul traveler	na	44	51	56
Number of trips per year	na	11.5	19.3	11.9
Singapore resident	na	49	23	29
Singapore resident and citizen	na	54	23	30
Choice of Airlines				
Singapore Airlines	na	7.00	2.63	2.24
Flag carrier of traveler's country of origin	71	68	75	34
Flag carrier of traveler's country of residence	70	74	65	38
Carrier recommended by employer or travel agent	na	32	32	32
Average price of airfare	**na**	**0.280702**	**0.338028**	**0.325926**
Participation in frequent flier programs				
Concentrates in only one FFP	72	74	73	38
Importance of FFPs	3.8	3.8	3.7	2.0
Number of FFP memberships	1.92	2.05	1.70	0.93
Star Alliance FFP member	57	86	60	30
OneWorld FFP member	43	39	39	25
Membership of other airlines' FFPs	50	40	55	30

The behavioral and attitudinal profile of Krisflyer members were analyzed with respect to three other groups of respondents, namely all FFP members, non-Krisflyer members and members of other FFPs except Krisflyer. Since the second group , non-Krisflyer members, includes many non-FFP members the percentage of this group differs with the rest of the three significantly (see Table 4). A Krisflyer member on average belongs to 2.05 FFPs, this is higher than the overall average of 1.92. A vast majority of Krisflyer members join at least one other FFP with 54% of the Krisflyer members joining two other FFPs.

Over 50% of the FFP members join FFPs of Star Alliance carriers. This percentage is larger than those who join the FFP of OneWorld (42%). A relatively lower percentage of Krisflyer members belong to the FFP of OneWorld compared to 42% of non-Krisflyer members. Almost 40% of

the sample that are members of Krisflyer belong to FFPs of other Star Alliance airlines but are not members of FFPs of OneWorld airlines, while only 15% of Krisflyer members belong to FFPs of OneWorld but not Star Alliance carriers. An overwhelming proportion of FFP members are members of FFPs of the flag carriers of their country of residence (69%). This percentage is approximately the same as those joining FFPs of the flag carrier of their country of origin. This percentage is higher among Krisflyer members. Being a resident of Singapore is an important factor in influencing an individual's decision to join the Krisflyer FFP.

A majority of FFP members felt that concentrating on one FFP would yield the best benefits (72%). This percentage is marginally smaller in Toh and Hu (69%, 1988). An overwhelming percentage of Krisflyer members are business travelers (70%). This is the highest among the three groups. A small proportion of Krisflyer members make short haul trips. Since a significantly larger proportion of Krisflyer members are either Singapore citizens or residents, the average number of SIA trips made in one year is higher than that in other categories.

Summary

The majority of respondents flew between Singapore and Europe and Singapore and Asia. About 35% of the respondents are stationed at Singapore, 50% of whom are business travelers. Over 50% of the business travelers chose to fly with SIA. However, a higher proportion of business travelers as compared to leisure travelers choose the flag carrier of their country of residence. Business passengers rate FFPs as being more important in affecting their choice of airline. A large proportion of short haul business travelers chose to fly SIA and to participate in the Krisflyer FFP.

About 66% of the respondents are FFP members and are short haul business travelers who take more flights and pay higher airfare. A higher proportion of FFP members, compared to non-FFP members, chose flag carriers of their country of residence and belong to FFPs of the Star Alliance rather than OneWorld. There is no significant difference between Krisflyer member and other FFP members in terms of FFP participating behaviour except that a higher proportion of Krisflyer members, compared to members of other FFPs, enroll in at least one other FFP that is a member of the Star Alliance. This implies there are more benefits to Krisflyer members if they join other FFPs. Most members of the Krisflyer FFP concentrate on one FFP.

THE DEMAND FOR AIR SERVICES

This section will propose several model specifications to explain the demand for air services with respect to the presence of SIA. The objective is to identify the relevant variables and estimate their relative importance in affecting travelers' choice of airline and ascertain the extent of Krisflyer membership in influencing a traveler's probability of choosing SIA, and the effect of the Krisflyer FFP on SIA's market share. The variations for each factor across different market segments are also examined.

Model Framework

Probabilistic choice theory is applied to the traveler's choice when making a trip. Binary choice models are specifically chosen since data attributes of only two alternatives are readily available for the entire sample. We specify individual i's indirect utility for choosing SIA's air services, U_{si}, as follows, $U_{si} = V_{si} + \varepsilon_{si}$ where V_{si} = deterministic component of individual i's utility and ε_{si} = SIA's specific error term. We specify individual i's utility for choosing any other airline j's transportation services as $U_{ji} = V_{ji} + \varepsilon_{ji}$ where V_{ji} = deterministic component of individual i's utility and ε_{ji} = j's specific error term.

An indicator variable defined as $y_{si} = 1$ if traveler i chooses SIA, and 0 if he or she chooses the another airline j. The probability of choosing SIA, that is, Prob($y_{si} = 1$) is defined as follows,

$$P_i(s) = \Pr(U_{si} \geq U_{ji})$$
$$= \Pr(V_{si} + \varepsilon_{si} \geq V_{ji} + \varepsilon_{ji})$$
$$= \Pr(\varepsilon_{ji} - \varepsilon_{si} \leq V_{si} - V_{ji}).$$

The net utility to individual of choosing SIA is given by $V_i = V_{si} - V_{ji} = \sum_{k=1}^{K} b_k x_{ki}$ where b_k = unknown parameter of the kth independent variable x_k; $x_k = f(z_{si}, z_{ji}, S_i)$ in which, z_{si} = the vector of SIA's attribute value to individual i, z_{ji} = the vector of airline j's attribute value to individual i and S_i = the vector of socio-economic variables which are included as SIA specific variables.

P_i will depend on the joint probability distribution function assumption for $\varepsilon_{ji} - \varepsilon_{si}$ and the specification of V_i. If $\varepsilon_i = \varepsilon_{ji} - \varepsilon_{si}$ is logistically distributed, then it would be a binary logit model. If the disturbances follow a normal distribution, it would be a binary probit model. Various specifications of V_i will be discussed throughout the section.

The likelihood function in terms of the set of coefficients b_k of k variables is $L(b_1 \, b_2, \ldots . b_k)$

$$= \prod_{i=1}^{I} P_i(s)^{y_{si}} P_i(j)^{y_{ji}}$$

The maximum logarithm of the likelihood function, denoted by, L (b_1, b_2,...b_k) is used to estimate the vector of coefficients, b. If all individuals in the market have the same deterministic component (attributes and weights) and the stochastic components (ε_{ji}, ε_{si}) from either a Gumbel distribution or a normal distribution, the aggregate SIA's market share is the same as the average individual forecast under the logit or probit assumption respectively.

Model Specifications

V_i is specified first in terms of the variables, which are believed to have an impact on the travelers' choice of airline. E-views and Limdep are used to run regression on the data under the assumptions of binary logit (b-logit) and binary probit (b-probit). The deterministic utility for SIA and that of airline *j* is specified as:

$V_{si} = b_1 + b_2 SCHEDULE_{si} + b_3 LG(FARE_{si}) + b_4 LG(TIME_{si}) + b_5 RES_i + b_6 RECOM_i + b_7 IMPT_i * KRIS_i + b_8 CONCENT_i * FFP_i + b_9 STAR_i + b_{10} LG(INCOME_i)$,
$V_{ji} = b_2 SCHEDULE_{ji} + b_3 LG(FARE_{ji}) + b_4 LG(TIME_{ji})$.

Since it is the difference in utility that matters the difference in attribute value between alternatives is expressed in one term. Thus V_i is given as,

$V_{si} - V_{ji} = b_1 + b_2(SCHEDULE_{si} - SCHEDULE_{ji}) + b_3 LG(FARE_{si} - FARE_{ji}) + b_4 LG(TIME_{si} - TIME_{ji}) + b_5 RES_i + b_6 RECOM_{ji} + b_7 IMPT_i * KRIS_i + b_8 STAR_i + b_9 CONCENT_i * FFP_i + b_{10} LG(INCOME_i)$ is expressed as the following models.

MODEL 1: Basic model

$V_{si} - V_{ij} = b_1 + b_2 SCHEDULE + b_3 LG(FARE) + b_4 LG(TIME) + b_5 RES + b_6 RECOM + b_7 IMPTKRIS + b_8 STAR + b_9 CONFPP + b_{10} LG(INCOME)$

MODEL 2: Modified basic model

$V_{ii} = b_1 + b_2 SCHEDULE + b_3 LG(FARE) + b_6 RECOM + b_7 IMPTKRIS + b_9 CONFFP$

MODEL 3: Impact of travel type—Business versus leisure travel

$V_{si} - V_{ji} = b_1 + b_2 SCHEDULE + b_3 LG(FARE) + b_6 RECOM + b_7 IMPTKRIS + b_9 CONFFP + b_{11} BIZ$

MODEL 4: Impact of length of travel—Long haul versus short haul travel

$V_{si} - V_{ji} = b_1 + b_2SCHEDULE + b_3LGFARE + b_6RECOM + b_7IMPTKRIS + b_9CONFFP + b_{12}LONG$

MODEL 5: Impact of length and type of travel—Comparing between market segments of LB, SB, SL and LL

$V_{si} - V_{ji} = b_1 + b_2SCHEDULE + b_3LG(FARE) + b_6RECOM + b_7IMPTKRIS + b_9CONFFP + b_{11}BIZ + b_{12}LONG$

MODEL 6a: Impact of FFP—Krisflyer members versus non-Krisflyer members

$V_i = b_1 + b_2SCHEDULE + b_3LG(FARE) + b_6RECOM + b_7IMPTFFP + b_9CONFFP$

MODEL 6b: Impact of FFP—Krisflyer members versus non-Krisflyer members (modified)

$V_i = b_1 + b_{2S}CHEDULE + b_8STAR + b_{13}QFFPCON + b_{10}LG(INCOME)$

MODEL 7: Impact of FFP—FFP members versus non-FFP members

$V_{si} - V_{ji} = b_1 + b_2SCHEDULE + b_3LG(FARE) + b_6RECOM + b_{14}NO$

Where,

1. Coefficient b_1 is the alternative specific constant (SIA here) is $\varepsilon_{si} - \varepsilon_{ji}$. It reflects the difference between the utility of choosing SIA and that of any other airline *j*, other things remaining constant.

2. SCHEDULEni s , j (n (s: SIA, j: all other airlines) is respondent's ordinal rating of the schedule of airline n for the specific trip discussed on a 5-point scale (where 5 stands for Excellent and 1 stands for poor). This often refers to the quality of air services measured by frequency stochastic delay.[1]

3. $LG(FARE_{ni})$ s , j $\in$ *n* which is the natural logarithm (log) of the airfare respondent *i* faces for the particular trip discussed expressed in terms of Singapore dollars. This generic[2] variable of monetary cost represents payments by foreign visitors for their airfare in foreign currency.[3]

4. $LG(TIME_{ni})$ is the log of trip duration on airline *n* measured in terms of hours. TIME*ni* obtained from flight time connecting time

and stop over time, which includes the waiting time at the airport to get transit onto a connecting flight but excludes time spent outside the airport. This time variable is meant to capture the time required to complete the trip. Time spent in activities to gain utilities should be as far as possible excluded from the measurement.

5. RES_i is the dummy variable that equals 1 when individual i chooses the flag carrier of his or her country of residence and 0 otherwise. This will also equal 1 if the airline chosen is the flag carrier of the traveler's country of origin.

6. $RECOM_i$ is a dummy variable that equals 1 when individual i chooses the airline upon recommendation of the travel agency or corporate travel policy and 0 otherwise.[4]

7. $IMPTFFP_i$ is an individual i's 5-point scale rating (in which 5 = very important and 1 = not at all important) of the importance of an FFP in influencing his or her choice of airline.

8. $KRIS_i$ is a dummy variable that takes a value of 1 if the individual i is a member of Krisflyer and 0 if not.[5] The individual specific weight $IMPT_i$ is multiplied by $KRIS_i$ to obtain $IMPTKRIS_i$.

9. $CONCENT_i$ is a dummy variable taking the value of 1 when the individual i thinks that concentrating in one FFP will yield him the largest benefits and 0 otherwise. This also equals 1 if the rating is three or greater and 0 if the rating is less than three.

10. $JFFP_i$ is a dummy variable that equals 1 when individual i is a member of airline j's FFP (i.e., a member of any other FFP besides or in addition to the Krisflyer FFP) and 0 otherwise. $CONFFP_i$ is the product of $CONCENT_i$ and $JFFP_i$ to examine the interactive effect.[6]

11. $STAR_i$ is a dummy variable equals to 1 if an individual i is a member of a FFP of a Star Alliance airlines other than SIA and 0 otherwise. If the FFP belong to airlines in the Star alliance, then $STAR_i$ will take the value of 1 and 0 otherwise. This reflects the impact of membership in the Star Alliance FFP on the demand for SIA's service. This does not include Krisflyer membership, which has been captured by the variable $IMPTKRIS_i$.

12. $LG(INCOME_i)$ which is the natural log of individual i's monthly income measured in terms of Singapore dollars. This measures the impact of income on the variations and relative utility of flying SIA.

13. BIZ is a variable equal to 1 if the traveler is categorized as a business traveler, and equal to 0 if the traveler is categorized as a leisure traveler.

14. LONG is a variable equal to 0 if the traveler's origin or destination is any city in Asia, Australia or New Zealand to or from Singapore;=, and 1 if the origin or destination was further.

15. QFFP is the five point rating of Krisflyer or SIA services minus the corresponding rating of any other airline's FFP or services.

16. QFFPCON is the product of IMPTFFP*CONCENT.

17. NO is the difference between the average number of SIA flights per annum minus the average number of other airlines' flights.

Empirical Results

Models 1 and 2: Deriving the basic model

The b-logit model[7] is significantly different from the intercept only hypothesis ($b_1 = c$ and $b_2 = b_3 = ... = b_{10} = 0$) as shown by the likelihood ratio (LR) statistic of about 52 which is significant in a χ^2 distribution with a degree of freedom (df) = 11. Only three out of ten variables are significant at a 10% level of significance for a two-tailed t-test.[8] The ρ^2 is only 0.20 with adjusted $\bar{p}^2$ significantly smaller at 0.13. This implies that too many variables have been included in the regression equation and that multicollinearity is present. Given the presence of an insignificant estimated coefficient $\hat{b}$, the final specification of V_i is given by Model 2 (see Table 5). The results of b-probit is presented and given higher $\bar{p}^2$, compared to the b-logit model. Only SCHEDULE and IMPTKRIS have significant coefficient estimates. The estimated b_2 is almost twice the estimated b_7 indicating that an increase in the schedule rating by one unit will increase the probability of choosing SIA by a larger amount as compared to a one unit increase in the rating of importance of FFPs.

Model 3: Impact of travel type—business versus leisure travel

The airline market is segmented by purpose of travel and distance of trip. Thus the observed different proportion of passengers in each segment may be due not only to the different average value of attributes across segments but also to the different weights placed on each attribute. Model 2 is used as the base equation to analyze various market segments by different categories of travelers. The analysis on trip type gives Model 3 and includes the addition of the variable BIZ. This resulted in a higher $\bar{p}^2$ (0.111961 >

Table 5. Significance of variables on choice between using SIA and any other airline, by type of traveler

Variable	All travelers		All travelers		Business traveler		Leisure traveler		Long haul traveler		Short haul traveler	
	Coeff	*Prob*	*Coeff*	*Prob*	*Coeff*	*Prob*	*Coeff*	*Prob*	*Coeff*	*Prob*	*Coeff*	*Prob*
No differences	-1.663451	0.1588	-0.12117	0.419	0.10098	0.7008	-0.23590	0.2049	-0.3336	0.128	0.05461	0.7966
Quality of schedule	0.295960	0.000*	0.262028	0.00*	0.34794	0.0000	0.179473	0.0225	0.38769	0.000	0.18909	0.0055
Price of airfare	-0.104883	0.5078	-0.14593	0.369	-0.0124	0.9653	-0.16094	0.4750	-0.0308	0.847	-0.2903	0.3271
Length of trip duration	0.591069	0.1508	-	-	-	-	-	-	-	-	-	-
Airline is flag carrier of traveler's country of origin or residence	0.636024	0.003*	-	-	-	-	-	-	-	-	-	-
Recommendation of travel agent or employer	-0.260546	0.2298	-0.23459	0.266	-0.3934	0.1947	-0.05524	0.8528	0.19882	0.504	-0.7317	0.0246
Importance of Krisflyer FFP membership	0.098515	0.0924*	0.1336	0.013*	0.11483	0.1200	0.107689	0.2454	0.13024	0.132	0.13366	0.0633
Strategy of concentrating in one FFP	-0.496367	0.045*	-0.29304	0.204	-0.4938	0.1345	-0.17711	0.6002	-0.4985	0.164	-0.1304	0.6815
Membership in Star Alliance FFP	0.070428	0.7550	-	-	-	-	-	-	-	-	-	-
Traveler's income	0.154162	0.2546	-	-	-	-	-	-	-	-	-	-
Summary statistics												
L($\hat{b}$)[i]	-107.0648		-113.15									
L(c)[ii]	-133.043		-133.0426									
LR[iii]	51.95554		39.77109									
ρ^2[iv]	0.195259		0.149468									
$\bar{\rho}^2$[v]	0.127612		0.111887									

(*continued*)

Table 5 - continued

* Significant at the 10% level

i. $L(\hat{b})$ is the value of log likelihood function: at its maximum

   $:L(\hat{b})=\sum_{i=1}^{I}\{y_{si}\log P_i(s)+(1-y_{si})\log[1-P_i(s)]\}$

ii. $L(c)$ is the value of the log likelihood function when all the parameters except for an alternative specific constant are included. $L(c) = \sum_{g=1}^{2} I_g \ln \frac{I_g}{I}$

    Where n is the number of alternatives (in this case, 2), I_s is the number of individuals choosing SIA and I is the total number of respondents in the sample.

iii. The likelihood ration statistics is used to test the null hypothesis that all the parameters except the alternative specific constant are zero. It is asymptotically χ^2 distributed as with K- 1 degree of freedom in binary choice models, where K is the number of parameters in the model.

    LR statistic $= -2[L(c)-L(\hat{b})]$

iv. ρ^2 is an informal goodness of fit index for a binary model with an alternative specific constant ρ^2 must be between zero and one. $p2 =1 - \dfrac{L(\hat{b})}{L(c)}$ [13]

v. ρ^2 is another goodness of fit measure corrected for the K number of parameters calculated as follows $\overline{p}^2 = 1 - \dfrac{L(\hat{b}) - k}{L(c)}$

0.111886) indicating a slightly better fitting model[9] but does not alter the $\hat{b}$ and statistical significance much. The test of equity shows that there is no significant difference in the value of $\hat{b}$. However, the test for parameter difference between the business and the leisure travel market shows that variations exist across them (see Table 6).[10]

The SIA-specific constant is positive for business travelers but negative for leisure travelers. One possible reason is that SIA offers the best schedule of flights to and from Singapore. Business travelers who rank convenience of schedule high generally prefer SIA in spite of a higher airfare. It is on average 1.19 times more expensive than other airlines. Leisure travelers are more price sensitive as shown by the higher $\hat{b}^3 = -0.161$ as compared to $\hat{b}^3 = -0.0123$ for business travelers. However it is not the difference in the average value of the attribute in each group that determines the value of b but the perceived value attached to an airline's reputation that will affect the alternative specific constant.[11] Krisflyler FFP membership is an important factor affecting the probability of choosing SIA for business trip; but is not an important factor for leisure trips. The sensitivity of the variable SCHEDULE, which is the only significant factor influencing the choice of airlines for a leisure trip is smaller compared to that for a business trip ($b_2^{lei} < b_2^{biz}$: 0.18 < 0.35).

The coefficient of SCHEDULE is larger than that of IMPTKRIS and LG(FARE). Nako's (1990) results confirm that the number of flights and the presence of direct flights (as a proxy for schedule convenience), followed by FFPs and then airfare, have a large impact on the choice of airline. Hoffman's (1985) found that business travelers' choice of flight is not determined by brand loyalty but entirely by schedule convenience. Business people are willing to pay a premium because of tight business schedules. This explains the smaller absolute value of LG(FARE)'s coefficient of the business travelers as compared to the leisure travelers.

Model 4: Impact of length of travel—Long haul versus short haul travel

There is no significant difference in the value of $\hat{b}$ for distance except for RECOM. The absolute value of $\hat{b}$ for the variable LONG is small and insignificant, but the negative sign imply that long haul travelers are not in favor of SIA fights. The inclusion of LONG in the travel market segment using b-probit resulted in a better fit than the b-logit for the short haul travelers ($\bar{p}^2$: 0.056 < 0.057), but the b-logit model seems to be better in explaining long haul travelers ($\bar{p}^2$: 0.15 > 0.14).[14]

The $\hat{b}$ shows significant differences between the coefficients of SCHEDULE and RECOM in the two market segments (see Table 6). The long haul passenger's probability of choosing SIA is more responsive to a

Table 6. Impact of the length and type of travel on choice between using SIA and any other airlines, by type of traveler

Variable	Long haul business		Short haul business		Long haul leisure		Short haul leisure	
	Coeff	*Prob*	*Coeff*	*Prob*	*Coeff*	*Prob*	*Coeff*	*Prob*
No differences	0.00161	0.9965	0.534535	0.2547	-0.546865	0.1061	-0.057956	0.8895
Quality of schedule	0.47190	0.0034	0.336169	0.0047	0.471250	0.0040	0.061315	0.6903
Price of airfare	0.68661	0.1280	-1.12880	0.1463	-0.321376	0.4665	-0.148473	0.8549
Recommendation by travel agent or employer	-0.202	0.6310	-0.64963	0.1730	0.514966	0.3329	-2.141455	0.0702
Importance of Krisflyer membership	0.05388	0.6415	0.138705	0.2240	0.283939	0.1477	-0.065555	0.7798
Strategy of concentrating on one FFP	-0.9268	0.0775	-0.42372	0.4000	0.022382	0.9678	-0.450983	0.5816
$L(\hat{b})$	-24.1885	-20.6844	-23.1537	-29.1758				
$L(c)$	-31.755	-28.9746	-33.2711	-31.755				
ρ^2	0.238277	0.286119	0.304088	0.081223				
$\bar{\rho}^2$	0.080822	0.113554	0.153808	-0.07623				

Note: See notes in Table 5 for an explanation of symbols.

change in the ranking of SCHEDULE. As the distance between hub city pairs increases, the number of airlines providing direct flights declines. An increase in flight frequency may induce a greater positive impact on SIA's market share of the long haul market than on that of the short haul travel market where there are more alternatives available.

To minimize the discomfort of long haul flights, direct flights with the shortest duration and the most convenient schedule is chosen. The relative higher explanatory power of IMPTKRIS in the short haul travel market is due to a larger proportion of of Krisflyer members (66%). The difference in sign specific constants indicates that the short haul travelers have a positive preference for SIA, while the long haul travelers seem to prefer other airlines more.

Travel agents seem to favor SIA for long haul travel as indicated by the positive sign. It is not favored for short haul travel. Membership in the Star Alliance FFP will enhance this position and lead to a greater impact on its long haul flight market share. SIA is usually recommended in addition to airlines in the Star Alliance for long haul tour packages. Although the value of RECOM's coefficient is estimated to be larger in the long haul market, the significance level of its estimate is much higher in the short haul market. Short haul travelers have more alternative choices of airlines offering direct flights. Given that SIA's airfares are relatively more expensive, travel agencies tend to avoid it when given cheaper alternatives fares. Travel agencies tend to have more contracts with other airlines than SIA for short haul flights. The lower p-value for CONFFP in the long haul market indicates that the market for long haul flight service is more competitive than that for the short haul service, especially at the high end of the market characterized by good quality service. This is probably due to more long haul travelers who are mainly from developed countries traveling on flag carriers with more established FFPs compared to Asian airlines.

Model 5: Impact of length and type of travel—comparing between market segments of LB, SB, SL and LL

The addition of dummy variables LONG and BIZ gives Model 5 improved overall fit. B-probit models gave a better fit than b-logit, which is why only the table of coefficients estimated under the b-probit models is presented. A test of variation across the four market segments was significant at the 10 % level.[14] The logs of the maximum likelihood function indicate that SB respondents have a higher probability of choosing SIA followed by LL, LB and then SL travelers.

Model 5a: Long haul business (LB) travelers

Two significant factors that determine long haul business travel are SCHEDULE and CONFFP. Over 35% of LB travelers are FFP members of other airlines and hence there is a higher chance of a LB traveler concentrating his mileage with another airline's FFP. A high proportion of LB travelers are members of the FFP of the flag carrier of their country of residence (56%). This makes sense, since the flag carrier is probably the LB traveler's most frequently used airline due to schedule convenience. Many of these LB travelers come from developed countries with well-established flag carriers providing established international air service. Hence the relative large absolute value of $\hat{b}$ of CONFFP which is significant and implies more intense competition from well-established FFPs of foreign international air carriers. This will have an adverse effect on SIA's share of the long haul market. Thus CONFFP has significant negative effect that probably offsets the positive effect of IMPTKRIS (see Table 6).

The positive sign of b_{3^*}, the airfare coefficient, is probably due to the overriding positive effects of SCHEDULE and FFP. One other possibility is that since the fare is paid by the employer the incentive to search for a lower fare is absent. Published airfares were used for respondents who did not know the true fare of the flight in question, however business travelers might receive a much lower fare because of their company's bulk discount arrangements with a travel agency. Also LB travelers take more flights than LL travelers. This may explain the large negative effect of CONFFP on a LB traveler's higher probability of choosing SIA than a LL traveler's segment.

Model 5b: Short haul business (SB) travelers

Airfare seems insignificant but $\hat{b}$ has the expected negative sign. The only significant estimate is that of SCHEDULE. Though the estimate of the coefficient of airfare is not very significant, its largest absolute value may imply that SB travelers have the highest fare sensitivity. The SIA specific constant in the SB market is about 500 times than that in the LB market with a smaller p-value (see Table 6) indicating that SB travelers prefer to travel by SIA as compared to LB travelers. Further the absolute value of $\hat{b}$ of IMPTKRIS is larger and more significant for SB travelers. This is consistent with the observation that more Krisflyer members travel short haul. On the other hand, $\tilde{b}$ of CONFFP is smaller in absolute value and has a larger p-value in the SB market than in the LB market. This may imply that SIA and/or the Krisflyer FFP has a niche in the market of regional travelers where there are fewer competitors providing the same high standard of service.

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Table 7. Impact of Frequent Flier Programs (FFPs) on choice between using SIA and any other airline: Krisflyer members versus non-Krisflyer members

	Krisflyer Member		Non-Krisflyer Member		Krisflyer Member		Non-Krisflyer Member	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
No differences	0.22964	0.75850	-0.1209	0.52593	-2.39157	0.336756	-1.0791	0.423365
Quality of schedule	0.372821	0.00081	0.22810	0.00017	0.427127	0.000300	0.24763	6.2e-005
Cost of airfare	-0.21065	0.63979	-0.1622	0.37024	0.282602	0.496704	0.17831	0.543469
Recommendation by travel agent or employer	-0.22579	0.58084	-0.2413	0.33683	0.039111	0.081029	0.03017	0.039216
Importance of Krisflyer membership	0.058283	0.74496	-0.0057	0.93568	0.275634	0.310292	0.10345	0.515182
Strategy of concentrating in one FFP	-0.56692	0.20929	-0.1700	0.615				

Model 5c: Long haul leisure (LL) travelers

LL travelers are as sensitive to schedule convenience as LB travelers even though they are less fare sensitive, as shown by the smaller absolute value of $\hat{b}$ of LG(FARE) of 0.32 compared to that of 1.10 for SB travelers. Given that 37% of the SB travelers are either CEO or sole proprietor of their business, choosing the lowest available airfare will minimize business cost. Since the principal and the agent is the same person there is no moral hazard problem. LL travelers who fly less frequently than SB travelers may be unaware of the lowest available airfare at their desired departure time or variation of airfare over time and across different distribution outlets. Moreover, LL travelers probably have fewer choices of airlines providing direct flights than do SB travelers.

LL travelers with a tighter budget are more responsive towards FFPs, which offer rewards in terms of free trips that reduce the implicit cost of each trip. This is confirmed by the larger $\hat{b}$ of IMPTKRIS (of 0.20) in the LL market as compared to the LB and SB markets. The p-value is also lower in the LL market. A few long haul trips will contribute a significant amount to the mileage bank. LL travelers try, as far as possible, to choose airlines with FFPs they belong to in order to concentrate mileage under one program in order to maximize rewards.

However $\hat{b}$ of IMPTKRIS is still smaller than that of SCHEDULE and LG(FARE), indicating the latter two variables are more important than a FFP in their choice of airline. About 29% of LL respondents chose airlines recommended by the travel agency, which explains the positive sign for $\hat{b}$ of RECOM. Being infrequent travelers they may not be fare sensitive and thus fare differentials may not make a difference to their budgets. Convenience of schedule may not be important since tours come in a package.

Model 5d: Short haul leisure (SL) travelers

SCHEDULE, which is an important factor in the above three market segments, is insignificant here. A large number of airlines offer services of higher frequency to nearby hub cities as opposed to destinations further away. This implies a smaller difference in the attribute of schedule between alternative choices. Holiday-makers who book a tour package will perceive this small difference but it will not have an adverse effect on their choice. In contrast, LB travelers do care about schedule convenience. RECOM seems to be the only other significant factor in affecting SL travelers' choice of airline.

Models 6a and 6b: Impact of FFP—Krisflyer members versus non-Krisflyer members

We divide the population into two market segments, those who are Krisflyer members and those who are not Krisflyer members (non-Krisflyer members) and compare these groups on the importance of FFPs on their choice of airline (IMPTFFP). There does not seem to be a large variation between Krisflyer members and non-Krisflyer members. The only significant variable in both cases is SCHEDULE. Krisflyer members are more sensitive to a change in the SCHEDULE, given that a majority of them are business travelers with tight schedules. SIA provides the most number of direct flights to and from Singapore. This accounts for the large proportion of Krisflyer members as compared to non-Krisflyer members choosing SIA (63% versus 49%, respectively). The $\hat{b}$ of IMPTFFP is positive for Krisflyer members but negative for non-Krisflyer members.

Model 6b: Impact of FFP-Krisflyer members versus non-Krisflyer members (modified)

The inclusion of LG(INCOME), QFFPCON and QFFP increases the $\bar{p}^2$ from 0.08 and 0.04 to 0.14 and 0.07 (see Table 7).[15] The significant variables are SCHEDULE and QFFPCON. Krisflyer members are more sensitive to the difference in rating than non-Krisflyer members as shown by $\hat{b}$ (0.40 > 0.25). Note that the coefficient values are close to those estimated in Model 6a, indicating stability of the coefficient estimate across various specifications.

QFFPCON has a smaller impact than SCHEDULE on one's probability of choosing SIA. QFFPCON's coefficient is marginally larger for Krisflyer members. This confirms the importance attached to the relationship between FFP membership and the traveler's strategy of concentrating on one FFP and how that relationship has an impact on a traveler's probability of choosing a specific airline. This is partly due to the limited choice set. The $\hat{b}$ of LG(INCOME) is insignificant at the individual t-test level but contributes to the overall significance of the model. A Krisflyer member's probability of choosing SIA is twice as income sensitive as a non-Krisflyer member's probability. SIA is reputed for providing high quality for a price. Thus an increase in income is likely to increase one's probability of choosing SIA. It also indicates their relative preference for SIA.

STAR is positively related to the probability of choosing SIA, implying that mileage for the Star Alliance FFP can be earned from SIA flights, however its insignificance may be due to ease of mileage transfers across FFPs. The impact of FFPs has a smaller impact on the choice of airline for the group of non-Krisflyer members that do not belong to any FFP.

Model 7: Impact of FFP—FFP members versus Non-FFP members

The sample is split into two segments: non-FFP members (respondents who do not belong to any FFP) and FFP members (respondents who are members of at least one FFP). About 65% of the respondents are FFP members of which 52% of them choose SIA. The absolute values of $\hat{b}$ of SCHEDULE is larger than that of LG(FARE), and IMPTKRIS (see Table 8). This is consistent with Toh & Hu (1988) survey's finding of FFP members rating schedule convenience, fare and then FFP in descending order of importance. One possible explanation for the relatively large absolute value for the coefficient of RECOM is that business travelers do not always decide on the airline used for business trips. Corporate travel policies may require employees to take one specific airline or choose from one restricted list. The impact of membership in the FFPs of other airlines may help explain the large but insignificant estimate.

The only significant variable is SCHEDULE. There is no variation in terms of SCHEDULE across the two subsamples. The SIA specific constant has a significant estimate with a larger positive value in the market of non-FFP members (0.90 > 0.20). The $\hat{b}$ of LG(FARE) has a large absolute value of 1.10 in the market of non-FFP members, as compared to that of 0.91 in the FFP member group (see Table 8). Non-members are more fare sensitive. One possible reason is that FFP members in redeeming do not mind paying a higher fare or choosing business or first class. There is probably a net gain from the FFP rewards system that induces them to incur the present cost or investment relative to higher airfare.

The higher but negative coefficient for RECOM of 0.69 for non-FFP members as opposed to 0.20 in the FFP member group suggest that non-FFP members do not have any incentives to stick to any particular airline. The infrequent flyer non-FFP member who averages three trips a year (as compared to 16 made by FFP members) may not have much information about the available choices and service attributes. They simply rely on the advice of travel agencies. The negative sign indicates that travel agencies are not in favor of using SIA.

Model 7b: Importance of service factor

When the variable NO was introduced (see Table 8) the positive sign of LG(FARE)[16] is really surprising because FFP members pay for the service and receive accumulated points to be redeemed for potential free trips or upgrades. The higher airfare expense (either from longer distance trip or from a higher fare class) will result in more travel awards being earned within a shorter period of time and hence resulting in a lower cost per flight taken.

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Table 8. Impact of Frequent Flier Programs (FFPs) on choice between using SIA or any other airline: FFP members versus non-FFP members

	FFP Member		Non-FFP Member		FFP Member		Non-FFP Model 7b	
	Coeff	*P-value*	*Coeff*	*P-value*	*Coeff*	*P-value*	*Coeff*	*P-value*
No differences	0.229642	0.75850	0.09726	0.70339	0.008267	0.97655	0.07996	0.764621
Quality of schedule	0.372821	0.00081	0.35905	0.00147	0.365455	0.001378	0.30972	0.012144
Cost of airfare	-0.21065	0.63979	-.12661	0.066522	0.305547	0.49413	-0.96454	0.127686
Recommendation by travel agent or employer	-0.22579	0.58084	-0.6945	0.071159	0.024876	0.955348	-0.673	0.124552
Importance of Krisflyer membership	0.058283	0.74496	-	-	0.110508	0.027824	-	-
Difference in number of flights on SIA and other airlines							0.13196	0.008172
Strategy of concentrating in one FFP	-0.56692	0.20929	-	-	-	-	-	-

The coefficient of RECOM is positive in the sample of FFP members and negative in the sample of non-FFP members. A larger proportion of FFP members are traveling on business and thus choose airlines recommended by their companies due to schedule convenience. On the other hand travel agencies may capture a large proportion of non-FFP members who are more fare sensitive and opt for airlines with lower fares. FFP members' probability of choosing SIA is more than twice as sensitive to the difference in the number of trips made. The higher the number of times one flies with any one specific airline the greater the potential benefits.

Estimation of SIA's Market Share

Drawing upon the results from b-probit models and assuming market homogeneity (i.e., every individual in the population is identical) this section attempts to analyze SIA's market share and the probability of an average individual choosing SIA. This is estimated by the exponential of the average log likelihood, where Ave Log is equal to the maximum log likelihood divided by the total number of respondents in the sample. Given Model 2 and the respective specification of V_i the Ave Log is -0.58933 and market share is 0.5547.

Classification Approach of Aggregation Across Market Segment

The market segmentation approach estimates SIA's market share by using the explicit integration approach within each segment and the classification approach across all the market segments. Ave Log estimates SIA's market share in each segment. Given the probit assumption, SIA's total market share will be the weighted average of all market shares in each segment. SIA's market share for business versus leisure and long verse short haul markets is estimated to be 0.56 and 0.57,[17] respectively. In the case of the four market segments of LB, SB, LL & SL, SIA's weighted average market share is estimated to be higher at 60%. The same method is applied to the market segmentation of Krisflyer members versus non-Krisflyer members and FFP members versus non-FFP members with the weights 57/192, 135/192, 126/192 and 66/192 respectively (see Table 9).

Given the four market segments or groups, SIA is estimated to have the largest market share (65%) of short haul business travel. It seems to have captured a larger share in the market of non-Krisflyer members (38%). SIA is believed to have a much larger share of FFP members (54%) as opposed to non-FFP members (20%). This resulted in a significantly larger estimate of 74% under market segmentation based on FFP membership. Intuitively, this implies that Krisflyer membership is more effective in enhancing the

Table 9. Estimation of SIA's market share for different types of travelers

	Business traveler	Leisure traveler	Long haul traveler	Short haul traveler
Ave log likelihood A=L($\hat{b}$)/48	-0.5137	-0.63994	-0.53481	-0.5992
Each segment's Market share Exp (A)	0.598281	0.527325	0.585782	0.549251
Each segment's weighed Market share Exp (A)/2	0.29914	0.263662	0.292891	0.274625
Total SIA market share	0.562803		0.567516	

demand for SIA's services in market segments where FFP membership is prevalent. This highlights the importance of attracting business travelers who also belong to other FFPs especially FFPs of major alliance carriers (see Table 10).

Krisflyer membership and the availability of a wider range of flight schedules will increase a traveler's probability of choosing SIA. Hence, increasing loyalty through an attractive FFP can increase the demand for its services especially from repeated patronizing of increased number of customers. FFPs of other airlines with a good service network similar to that of SIA will affect SIA's market share when mileage points are not transferable. Transferability and mileage trading within an alliance or partner will enhance its position. Other factors such as airfare, income, flight duration and recommendation of travel agencies seem to be relatively insignificant in explaining the demand for SIA. This may be due to SIA's position as the dominant operator in Singapore and the lack of comprehensive schedules offered by other carriers.

Variations across different market segments are also observed. However there is no significant difference in the weight placed on each variable across market segments. Generally, schedule convenience and Krisflyer membership can explain the demand for SIA's services in all of the market segments except that of short haul leisure travel. A large proportion of long haul travel is business travel with an estimated market share of 60% while short haul travel have a share of 55%. No significant variations were observed across Krisflyer members and non-Krisflyer members.

There appears to be significant differences in $\hat{b}$ of LG(FARE) between FFP members and non-FFP members. The demand for air services by FFP members is positively related to airfare while that of non-FFP members is inversely related with airfare. This is because the cost of air service to FFP members does not discount the potential benefits credited to mileage accumulation. The number of trips made per year is an important

Table 10. Estimation of SIA's market share for different types of travelers

	Krisflyer Member	Non-Krisflyer Member	FFP Member	Non-FFP Member	Long haul buisness traveler	Short haul business traveler	Long haul leisure traveler	Short haul leisure traveler
$A = L(\hat{b})/48$	0.609242	0.5467896	0.820871	0.574097	-0.503928	-0.43093	-0.48237	-0.60783
Exp(A)	0.180869	0.3844614	0.538697	0.197346	0.6041529	0.649908	0.617319	0.544532
Total SIA market share	0.5653302		0.736043		0.60364			

determinant of demand. Krisflyer membership increases one's probability of choosing SIA marginally. However the Krisflyer FFP does not have a significant effect on SIA's total market share.

STRATEGIES AND TRAVELER SATISFACTION

Does the generalized cost of travel matter with FFPs?

The insignificance of travel time and airfare is apparent in this study. Further there is not much variation in the magnitude of the coefficients of the variables compared to that used in the time series analysis. Most respondents are unaware of the significant differences in airfare between airlines, let alone gather information on airfares of other airlines for a given schedule. A reason for this is that the fare difference is too small to yield significant benefits for the decisionmaker to invest time in information gathering. In addition, most travel takes place within the conditions set up between the respective companies and travel agent with whom long term contracts are established. Even if the individual has a choice of airlines the fares quoted are either often discounted or not made available to him since the employer is paying for the trip. Thus schedules and gains from a business deal is often more crucial than the monetary cost of travel.

Moreover over half of the long haul business travelers choose airlines recommended by their employer. Corporate travel policies may include cost controlling measures that restrict the employee's choice of airlines. Under such restrictions, there may not be a great difference between the attributes of the given choices.

The estimated coefficient for travel time, LG(TIME), is surprisingly positive for all samples of market segments and is significant for short haul business travel. The reasons for this are similar to that for the apparent lack of importance of fares. Most respondents did not seem to detect significant differences between flight times for direct flights across airlines. The marginal difference in time due to flight delays seems to be immaterial to travelers who were prepared to incur delays of up to a couple of hours. The general perception is that most of the airlines are on time. The estimated coefficient of the variable measuring on time performance is also insignificant in Nako (1990) and Toh and Hu (1988). Large differences arise between direct versus indirect flights, but passengers prefer their choice set to direct flights. Indirect flights are chosen only when all the direct flights are fully booked or in situations where the traveler could use the delay for shopping or sight seeing. Since this is voluntarily time to participate in benefit yielding activities, it cannot be included in the time cost component of air travel. Excluding transit time yields no large difference in the time duration between direct and indirect flights. If no

benefits are incurred, the time cost of indirect flights is still greater than direct point-to-point flights. A positive relationship between travel time and the choice of airline seems to arise for reasons not specified in the model. One explanation for this is the possible correlation between travel time and variables such as NO.

Schedule Convenience and FFPs

Krisflyer membership does have a significant positive impact on an individual's probability of choosing SIA's services and a positive impact on market share. However the magnitude is smaller than that for schedule convenience. This is consistent with previous studies, which indicate that an airline's market share is very elastic to the frequency of flight services provided. Frequency of flight service is often used as proxy for schedule convenience. These studies confirm that the effectiveness of a FFP is enhanced with a large presence at an airport. This is supported by the finding that FFP members, most being business travelers, place great importance on schedule convenience while choosing an airline.

The implications for this on consumer targeting is important. There are slight variations between various market segments consisting of business versus leisure travelers, long haul versus short haul travelers, and Krisflyer members versus non-Krisflyer members. However none of these variations are large enough to result in a significant impact on SIA's dominance. FFP members are observed to have a preference for SIA's services. The overall quality of its services relative to other airlines is the most important factor determining a traveler's choice of airlines. An individual's decision to join the Krisflyer seems to be insensitive to the number of SIA flights taken.

Variables reflecting the joint benefits from alliance of FFP have a significant impact on the probability of joining Krisflyer. This seems to be in line with previous studies that observed that travelers are members of many FFP but concentrate on one. Thus targeting members of the Star Alliance FFP is advantageous to increasing SIA's market share. The Krisflyer FFP is more effective in increasing the demand for SIA's services within the group of FFP members than among non-FFP members. As such, SIA should target FFP members who are willing to pay a premium for high quality air services.

A larger proportion of frequent flyers from developing countries compared to those from developed countries seem to prefer SIA. Many of the regional travelers residing in the neighboring countries are members of Krisflyer given the preference for high quality service in the form of frequent flights to major hub cities. This is prevalent among the short haul business travelers. However, SIA seems to have a lower share of the regional leisure market that is made up of fare sensitive leisure travelers.

Competition with the Krisflyer FFP comes from European, American and Australian airlines with an established pool of loyal FFP passengers. Good repute and high quality air services have attracted a considerable portion of the long haul business and leisure markets but these comprise mainly of residents of developed nations. However, the difference in attribute of service quality has marginal effects on SIA's overall market share. An airline's global market share is determined by its service network that is very much restricted in a regulated environment. Penetrating markets lies in forming alliances and partnerships and remains the second best effective way open to SIA.

Enhanced schedule convenience arrangements such as code sharing and FFP alliance are important. Fostering direct contracts with large companies and Multi National Corporations (MNCs) will further guarantee a large share of business travel. Enlarging one's market share through joint maximizing of revenues is one strategy. On the regulatory front, the recent step toward multilateralism, between the U.S., Brunei, Chile, New Zealand and Singapore, seems encouraging but does not consider issues of cabotage and ownership. However, shifting from bilaterals to multilaterals is progress.

ENDNOTES

1. Although subjective rating may not be as reliable as objective facts such as flight frequencies or load factors, it captures information specific to each decision making process. Different individuals experience different frequency delay for the same flight schedule. In one instance, the respondent flew with an airline that was not his usual choice due to the unavailability of seats on his preferred airline at the time of booking. This is simply stochastic delay on the part of the preferred airline. An airline which offers infrequent flights between a city pair may just happen to offer a service at the time desired by this particular traveler and this explains his choice of the airline. This effect is not captured when aggregate data of the frequency of flights between two city pairs is used as a proxy for frequency delay. Moreover past studies pointed out that regressing the demand for air service upon the product of frequency of flights and load factors is regressing the independent variable upon itself.

In most cases respondents only include direct flights (if available) in their choice sets. Thus there are few cases where SIA is offering a direct flight while the alternative airline does not. Moreover respondents usually filter the presence of direct flights into their rating of SCHEDULE. Thus the dummy variable of direct flight is excluded from the specification due to the few observed differences in this attribute and its high correlation with the variable of SCHEDULE. Air service here refers specifically to schedule convenience, which differs from the layman understanding in terms of cabin crew service. This general notion of service is probably taken into account by the alternative specific constant.

2. Assume that one Singapore dollar has the same marginal (dis)utility regardless of whether it is used to pay for SIA service or another airline's services. Thus the coefficient for $FARE_{ni}$ is the same b_3 in both utilities, U_{si} and U_{ji}.

3. It is converted to Singapore dollars based on the exchange rate prevailing in early January 2001. The class in which the passenger travels is not taken into consideration, as the

difference among airfare of the same class across airlines is the concern. The difference in airfare between airlines is assumed to be independent of the class of travel.

4. In many instances, an airline is chosen just because it has been recommended by the travel agency or by company travel policy. For around-the-world holiday trips, the travel agencies normally offer their customer a package of air services (usually provided by airlines within an alliance) consisting of trips to different countries. From another point of view, it seems to become a comparison of alternative alliances instead of individual airlines. This is classified as long haul leisure trip as the price paid is for a package of air service instead of individual airfares. This price is compared with that of other similar packages. To a leisure traveler, schedule and time are not the top considerations, thus they may not even bother to gather information that differentiates between the alternative airlines' schedule and flight duration from one point to the other. Believing that paying a packaged price for a bundle of services is more economical in terms of monetary cost and information collecting cost, these holiday travelers will just choose among the available packages instead of individual airlines. The decision to fly from one point to another throughout the journey is made by the travel agencies who would usually purchase seats from major airlines in order to gain bulk discounts. And major airlines usually provide service of the same general quality. Hence the differentiating factor among airlines will lie in their network of marketing outlets and their membership in major alliance. A business traveler may be required to choose from the list of airlines recommended by his company. Schedule is his top priority. Hence recommendation is the conditional, if not the critical factor, in the choice of airline for business trips.

5. There are Krisflyer members who meet the membership requirement at the margin, but are not enjoying benefits significant enough to make him or her put much weight on FFP membership in their choice of airline. Due to the different trip frequency and travel behavior, FFPs will benefit different individuals at varying degrees. Hence, FFP members place varying weights on the importance of FFPs in their choice of airline.

6. If the FFP member's strategy is to concentrate his or her mileage on one FFP which happens to not be the Krisflyer FFP, he or she will probably prefer the airline(s) associated with the other FFP over SIA This assumes that mileage earned on SIA cannot be easily transferred over to the other FFP, which seems to be the case in spite of the airlines' claim of transferability. Thus the maximum strategy is to earn the mileage, as much as possible, from the airline from whose FFP one desire to redeem benefits.

7. The coefficient estimated under the b-logit instead of the b-probit assumption is displayed due to the slightly better fit of its index, under the logit model.

8. As the sample size becomes larger the t-statistic approaches the z-statistic. And the p-value gives the probability of a type one error. A p-value of less than 0.1 indicates that the estimate is significant at a 10% level.

9. Reject null hypothesis $b_{11} = 0$. Test statistics of 2.02 is significant at the 10% level.

10. The likelihood ratio estimated statistics (5 df) = 127.6846 is χ^2 distributed. It is significant at the 10% level.

11. Discounted SIA airfare may be cheaper. The perception by travelers that SIA is a premium airline commanding premium fares may deter them from including SIA in their choice set. This may help explain the negative specific constant for SIA.

12. Test of overall variation across the long and short haul markets with a test statistics of (5 df) = 8.5844 which is χ^2 distributed. It is significant at the 10% level.

13. The above definition is more useful in comparing two specifications developed from the exact same data. $[K/OK-1)][\rho^2/(1-\rho^2)]$ is approximately F distributed with (K-1, K) degree of freedom under the null hypothesis that B = C.

14. Test statistics (15 df) = 31.90914 which is χ^2 distributed.

15. $\bar{p}^2$ increases further to 0.17 and 0.08 when only two variables SCHEDULE & QFFPCON are specified.

16. $\bar{p}^2$ Increases from 0.08 to 0.19 for FFP members and from 0.14 to 0.25 for non-FFP members.

17. For each segment (type of travel and length of travel) the weights will be half as there are equal number of respondents surveyed for each segment. When divided into four segments (LB, BB, LL,SL) the weight will be one quarter.

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