Demand for Low-Cost Airlines in Australia

Panarat Srisaeng, Cees Bil, Margaret Tein
School of Aerospace Mechanical and Manufacturing Engineering
Royal Melbourne Institute of Technology University
Melbourne, Australia

***Abstract* — the purpose of this study was analysis of low-cost airline demand in Australia. As part of this project, an econometric method was applied to develop a regression model for forecasting demand. The research hypothesis being that low-cost airline demand in Australia is based on the following variables: domestic airfares, price of other transport modes, population, disposable income and tourist numbers. It was found that demand for low-cost airlines is primarily a function of domestic airfare and population while tourist numbers and price of other transport modes did not have a significant influence.**

Keywords-low cost airlines; demand modelling

I. INTRODUCTION

The low-cost airline concept has been very successful in North America and Europe. Emergence of low-cost airlines has significantly stimulated demand for air travel. In Australia, after deregulation in 1990, several low-cost airlines were established but most were unsustainable. In 2000 Virgin Blue entered the market and is the first low-cost airline in Australia to be both successful and profitable (Forsyth, 2003). Virgin Blue's success has attracted other low-cost airlines such as Jetstar to enter the market. The study aims to develop a demand model for low cost airlines in Australia and identify variables affecting the demand model significantly. As demand for air travel is related to and affected by one or more economic, social or supply factors, this study used an econometric method to develop a demand model. Econometric models attempt to measure causal relationships allowing forecasting of the impact of change implementation on any variable and consequent prediction of demand level impact (Doganis, 2002). Knowing demand for low-cost airlines helps government and business sectors arrange adequate air service infrastructure to meet future demand and provides more accurate information on which to base strategic plans and decisions. The hypothesis of this research is that the total number of low-cost airline passengers depends on the following independent variables: domestic airfares, price of other transport modes, population, disposable income and tourist numbers. A multiple linear regression analysis was used to test this hypothesis. This paper starts with a general background of the Australian airline industry, followed by a review of previous research studies. The methodology is then introduced and finally results are presented followed by conclusions.

II. LITERATURE REVIEW

Studies of air travel demand have used a variety of methodologies and variables. Battersby and Oczkowski (2001) analyzed a demand model for domestic air travel in Australia using the regression method. Four independent variables: airfares, income, substitute prices and seasonality were considered. Both price and income elasticity were found to be lower than in previous studies. Savage and Dykstra (1995) studied demand elasticity for air travel to and from Australia. The model was separated into two parts: leisure travel and business travel. The study found variables determining leisure travel were airfares, income and relative prices while income and relative prices were found to be the most important determinants for business air travel. Ghobrial and Kanafani (1995) estimated air passenger demand between various city pairs in the United States by using regression analysis. Population and per capita income were selected to represent the socioeconomic variables while the supply variables included airfare, travel time, city specific variables and level of service parameters including aircraft size and number of flights. Although the model explained only 50% of the variation in data, results suggested that air passenger demand was highly dependent on the frequency of flights, travel time and airfare. Tretheway and Oum (1992) identified variables which possible affect

ISBN: 978-0-615-20720-9

demand for air travel, price income price and other modes of transport, frequency of service, timing of service, day of the week, season of the year, safety and company goodwill, demographics, distance, in-flight amenities, customer loyalty and travel time. The results showed that the most significant of these determinants of demand for air travel are price and income.

III. METHODOLOGY

Previous studies focused on demand elasticity for full-service air travel in Australia. However demand for low cost airlines has not yet been studied in detail. This study therefore will focus on developing a demand model for low cost airlines in Australia by using secondary data sources from the Australian Bureau of Statistics (ABS) Bureau of Transport and Regional Economics (BTRE) and low cost airlines' annual reports. In air travel demand, analysis many explanatory variables influence passenger numbers. The procedure for developing regression models and forecasting air passenger traffic can be illustrated by the flowchart shown in figure 1. The major objective of regression analysis is to study the relationship between selected variables by measuring the response of one variable by a set of variables then use the regression model to estimate the dependent variable by given independent variables. The first step in demand model development is reviewing past travel trends. To identify patterns in the relationship between these variables a scatter diagram is plotted. The next step is to identify factors influencing travel in the past and those which may affect it in future. This step mainly relies on previous research studies. A literature review can assist variable selection by highlighting general characteristics influencing demand for travel. Variable selection also depends on availability of empirical data and operational costs. Next the function form of the demand model is established from the list of variables selected. Plotting a scatter diagram can assist to identify variable relationships whether linear or non-linear forms. The model is then used to fit historical data using the ordinary least squares (OLS) method to estimate coefficients. The next step in model development is to evaluate model accuracy. Statistics such as the coefficient of determination (R^2) and analysis of variance (ANOVA) are used to evaluate the model. The coefficient of determination (R^2) is a measure of the

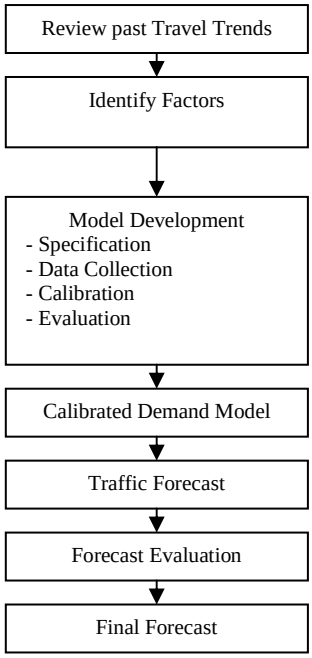

Figure1: Regression Model Development (Taneja,1978)

adequacy of the regression equation. In other words, this statistic shows how well the model fits the data. If the R^2 value is near 0 it implies a relationship does not exist between dependent and independent variables. Conversely, if the R^2 value is near 1 it implies there is a strong relationship between dependent and independent variables. Analysis of variance (ANOVA) is often presented in connection with the regression model. This is the breakdown of the total sum of squares into the explained sum of squares and the residual sum of squares. The purpose of presenting the table is to test the coefficient significance (Muddala, 2001). The next step is to estimate air travel demand. Demand forecast is produced by using this verified demand model and the trend projection. With this method the independent variables will be projected and the dependent variable can be estimated.

IV. VARIABLE SELECTION

The dependent variable used is the total number of passengers who traveled on Virgin Blue Airways and Jetstar, the two low cost carriers in Australia, in a particular year. Since Virgin Blue has operated since 2002 and Jetstar has flown since 2004 historical data on low cost airlines passengers was

ISBN: 978-0-615-20720-9

only available from 2002. In this study the series of total number of passengers are represented per quarter. Based on previous research, most air passenger demand studies selected socioeconomic factors and transport supply factors to analyse the relationship between variables. In this study, the following variables are selected as socioeconomic variables: population, disposable income and tourist numbers while airfares and price of other transport modes are chosen as transport supply factors. Tourist numbers were not selected by previous demand model development, however this variable might impact a demand model for low cost airlines as low fares may attract tourists who would otherwise travel by other transport modes. The total population of Australia is collected from the Australian Bureau of Statistics covering the second quarter of 2002 and extending to the final quarter of 2004. Disposable income is the net income from which taxes have been deducted to represent purchasing power. This is an important airline industry variable because it give a sense of the amount of money people can spend on air tickets (Ellsworth, 2000). To adjust for inflation, disposable income is divided by the consumer price index (CPI) taken from the Australian Bureau of Statistics with 1990 as the baseline. Tourists are people whose main purpose for the trip is holiday include those who not only travel by air but also by other transport modes. Domestic full-service airline fare is an important factor in passenger decisions which influence low cost airline demand. This study uses the domestic airfares price index for economy class for full-service airlines taken from the Bureau of Transport and Regional Economics (BTRE) to calibrate the demand model. The airfares price index for economy class uses July 2003 as the baseline and is adjusted for the CPI using the Australian Bureau of Statistics Consumer Price Index. The price index of other transport modes is selected to analyse the relationship between numbers of low cost airlines passengers and price of alternative travel options. Like previous variables, the price index of other modes of transport is adjusted for inflation and has 1990 as the baseline.

V. DEMAND MODEL

The demand model is developed to estimate the total number of low cost airline passengers. The statistical software, SPSS, is used to determine the final forecast model. From the scatter diagram of these variables, the relationship between dependent and independent variables in this model is determined to be a linear relationship.

The general form of the regression model is:

$$Y_t = b_0 + b_1P_t + b_2I_t + b_3T_t + b_4A_t + b_5O_t$$

Where Y is the dependent variable, total number of low cost airlines passengers, P is the population of Australia, I is the disposable income, T is the total number of tourists, A is the domestic airfare index and O is the fare of other modes of transport index. The SPSS is used to perform the regression analysis. The ordinary least-square method (OLS) is used to determine the parameters bi in the regression model and the STEPWISE method is used to select the variables. Stepwise regression begins by entering variables into the model one at a time. The first variable to be selected is the parameter which shows the strongest correlation with the dependent variable. Each time a new parameter is considered for entry into the model, the program simultaneously tests the variables in the model for removal. The t statistic is used to test the hypothesis that the coefficient of the variable is 0. If the significance of adding a variable to the equation is less than or equal to 0.05, in other words the confident interval is less or equal to 95%, then the variable is included in the model. However, a parameter will be removed if its significance level exceeds 0.10. The stepping procedure ends when the significance of the dependent variable does not improve (Ellsworth, 2000).

VI. RESULTS

A stepwise multiple regression analysis was executed with five exogenous variables. The adjusted coefficient of determination, Adjusted R^2, is a measure of model adequacy or how well the model fits data corrected for bias. Statistical results indicated the model explained 98% of variation in the endogenous variable “total number of low cost airlines passengers”. The model is tested for overall significant by using F-test. The F-test is a formal hypotheses test that is designed to deal with a null hypothesis that contains multiple hypotheses or a single hypothesis about a group of coefficient. Alternatively, there is a measure called the p-value or marginal significant value which is used to test the hypothesis of regression. If p-value is less than

ISBN: 978-0-615-20720-9

critical value the null hypothesis will be rejected. T-test is the test usually used to test a hypothesis about the individual regression slope coefficient. If p-value is less than critical value the null hypothesis will be rejected. Overall the model is statistically significant (p-value < 0.000). It can be implied that there is at least one independent variable which relates to the total number of low-cost airlines passengers. To determine which independent variables have a relationship to the dependent variable, T-statistics were used as a criterion. If p-value of each variable is less than or equal to 0.01, the variable will be included in the model. We find two variables, population (P) and domestic airfares index (A) are statistically significant (p-value < 0.01). The signs of the regression coefficients of these variables are positive which is in line with expectations. If fares of full-service airlines increase, passengers are more likely to fly with low cost carriers. However, three other variables, disposable income (I), total number of tourists (T) and price index of the other transport modes (O) did not prove to be significant at a 0.1 probability level and were removed from the model. The resulting simple demand model for low cost airlines is:

$$Y_t = -80{,}923{,}650.611 + 3.125P_t + 11{,}146.106A_t ,$$

The coefficient of the population variable is positive (b = 3.125) and statistically significant (p-value < 0.01). This indicates the higher the greater the Australian population, the more likely demand will be for low cost airlines. According to the stepwise regression, it is determined that disposable income, the total tourist numbers and price index of other transport modes are not statistically significant for estimating the number of low cost airlines passengers.

VII. CONCLUSION

It can be concluded that demand for low cost airlines in Australia is a function of population and full-service domestic airfares price index. This study shows exogenous demand variables for low cost airlines are different from demand variables for full-service air travel in Australia. Disposable income, tourist numbers and the price index of other transport modes are not significant to the model. When domestic airfare increases the number of low cost airline passenger will increase and also when number of population increases the number of low cost airline passenger will increase as well. This model is based on data for the past three years, and can be verified in future as more data becomes available.

REFERENCES

[1] Australian Bureau of Statistics 2003-2006, 2003 year book Australia, cat. no. 1301.0, ABS, Canberra.

[2] Australian Government Department of Transport and Regional Services 2006, Domestic Airfares indexes

[3] Battersby, B. & Oczkowski, E. 2001, An Econometric analysis of the demand model for domestic air travel in Australia, International Journal of Transport Economics, Vol. 28, No. 2, pp.193-204.

[4] Doganis, R. 2002, Flying Off Course: The Economics of International Airlines, Routledge, London.

[5] Ellsworth, S. 2000, Estimating Air Passenger Travel in the Atlantic Region, master of science in engineering Thesis, The University of New Brunswick.

[6] Forsyth, P. 2003, Low-cost carriers in Australia: Experiences and impacts, Journal of Air transport Management, Vol. 9, pp. 277-284.

[7] Maddala, K. 2001, Introduction to econometrics", 3rd edition, Wiley, England

[8] Qantas Airways Limited, 2005, Preliminary monthly traffic and capacity statistics,(http://www.qantas.com.au/infodetail/about/investors/trafficStats/July2005.pdf)

[9] Qu, H. & Lam, S. 1997, A travel demand model for mainland Chinese tourists to Hong Kong" , Tourism Management, Vol. 18, No. 8, pp. 593-597.

[10] Savage, S. & Dykstra, C. 1995, Demand Elasticities for Air Travel To and From Australia, working paper 20, Bureau of Transport and Communications Economics, Canberra.

[11] Taneja, N. 1978, Airline Traffic Forecasting, Heath, Toronto.

[12] Virgin Blue Holdings Limited, 2005, Summary of operating statistics, (http://www.virginblue.com.au/pdfs/investors/December2004.pdf)

ISBN: 978-0-615-20720-9