Demand Management of Air Trip Distributions for Penghu Off-shore Island

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Abstract: This cycle trend issues of trip distribution always are not good allocation management, which causes the residents are inconvenient by air in the off seasons and the tourists are not available tickets by air in the busy seasons. In order to solve the issues between transportation needs of the residents, transportation demands of the tourists and the operating dilemma of the airlines. This study collects the resident subsidies and the tourist trips data of Penghu County Government, and proposes the estimators of the air trip for the residents and tourists in different seasons, and then the airlines assigning how many flight frequencies in different seasons will be good to allocated. The multiple regression models are applied to predict the number of residents in the various routes by air in busy/off-seasons. The outcomes show the management strategies of airlines routes and aircraft for residents and tourists trips.

Keyword: Busy/Off-seasons, Air trip distribution, Off-shore island residents, Multiple regression, Demand management, Spoil seats.

1. INTRODUCTION

In recent years, the Penghu tourism is booming development and expansion area of Kiman and Ximan. Airport passenger traffic continues to increase, the passenger amounts in 2013 reached 2,156,441 passengers, and the cargo amounts 7,308.9 tons. According to the tourist reports of Penghu County Government Tourism Office, an annual total of 951,797 tourist passengers come to Penghu Tourism, the number is not including Penghu residents. Off-shore island sightseeing trips by air transportation reached 802,626 passengers last year 2013 and occupied 84.33% of the total Penghu tourist trips, the tourist trips by water transportation only 15.67%, the 802,626 air tourists are more than 149,171 tourists by water transportation. They show the critical importance of air transport with Penghu tourism development between the Penghu and Taiwan, but also expand geographical tourism areas between the intra-islands and Penghu inter-islands, such from Magon to Chimei, Magon to Kinment. The Magong airport nearly enhances an important transshipment hub from aviation strength. Penghu tourism development has been extended to cross strait both sides, therefore, to create regional gate

airport, enhance Penghu value added of social and economic development, which are the goals and missions have been committed to public airports and airport flight network connectivity, and scalability tasks, a very important role in airport development and core values, but also worth efforts.

Thus, the amount of proportion between residents and tourists of Makung airport passengers in busy and off-seasons shows reverse the trends. This means not only the large variance of the amount of tourist trips between busy seasons and off seasons for the off-shore island during last years, but also the small amount and variance per month of the resident trip between busy seasons and off seasons. The figure 1 shows that the amount of visiting Penghu tourist trips reach 130,000 trips in busy seasons, and the amount of tourist trips down to 2 ten thousand trips in off seasons. Meanwhile, the amount of the resident trips always keep the stable 20,000 trips up and down of the trip demand, no matter in the busy season or off season. Not only the number of trip is the cycle trend in busy season and off season, the figure 2 also shows that cycle trend of the ratio of tourist/resident change during busy and off seasons. The figure 2 point out the ratio of passengers between the residents and tourists reached nearly 1: 5 in busy seasons during April to September every year, shows that cycle trend of the ratio of passengers between the residents and tourists reached nearly 1: 5 in busy seasons during April to September every year, contrarily the ratio of passengers between the residents and tourists reached nearly 1: 1 in off-seasons during October to next year March. Owing to Makung airport are not metropolitan airport, there is not more business passengers only vacation and leisure passengers. This large proportion difference of the passenger between the residents and the tourists also cause the amount balance transportation issues of origin and destination in the different busy/off season, also cause the resource spoil, such as bad flight load factor in the off season, and in the off peak of busy season.

Unfortunately, the mixed and complex factors of balance transportation issues for the large resident/tourist proportion difference are not effectively served in an unstable supply with flight schedules and flight frequencies during different seasonal conditions, and causes the residents are inconvenient by air trips in the off-seasons, and the tourists are not available tickets by air in the busy seasons. Penghu County Government always requires the airlines and Civil Aviation Administration to increase available frequencies during peak holiday and festivals to enhance positive development of the local tourism industries. During the off-season or Lunar New Year holiday due to the airline's policy of flight reduction, Penghu County Government also requires airlines to add additional flight schedules to serve the residents transportation need between Taiwan and Penghu off-shore Island routes. In order to solve the issues between transportation needs of the residents, transportation demands of the tourists and the operating dilemma of the airlines, this study considers the basis and right estimators of how many residents and tourists in different seasons must be constructed, and then the airlines assigning how many flight frequencies in different seasons will be very

clearly discussed and allocated. Therefore, this study collects the resident subsidies and the tourist trips data of Penghu County Government, and the passenger data of Makung airport. The multiple regression models are applied to predict the number of residents in the various routes by air in busy/off-seasons. The model outcomes can in advance provide flight schedule planning and references to discuss and research how to adjust and enhance the performance of flight frequencies assignment of off-shore-island. The paper can provide a basic research for off-shore-island air transportation flight planning and development to resolve the problem of tourist/resident transportation.

There are five sections in the papers, including the introduction of current off-shore island air transportation issues, demand management of air transportations at off-shore islands with multiple regression review, and multiple regression application and analysis and lastly, the conclusion and suggestions.

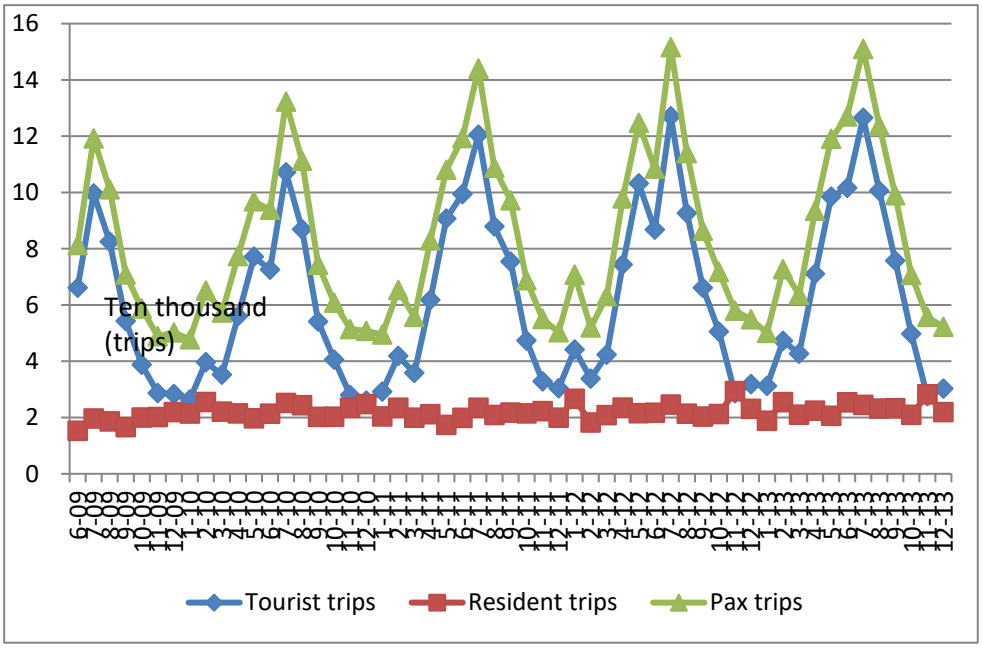

Figure 1 the tourist and resident distribution from Jun2009 to Dec2013

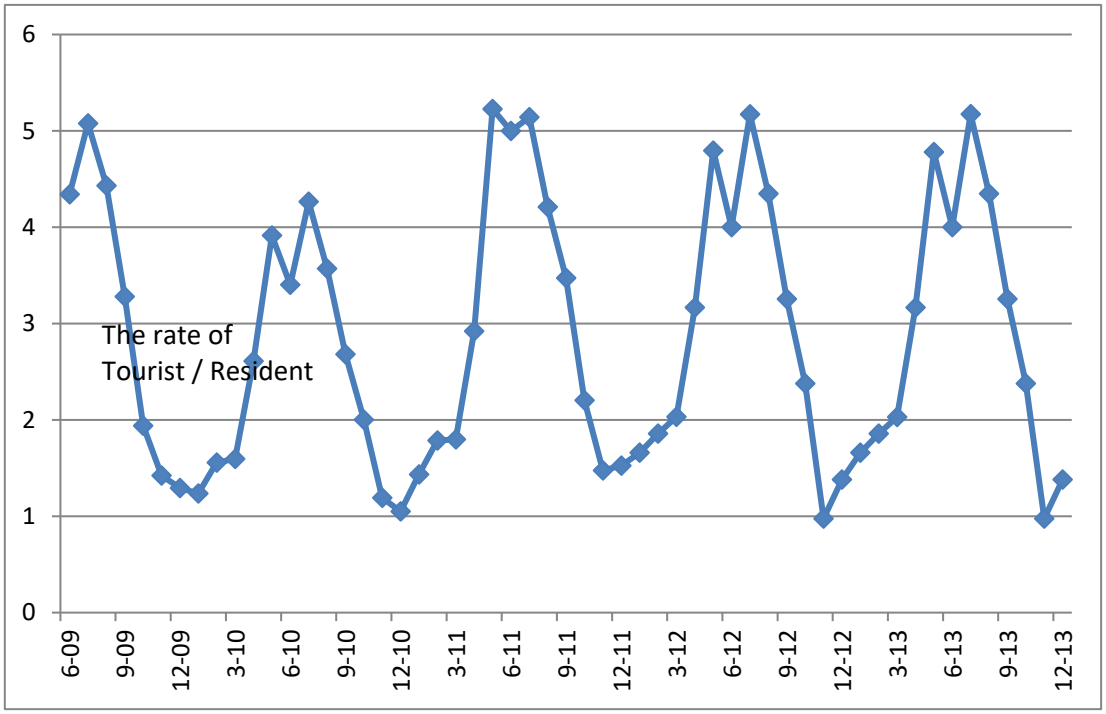

Figure 2 the rate of tourist/ resident distribution from Jun2009 to Dec2013

2. THE CHARACTERISTICS OF AIR TRIP DISTRIBUTION IN OFF-SHORE -ISLAND

There are some competition characteristics and factors to be considered including flight connectivity, carrier choice, frequency levels, average aircraft size and air fares (Fobruszkes, Givoni, and Vowles, 2017; Usami, Manabe, and Kimura, 2017; Fragoudaki, and Giokas 2016;Uittenbogarrt, 1997). The airline strategies are to increase flight frequencies between the city pairs, and to decrease the aircraft size used between city pairs, thus, saving the air fare charged between the city pairs, reconstructing the air route structures and influencing route operating costs and market share on routes. The focuses of model (Marrocu and Paci, 2013; Milan,1997;Seristo,1997)which analyzes airline relationship on the air route network are the market share, concentration, flight traffic, quality of service, and pricing policy. However, most airlines are constant returns to scale(Marrocu and Paci, 2013; Swan,2002). High traffic density has been found to bring significant economies to airlines. Route development has shown persistent increases in frequencies, new routes, and new airports. In the air transportation market (Weber, 2001), larger airplanes usually dominate long-haul flights, which grows much faster than short-haul ones. Long-haul air route must take the geography regulation, manufacture, passengers and airlines perspective to gain the configuration range of regional route network. The regional route network has been more stable than those of national carriers in Europe (Guillaume,2003), its configuration ranges from typical linear

networks, radial networks and is combined with a large amount of point-to-point routes to concentrated radial network. Most of the regional airlines to some extent concentrated their network around one or two central hub airports. Thus, Calderon (1997) proposed geo-economic factors (income-related variables), location factor (travel time), service-related factors, along with the air route structure, airlines' costs, and market share of airlines are to be taken into consideration and effectively evaluated for strategies for a competing air route planning. It's important route development variables such that social-economic variables and airline operating variables, little focuses on the routes of efficiency performance and market share competition. Therefore, this study attempts to test above social-economic factors and compare the strength of international airlines at Taipei airport. These works need to measure and evaluate which routes are competitive.

Taiwan's Makung airports in recent years to connect international charter flights, for the future development of the two airports have a plan and layout. The expanding scale of Taiwan's off-shore island holiday must examine the possible new routes and expansion strategies, which seem to be an important opportunity for Taiwan Island Airport to face international operations and future development, taking into account the operational status of the Islands Airport and the link between the holiday islands airports and the major cities. Therefore, this study will employ the interaction among city-offshore island network as a conceptual framework, discussing the spatial structure of city network in Asia holiday island market, identifying the key elements of city-pair interaction. Meanwhile, Analyzing whether if economic scale and whether if has threshold between off-shore island and main cities. To identify the Asia-renowned holiday-island airports, and analyzed these airports of the number of operating routes, weekly flight movements Quantity, operation of the main business models, interacting the main city pairs and other airport routes operating scale and factors. Under the different conditions of the relevant analysis and regression analysis and situational analysis of the airports, the future of Makung Airport may expand the route and planning strategy under different conditions of simulated operating organization and operating scale.

2.1 The Destination Distribution of the Resident Trips

The above mentions the amount of the resident trips each month are few change not tourists have the hot season and off season. But figure 3 shows that Taipei and Kaohsiung destination distribution for Penghu residents are high negative relation, the correlation coefficient of both routes' trip is -0.805. This the composition of trip destination distribution for Penghu residents is very interesting, which the Kaohsiung is mainly destination occupies over 0.4 and the Taipei is the second destination occupies under 0.4, when the rate of resident trip distribution in highest and lowest points for Kaohsiung destination is the rate of resident trip distribution in lowest and highest points for Taipei lowest. The distribution of resident trip for

both destination like as 0.4 to separate opposite symmetric. Taichung is the third destination occupies the composition of the resident trip is under 0.15, which the resident trip are higher rate in spring vocation, summer vocation. Tainan is the fourth destination occupies the composition of the resident trip is under 0.1and over 0.05, which the resident trip are higher rate in spring vocation, summer vocation. Chiayi is the fifth destination occupies the composition of the resident trip is under 0.05, which the resident trip are higher rate in the Lunar New Year, September month. The Kinmen route is new expand destination and market scale is very small.

2.2 The Origin Distribution of the Tourist Trips

Thus, figure 4 shows the composition of trip origin distribution for travel Penghu tourists is Taipei(TSA) is mainly origin, which occupies 0.3-0.5 arrival Penghu tourists. Kaohsiung(KHH) is secondly occupies 0.225-0.425. Taichung(RMQ) is third, which occupies 0.20-0.115. Tainan(TNN) is fourth and occupies 0.05-0.08. Chiayi(CYI) is fifth and occupies under0.025. The last one is the Kinmen(KNH) route is new expand destination and market scale is very small. The figure 3 also shows that Taipei and Kaohsiung origins for visiting Penghu tourists are high negative relation, the correlation coefficient of both routes' trip is -0.986. Meanwhile, Taichung and Tainan origins for visiting Penghu tourists are high negative relation, the correlation coefficient of both routes' trip is -0.873. The amounts of tourist trips for coming from Taipei and Taichung are reach high points in hot season, but the amounts of tourist trips for coming from Kaohsiung and Tainan are reach low points in hot season. Owing to Kaohsiung and Tainan area are very nearly Penghu is the same culture, living patterns, environment and climate. When in off season, they will visit the Penghu, the amounts of tourist trips for coming from Kaohsiung and Tainan are reach highest points. In other hand, the amounts of tourist trips for coming from Taipei and Taichung are reach lowest points, they are not visit the Penghu in cold winter.

3. FORECASTING THE RESIDENT TRIPS IN HOT/OFF SEASONS

This section first studies the related variables of the resident and tourist for Penghu tourism busy/off seasons. Second, chooses the suitable explained variables of the resident amount prediction in busy/off seasons. This paper also use important explanatory variables such as airline flights, airlines can sell seats with airlines and other variables to predict the number of passengers in and out of the various routes by the number of explanatory variables residents.

3.1 Data Collecting

This study collects data sets of three kinds. First one data set from June 2009 to December 2013, which the supply seats of airline route per month and the load factors of airline route per month are getting from the internet of Civil Aviation Administration. The second data set from January 2011- December 2013, which the amount of tourist and residents per month data are getting from the tourism authority of Penghu Government. The third data set only June 2009- December 2010, which the resident trip data of per route per airline per month are getting by industry commercial office of Penghu Government. The Data of All variables are used the same unit are per month and sample are 55 months.

3.2 The Definition of Variables

Resident trip: represent the amounts of the resident travel trips for departure Makung airport per month.
Tourist trip: represent the amounts of the tourist travel trips for arrival Makung airport per month.
Tourist/Resident: represent the ratio of the amount for tourist travel trips and the resident travel trips per month
Resident/Tourist: represent the ratio of the amount for resident travel trips and the tourist travel trips per month
Hot season: represent the dummy variable, if month is April, May, June, July, August, and September, then the dummy variable value of hot season is 1, whether or not the dummy variable value is 0
Supply seats: represent the total seat amounts of all arrival/departure Makung flights per month.
Load factor: represent the ratio of the total passenger seat amounts of all arrival/departure Makung flights per month and the total seat amounts of all arrival/departure Makung flights per month
Load factor of TSA,RMQ,CYI,TNN,KHH,CMJ, KNH: represent the ratio per month of the total passenger seat amounts of route Taipei(TSA), Taichung(RMQ), Chiayi (CYI), Tainan (TNN), Kaohsiung(KHH), Chimay (CMJ), and Kinmen(KNH) to arrival/departure Makung flights and the total seat amounts of Taipei, Taichung, Chiayi, Tainan, Kaohsiung, Chimay, and Kinmen to arrival/departure Makung flights.
Subsidy impact: represent the number of months for Penghu residents implement 70% subsidy policy from the month of June 2009.

3.3 The Analysis of the Correlation Coefficient

Table 1 shows that the correlation coefficient of resident trip variable related among Load

factor of route flight variables are the route of Tainan (TNN), Chimay (CMJ), Chiayi (CYI),and Kinmen (KNH), and not related Load factor of route flight variables are the route of Taipei(TSA), Kaohsiung(KHH), Taichung (RMQ). This means the Taipei, Kaohsiung, Taichung are busy routes for tourists. The tourist trip relative correlation coefficient of load factor at the route Taipei, Kaohsiung, and Taichung are higher than other routes. The correlation coefficient between resident trip and hot season, tourist trip, supply seats, and load factor variables are not significantly related.

This means the resident trip variable is nearly stable month after month. The correlation coefficient between the dummy variable of hot season and the ratio of tourist trip/resident trip, the ratio of resident trip/tourist trip, tourist trip, and supply seats variables are significantly higher relation. The correlation coefficient between subsidy impact variable and the residents, load factor of route Taichung, Tainan, Chimay, Chiayi, and Kinmen variables are significantly relation. This means subsidy impact can enhance the resident travels and the load factor of routes Taichung, Tainan, Chimay, Chiayi, and Kinmen.

Table 1 The correlation coefficient of residents related variables (per month)

Variable Coefficient	Tourist/ Resident	Resident /Tourist	Hot season	Tourist trip	Resident trip	Supply flight Seats	Load factor
Tourist/Resident	1	-.916(**)	.884(**)	.962(**)	-.230	.941(**)	.644(**)
Resident/Tourist	-.916(**)	1	-.847(**)	-.867(**)	.368(**)	-.837(**)	-.603(**)
Hot season	.884(**)	-.847(**)	1	.854(**)	-.176	.838(**)	.611(**)
Tourist trip	.962(**)	-.867(**)	.854(**)	1	.009	.982(**)	.729(**)
Resident trip	-.230	.368(**)	-.176	.009	1	.043	.226
Supply flight seats	.941(**)	-.837(**)	.838(**)	.982(**)	.043	1	.611(**)
Load factor per month	.644(**)	-.603(**)	.611(**)	.729(**)	.226	.611(**)	1
Load factor of RMQ	.487(**)	-.505(**)	.340(*)	.593(**)	.262	.541(**)	.682(**)
Load factor of TSA	.682(**)	-.628(**)	.652(**)	.734(**)	.124	.630(**)	.910(**)
Load factor of TNN	.297(*)	-.335(*)	.241	.407(**)	.280(*)	.326(*)	.657(**)
Load factor of CMJ	-.261	.302(*)	-.400(**)	-.185	.282(*)	-.151	-.199
Load factor of KHH	.561(**)	-.521(**)	.591(**)	.609(**)	.121	.497(**)	.862(**)
Load factor of CYI	.432(**)	-.456(**)	.350(**)	.564(**)	.358(**)	.492(**)	.754(**)
Load factor of KNH	.349(**)	-.257	.201	.427(**)	.269(*)	.442(**)	.330(*)

** mean $\alpha = 0.01$ (two tails), it is significant; * means $\alpha = 0.05$ (two tails), it is significant, N=55

Table 1 The correlation coefficient of residents related variables (continuous)

Variable Coefficient	Load factor of RMQ	Load factor of TSA	Load factor of TNN	Load factor of CMJ	Load factor of KHH	Load factor of CYI	Load factor of KIM	Subsidy impact
Tourist/Resident	.487(**)	.682(**)	.297(*)	-.261	.561(**)	.432(**)	.349(**)	.019
Resident/Tourist	-.505(**)	-.628(**)	-.335(*)	.302(*)	-.521(**)	-.456(**)	-.257	.003
Hot season	.340(*)	.652(**)	.241	-.400(**)	.591(**)	.350(**)	.201	-.041
Tourist amount	.593(**)	.734(**)	.407(**)	-.185	.609(**)	.564(**)	.427(**)	.133
Resident amount	.262	.124	.280(*)	.282(*)	.121	.358(**)	.269(*)	.392(**)
Supply flight Seats	.541(**)	.630(**)	.326(*)	-.151	.497(**)	.492(**)	.442(**)	.134
Load factor per month	.682(**)	.910(**)	.657(**)	-.199	.862(**)	.754(**)	.330(*)	.228
Load factor of RMQ	1	.548(**)	.673(**)	.098	.457(**)	.734(**)	.621(**)	.479(**)
Load factor of TSA	.548(**)	1	.509(**)	-.110	.670(**)	.615(**)	.320(*)	.228
Load factor of TNN	.673(**)	.509(**)	1	-.091	.516(**)	.779(**)	.513(**)	.541(**)
Load factor of CMJ	.098	-.110	-.091	1	-.402(**)	.033	.239	.303(*)
Load factor of KHH	.457(**)	.670(**)	.516(**)	-.402(**)	1	.626(**)	.086	-.038
Load factor of CYI	.734(**)	.615(**)	.779(**)	.033	.626(**)	1	.329(*)	.298(*)
Load factor of KNH	.621(**)	.320(*)	.513(**)	.239	.086	.329(*)	1	.833(**)

** mean (two tails), it is significant; * means (two tails), it is significant, N=55

3.4 Regression Estimator of the Rate between Tourist and Resident

According to above mentions, the correlation coefficient analysis for the amount of resident relation influencing variables also in advance predict to measure and explain each other relations and influences between variables. Owing to the deal data of departure /arrival airport trips for the resident are not easy to get them. Therefore, this paper is applied with grey method to forecast single variable, and the regression to explain the single variable with more complex management issues and reasons. Two approaches use SPSS software solving. There are three kind data sets, the load factors of airline route per month by CAA internet from June2009 to December 2013, the amount of tourist and residents per month data by tourism authority of Penghu Government from 2010-2013, the amount of resident trips for per airline only June 2009-2010 data by industry commercial office of Penghu Government. This paper proposes two regression models.

Above five variables of the amount if tourist trips per month, the amount of resident trips per month, the rate between tourist trips and resident trips per month, the flight amount per month, to construct the least square regression models in order to predict the rate between the amount of tourist trips and the amount of resident trips per month. Function (1) represents the estimator of the rate of tourist trips and resident trips per month. Thus, the regression models are goodness of fitness. The outcome shows that the average rate between tourist trips and resident trips per month is 2.728, if tourist trips per adding one ten thousand trips, the rate of

tourist/resident will increase 0.414, but if Penghu residents per adding one ten thousand trips, the rate of tourist and resident will decrease 1.157. These both variables coefficients show that the Penghu resident trip variable is more impact than the resident trip variable. Meanwhile, in the hot season of April, May, June, July, August, and September month, the rate of tourist and resident will add 0.211. This means the rate of tourists and residents in busy seasons will get close to 3, and the rate of tourists and residents in off-peak seasons will decrease to 2.5.

$$\frac{\hat{\text{Tourist}}}{\text{Resident}} = 2.728 + 0.414\text{Tourist} - 1.157\,\text{Resident} + 0.211\text{Hotseason} \qquad (1)$$

$$(t = 12.983)\ (t = 25.088)\ (t = -11.842)\ (t = 2.131)$$

$$F = 1044.29, R^2 = 0.984, N = 55$$

$\frac{\hat{\text{Tourist}}}{\text{Resident}}$: Tourist : The rate between the amount of tourist trips per month by air and the amount of resident trips per month by air

Tourist : The amount of tourist trips per month (unit: ten thousand persons) by air transportation

Resident : The amount of resident trips per month (unit: ten thousand persons) by air transportation

Hotseason: The dummy variable of tourism months, if the month is April, May, June, July, August, and September then the value is 1.

Table 2 The correlation coefficient of hot season related variables

Variables	Tourist trips	Resident trips	Pax trips	Supply seats	Surplus seats	Load Factor	Hot season
Tourist trips	1	-.160	.998(**)	.997(**)	.653(*)	.895(**)	.970(**)
Resident trips	-.160	1	-.097	-.172	-.600	.206	-.311
Pax trips	.998(**)	-.097	1	.994(**)	.620	.916(**)	.958(**)
Supply seats	.997(**)	-.172	.994(**)	1	.702(*)	.868(**)	.967(**)
Surplus seats	.653(*)	-.600	.620	.702(*)	1	.263	.694(*)
Load Factor	.895(**)	.206	.916(**)	.868(**)	.263	1	.831(**)
Hot season	.970(**)	-.311	.958(**)	.967(**)	.694(*)	.831(**)	1

** mean (two tails), it is significant; * means (two tails), it is significant, N=10

4. DEMAND MANAGEMENT OF AIR TRIP ALLOCATION OF OFF-SHORE-ISLAND RESIDENTS AND TOURISTS

4.1 The Regression Estimation for Destination Distribution of the Resident Trips

According to above mentions, the correlation coefficient analysis for the amount of resident relation influencing variables, such as different routes difference, different operating airlines, and different amount of seats, this section will in advance predict to measure and explain each other relations and influences variables. Owing to data constraints, this study only collect from June 2009 to December2010, including the subside residents per month of the operator carriers for Far Eastern Air Transport, Trans Asia airway, UNI Air, and Mandarin Airlines, and five routes of Taipei, Kaohsiung, Taichung, Tainan, and Chiayi except Kinmen, and Chimay operating routes. The least square regression models predict the resident amount of taking different routes and airlines per month. Function (14) represents the estimator of the resident amount of taking different routes and airlines per month. Thus, the regression models are goodness of fitness.

The outcome shows that the average resident amount taking each route airline flight per month is 1226 persons, if taking the Trans Asia airways flights, the resident amounts will increase 2497 persons. The Trans Asia airways serve the mostly schedule flights, the Penghu residents almost take the Trans Asia airline flight to Taipei, Kaohsiung, and Kinmen. The Kaohsiung route and Taipei route are mainly routes in Makung air transportation. Therefore, if the residents go to Kaohsiung route, the resident amounts of Kaohsiung route will increase 1796 persons. The regression shows that the resident amounts of Kaohsiung route Trans Asia airline per month will reach 5519 persons to nearly occupy one quarter air market share of Penghu resident air travel. The Chiayi route only one operator namely UNI airline, the schedule flight is less, the residents go to Chiayi also less. Therefore, if taking the Chiayi airline UNI flights, the resident amounts will decrease 826 persons. This means the resident amounts of taking the Chiayi airline UNI flights will only 401 per month. The impact of flight seat to the residents is small, per adding one seat will increase 0.011 person taking flight.

$$\hat{\text{Resident}}_{ij} = 1225.563 + 2496.94\text{GE} + 1796.\text{KHH} - 825.607\text{CYI} + 0.011\text{Seat}_{ij} \qquad (2)$$

$$(t = 11.168)\ (t = 17.234)\ (t = 4.860)\ (t = -5.038)\ (t = 2.349)$$

$$F = 338.146, R^2 = 0.891, N = 170$$

Resident_{ij} : the amount of resident per month by air route i airline j flights per month

GE : The dummy variable, if resident board the airline Trans Asia flights per month, the dummy variable is 1, otherwise is o.

KHH : The dummy variable, if resident board the route Kaohsiung flights per month, the dummy variable is 1, otherwise is o.

CYI : The dummy variable, if resident board the route Chiayi flights per month, the dummy

variable is 1, otherwise is o.

$Seat_{ij}$: The airline supply the number of air route i airline j flight seats per month

4.2 Issues and Management of Flight Load Factors, Spoil Seats in Busy/Off Season

Figure 5 shows that the amount of the spoil seat in the hot seasons not decrease but increase, the serious periods happen in the past year 2011 and 2012. Last year has less increased but still spoil seats more 40,000 seats per month. Figure 6 shows that last year the load factor are improving, and also improving the spoil rate of seat. Figure 7 shows the load factor of the route CMI is poor, always lower than 65%. The load factor of route KNH is very vibration between hot season and off season. The load factor of route TNN is relative more stable and higher than the other load factor of routes. The load factor last year of route KHH and CYI are higher than past years. The load factor of route TSA is relative lower than the load factor of TNN, KHH, and CYI routes. The next steps, the airline and CAA will focus the management strategies for flight spoil seats issues of off-peak in off seasons and off-peak hours in hot seasons.

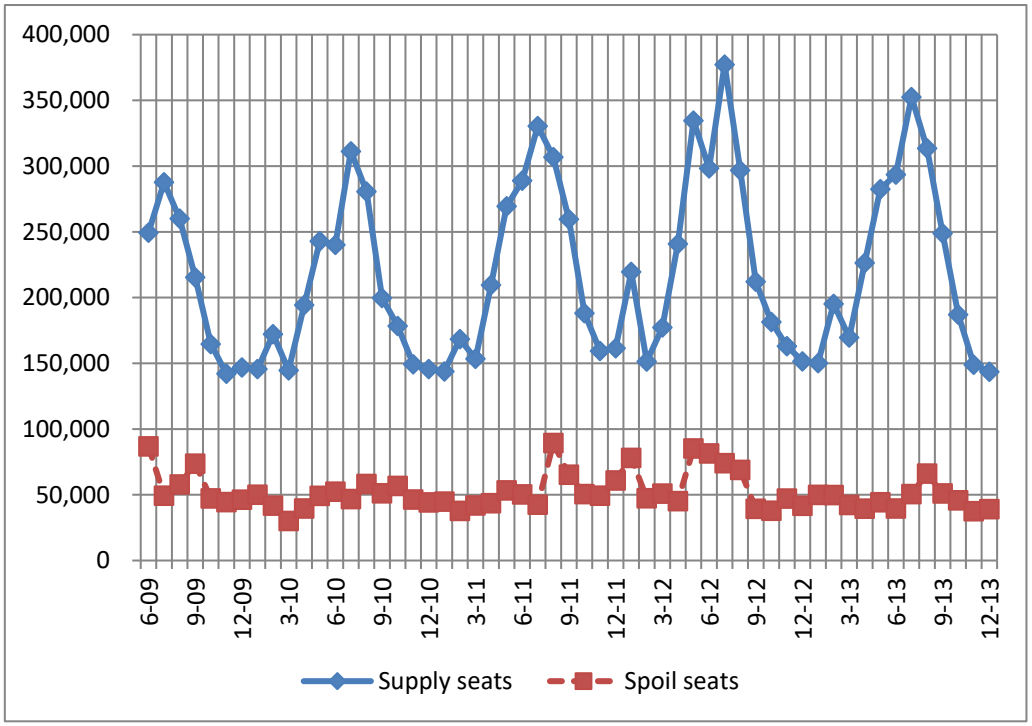

Figure 5 The flight supply seats and spoil seats distribution from Jun2009 to Dec2013

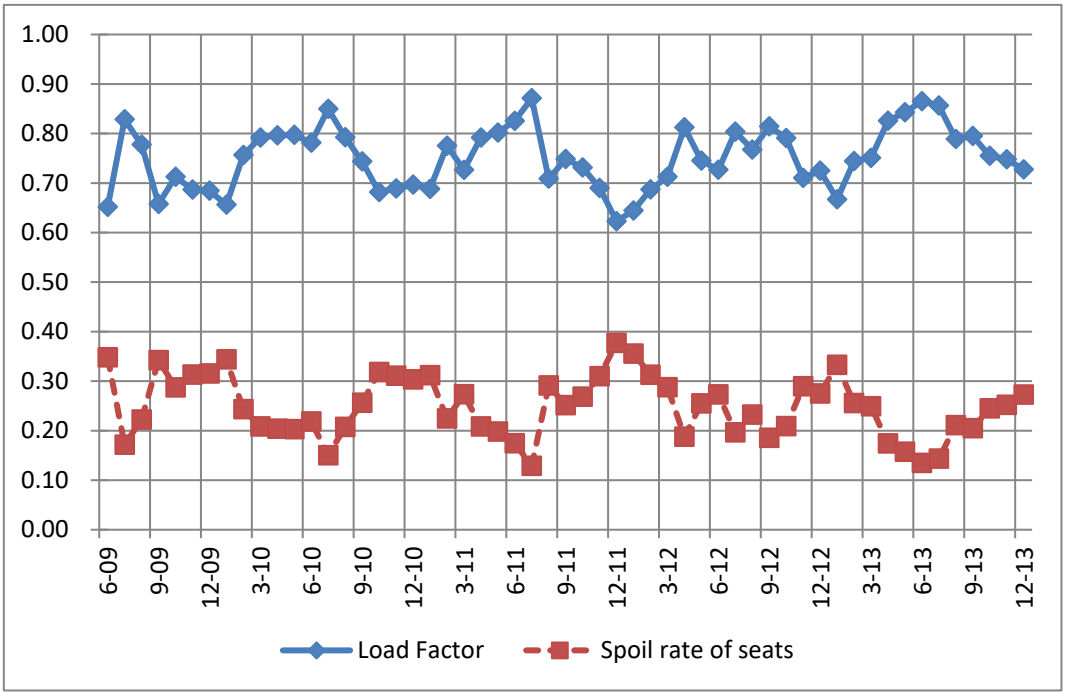

Figure 6 The flight load factor and spoil rate distribution from Jun2009 to Dec2013

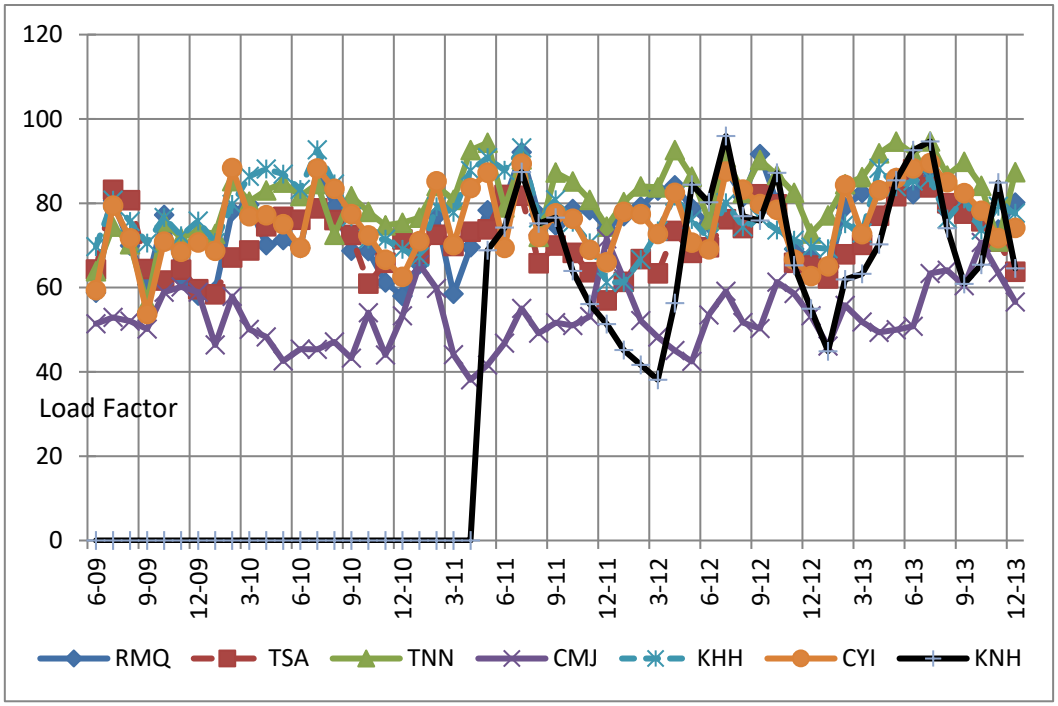

Figure 7 The flight load factor of seven routes distribution from Jun2009 to Dec2013

4.3 Improving the marketing strategies of the airlines

In order to solve the issues between transportation needs of the residents, transportation demands of the tourists and airlines operating cost, this study considers must solve the basis

and right estimator of how many residents and tourists during different seasons, and then the airline assigning how many flight frequencies during different seasons are very clearly discussed and allocated. Therefore, this study collects subsidies and sightseeing trips data of Penghu County Government, and passenger data of Makung airports. The gray forecast and multiple regression models are applied to predict the number of residents in the various routes by air during different sightseeing season. The outcomes can provide flight schedule planning for the airlines and references, also recommend CAA modify flight schedules and frequencies reference of off-shore islands. This study considers that the operating costs of airline operations on outlying islands are the same as in the peak season. This study also considers the operating costs of the most recurrent flights. The occupancy rate is 50%. Therefore, this study suggested following strategies.

4.3.1. The neglecting demands of the reverse during peak period of the peak season

Airlines' always neglects the demands of the reverse during peak period of the peak season During the peak season, the demand for late arrivals Penghu or early leaving Penghu passengers must be a discount on the application of fares discounts (early bird offers) and airlines' must be cooperation with the dwellers or hotels.

4.3.2 Adjustment of the flight distribution period of the off-season peak period

In the off-season, when the number of passengers and residents is equal, the demand for less demand is generated, so that the airline is transferred to other routes. Such as revival of aviation will be ATRS72 servings to adjust to Kinmen route, Huaxin and Far East models are large to cross-strait service. Therefore, as far as possible to allow residents and passengers to take the flight distribution time is a choice, the Civil Aviation Authority should be approved in the fall class table, Taipei and Kaohsiung route should not be two hours without any shift, to strengthen the clean-up operations to reduce the spot tickets Left too much, wasting the number of seats.

4.3.3 Application of strategic alliance of maritime passenger transport industry during peak season

Japan's aviation industry often with the Japanese national iron and private iron and the MRT as Taiwan's current promotion of the travel card together with the passengers, passengers not only have a variety of options, but also sparse season peak season passengers difficult to find the dilemma. Off-shore airlines must devote to strengthen the cleaning operations of flight seats to reduce the number of waiting tickets left too much, wasting the number of seats.

4.3.4 Open the sky powers of foreign airlines' competitions

Open the sky for foreign airlines of lower cost carries' running air markets of off-shore islands, let passenger's many more choice to travel off-shore islands.

5.CONCLUSION AND SUGGESTION

This study not can estimate the resident trip in busy/off seasons with regression method, also discuss the issues of air aviation for off-shore island tourism, The major findings from this study can be briefly stated as follows:

First, The resident and tourist trips can put into the ratio of regression between tourist trip and resident trip to predict the rate difference of tourist and resident in busy and off season in the future.

Second, the correlation coefficient between subsidy impact and the residents, load factor of route Taichung, Tainan, Chimay, Chiayi, and Kinmen variables are significantly related. This means subsidy impact can enhance the resident travel trips and enhance the load factor of routes Taichung, Tainan, Chimay, Chiayi, and Kinmen.

Third, the Penghu resident trip is more impact than the tourist trip to the rate of tourist trip and resident trip. The rate of tourist trip and resident trip in busy seasons will get close to 3, and the rate of tourist trip and resident trip in off-peak seasons will decrease to 2.5.

Fourth, the route flight trip estimator of the resident trip of taking different routes and airlines per month shows that the average resident amount taking each route airline flight per month is 1,226 trips. The resident trips of taking the Chiayi airline UNI flights will have only 401 trips per month. The impact of flight seat to the residents is small.

Fifth, The Trans Asia airways serve the mostly schedule flights, the Penghu residents almost take the Trans Asia airline flight to Taipei, Kaohsiung, and Kinmen. the regression also shows that the resident amounts of Kaohsiung route Trans Asia airline per month will reach 5,519 persons to nearly occupy one quarter air market share of Penghu resident air travel.

Sixth, the application of regression, the trip of the residents departing Makung to Kaohsiung per month is 9,145-9364 persons. The trip of the residents departing Makung to Taipei each

month is 7,732-7,859 persons. The trip of the residents departing Makung to Tainan per month is 1,544-1,545 persons.

Finally, the outcomes can provide flight schedule planning and references for the airlines. The airlines shall promote some marketing strategies to promote and extend more off-peak resident and tourist demands. CAA will encourage the airlines propose and enhance operating strategies for the flight spoil seats of off seasons and off-peak hours in hot seasons.

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