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Abstract. The increasing number of passengers from Jakarta to Surabaya each year will directly impact on the airport capacity in serving aviation traffic demand as it relates directly to flight frequency, runway capacity, terminal building capacity and others. The mode of Jakarta-Surabaya transportation for passengers is still focused on the mode of aircraft compared to other modes such as train. The imbalance between these modes of transportation indicates the need for other alternative modes to strengthen competitiveness in the improvement of service to passengers. This research was conducted to analyze the model of transportation mode selection between aircraft and high speed train of Jakarta-Surabaya route as an empirical case study, assuming the construction of high speed train infrastructure has been completed and ready to operate connecting Jakarta-Surabaya. This study offers the same travel time and fare between the aircraft and high speed train that reflects the special characteristics that become the passenger's main choice. Stated Preference techniques and binomial logit model are used in this study as tools for data collection and processing. As a result, the most influential passenger characteristic in this study is the level of passenger income level.

Keywords: *impact, traffic demand, high speed train, stated preference, binomial logit model*

1. Introduction

The government's plan to build the Jakarta-Surabaya high speed train will make the previous travel time between the two cities that was about 10 hours using the eksekutive train and about 4 hours using the aircraft will be approximately into 4 hours. This may cause a decrease in aircraft passenger demand with this route and increase the competition between the airlines and high speed train service companies. This study was conducted to determine the behavior of aircraft passengers in determining the choice of mode to be used. This research also attempts to develop strategies for air transport services to remain competitive in facing new competition from high speed train transport services as an alternative mode. However, since this study considers only limited variables such as rates and travel time, the resulting model may have limitations in reflecting the reality.

This study was conducted to determine the behavior of aircraft passengers in determining the choice of transportation mode to be used by using the Stated Preference technique, using several variables that are considered influential. Assuming that the Jakarta-Surabaya high speed train has been planned by the government. The operation of the Jakarta-Surabaya high speed train will be an alternative mode of choice that competes competitively with aircraft mode.

As you can see from Table 1, Passangers the Juanda International Airport and Soekarno-Hatta International airport's domestic flight passanger Jakarta-surabaya route increased at an annual average of about 3.87%.

Table 1. Jakarta-Surabaya route passangers aircraft.

	2012	2013	2014	2015	2016	Growth(%)
Jakarta – Surabaya	5.035.216	5.613.642	5.371.110	5.228.922	5.860.098	3,87

Source: [6]

2. Literature review

2.1. Literature of transport choice behavior by air passangers

Classified passengers into two distinctive groups as business passengers and leuisure passengers in order to analyze each group's choice of the mode transportasion when air transportation is in competition with hish speed rail Seoul-Jeju route. Flight fare, travel time, frequency, safety and duty free shopping avaibility were considered as explanatory variables [1].

Using a stated-preference survey, examine changes in air transport demand by the entry of low cost carriers into domestic service, and with the beginning of operation of the Linear Chuo Shinkansen. Total fares, total travel time and frequency were considered as explanatory variables [2].

Carried out SP research on Seoul-Daegu route air passengers supposing that KTX is introduced on the Seoul-Daegu route. After KTX was introduced, it was proven that there were actual changes in air transportation demand and passengers' preference compared to periods prior to the launch. To carry out the preference survey, access time, fare and the frequency of operation were set as variables [3].

Analyzed choice attributes of FSC and LCC business air passengers in South Africa. The choice attributes included eleven variables of degree of seat comfort, schedule/frequency, fare, authority of seat choice, cancellation charge, airport lounge facility, frequent flyer program, business seat choice, inflight food and drinks, method of payment and in-flight entertainment [4].

Classified passengers into two distinctive groups as business/travelers and residents/visitors in order to analyze each group's choice of airports among San Francisco International (SFO), San Jose Municipal (SJC) and Oakland International (OAK) airports, all located in vicinity of San Francisco Bay area. Flight fare, frequency and access time were considered as explanatory variables. As a result, preference towards air transportation in the SP research turned out to be 14% which increased to 28% after the KTX entry, slightly higher than the supposed value [5].

2.2. LCC operation

LCC or Low Cost Carrier airlines are airlines that offer low fares to their customers, with the consequent deletion or subtraction of some services or facilities to be gained by regular flights. This type of flight also called 'Discounter Carrier' is usually synonymous with the aviation services business that embraces "efficient, simple and concise" services. LCC aviation services are competing in fare war to attract a lot of customers, but sometimes ignore the safety and passenger service factors or technical matters relating to flight implementation.

This type of flight was introduced in the United States, which was followed by many airline companies around the world. How not, this type of business is quite big profit. Launched from various media, when the condition of international flight was experiencing crisis with the issue of terrorism and war, service base with LCC base still get profit. Consumers still choose cheap flights to travel even with those conditions.

3. Stated preference and model construction

3.1. Selecting choice variabel dependent

Binary logistic regression method were used to analyze how much the aircraft passengers' willingness will move using Jakarta-Surabaya high speed train, where variables are dichotomized with two

possibilities (1: yes and 0: no). The answer YES for those who want to move using high speed train and NOT for those who still want to use aircraft mode.

3.2. Selecting choice variabel independent
In our stated preference design, there are transportation modes on the Jakarta-Surabaya route: aircraft and high speed train as an alternative mode of transportation. As discussed in previous sections, the authors decided to use not travel time and fares. It is necessary to set the evels of value of these two variables. Authors too include variables gender, age, income level, job, educattion level, trip purpose and the modes used to the airport.

3.2.1. Travel time attribute
Travel time is the travel time of the vehicle in minutes or hours, which is the time required to start the journey from the starting point to the airport until arriving at the airport destination including the time of reporting the departure (check in, boarding pass), waiting at the terminal (waiting time), transit / stop time and baggage handling to the end of destination. The average travel time of air transport from major cities in the Jakarta-Surabaya was 240 min (90 min check in and waiting time, 30 min boarding time, 90 min on board and 30 min baggage handling/time to out in airport) shown in table 2.

3.2.2. Fare attribute
Fare are the costs incurred for the payment of the transportation fee in rupiah per person, which is the cost of the Jakarta - Surabaya route. This variable is given three levels of value. The highest level is set at average air fare of 2016. The medium and low levels are set at values respectively 10% and 20% lower than the highest level's value. This was due to the assumption that if high speed train, a new mode of transportation, is introduced to the market, air carriers would set lower air fares to maintain their market share and competitiveness [1].

Meanwhile, the lowest level's value in the fare attribute for high speed train is set at IDR 600.000 to low cost carrier passanger and IDR 1.000.000 for Garuda Indonesia passanger, the current average high speed train fare for the Jakarta-Surabaya route which is the longest leg of incumbent high speed train in Indonesia. The medium and highest levels' values are set 20 percent and 40 percent higher than the lowest level's value. This study assumes that the high speed train operator will increase high speed train fare slightly at the initial stage of operation to manage profit and retrieve investment cost.

Table 2. Variables in stated preference research for low cost carrier passanger.

Attribute	Value of each attribute level (differences between high speed train and air)		
	Level 1	**Level 2**	**Level 3**
Fare (IDR)	500.000	600.000	700.000
Travel Time (Minute)	300	240	180

Note: May 2017

Table 3. Variables in stated preference research for garuda indonesia passanger.

Attribute	Value of each attribute level (differences between high speed train and air)		
	Level 1	Level 2	Level 3
Fare (IDR)	700.000	800.000	1.000.000
Travel Time (Minute)	300	240	180

Note: May 2017

3.3. Stated preference survey and model calibration
In general, the sample size for the stated preference survey should be large enough to accommodate at least 75–100 numbers for each attribute or segment, examples of which include gender, income level,

job, age and trip purpose, which are determined by the intention and purpose of the analysis (Bradely and Kores, 1990; Kim, 2001).

The authors conducted a stated preference survey with travel alternatives composed of a combination of attributes and values of each level to gather travel choice data. The survey asked respondents to choose one alternative among multiple travel alternatives.

In general, regression analysis is essentially a study of dependent variables with one or more independent variables in order to estimate and / or predict the average population or the mean value of the dependent variable based on the value of the known independent variable. The result of regression analysis is a coefficient for each independent variable. This coefficient is obtained by predicting the value of the dependent variable with an equation. The regression coefficient is calculated with the aim of minimizing the deviation between the actual value and the estimated value of the dependent variable based on the available data

In the binomial logit model the decision is confronted with a pair of discrete alternatives, in which the alternatives to be chosen are those with the greatest utility. The utility in this case is seen as a random variable. The logistic regression model is a nonlinear model with which a transformation can be brought to a linear form. To get the linear form, then logistic regression transformed into logit form that is formula 1.

$$ln\frac{p}{1-p} = \beta_0 + \beta_1 X1 + \beta_2 X2 \dots \dots + \beta_n Xn \qquad (1)$$

The choice probabilities of the logit model is the integral calculus of the choice probability in the density of parameters as shown in formula 2.

$$P = \frac{\exp(\beta_0 + \beta_1 X)}{1 + \exp(\beta_0 + \beta_1 X)} \qquad (2)$$

Table 4. Number of sample in stated preference.

	Low cost carrier passanger	Garuda passanger
Total respondents	220	169
Actual number of effective response	205	160

4. Result of analysis

4.1. Overall review of the respondents
The questionnaire was prepared and issued by the surveyors directly to the respondents and collected immediately. The questionnaire was organized to collect data on gender, age, income level, job, educattion level, trip purpose and the modes used to the airport, in addition to other measurements asked for in general documentary records and the documentation of the stated preference test.

Table 5. Survey result.

Variable	Percentage	
	Low cost carrier passanger	Garuda passanger
Gender	Male : 83.9%, Female : 16.1%	Male : 69.4%, Female : 30.6%
Educattion	Junior high school : 1.5%	Junior high school : 2.5%
	Senior high school : 25.9%	Senior high school : 15.0%
	Diploma : 14.1%	Diploma : 4.4%
	Bachelor : 45.4%	Bachelor : 55.6%
	Postgraduate : 12.7%	Postgraduate : 22.5%
Job	Goverment employee : 10.7%	Goverment employee : 26.3%
	Employee : 50.7%	Employee : 41.9%

Variable	Percentage	
	Low cost carrier passanger	Garuda passanger
Income level	Businessman : 14.1%	Businessman : 13.8%
	Student : 10,7%	Student : 8,8%
	Other : 13.8%	Other : 9.4%
	IDR < 6.000.000 : 47.3%	IDR < 6.000.000 : 40.6%
	IDR 6.000.000 - 12.000.000 : 29.3%	IDR 6.000.000 - 12.000.000: 25.6%
	IDR 12.000.000 - 18.000.000 : 13.2%	IDR 12.000.000 - 18.000.000: 15.6%
	IDR > 18.000.000 : 10.2%	IDR > 18.000.000 : 18.1%
Trip purpose	Work : 77.1%	Work : 78.1%
	Social : 14.6%	Social : 7.5%
	Recreation : 6.3%	Recreation : 3.1%
	Study : 1.0%	Study : 6.3%
	Other : 1.0%	Other : 5.0%

The access transport modes to the airport were private car, airport taxi, online taxi, airport bus and motorcycle. Table 6 shown the modal share of access to both Airport based on the survey respondents.

Table 6. The modal share of access to airport.

Classifications	Percentage	
	Low cost carrier passanger	Garuda Passanger
Private car	30,6%	45,6%
Airport taxi	16,0%	20,6%
Online taxi	19,2%	15,6%
Airport bus	11,0%	6,3%
Official car	11,0%	8,8%
Motorcycle	5,9%	3,1%
No response	0,0%	0,0%
Total	100	100

4.2. Results of stated preference model

Binary logistic regression analysis was used to find out the percentage of respondents that are passengers of Jakarta-Surabaya route aircraft willing to move using high speed train of Jakarta-Surabaya route. In addition, binary logistic regression analysis can also be used to determine factors that may influence respondents to switch modes.

Analysis to find out how much chance passenger aircraft that will move using high speed train then analyzed by using technique of sated preference. The variables are tested simultaneously based on characteristics, travel time and fare.

In this analysis use chi square/Khi-Kuadrat test to see the relation between each independent variable with passenger behavior to choose the mode between of Jakarta-Surabaya high speed train. A characteristic that influences the respondent in determining the choice of using high speed train, is said to be significant if the value of sig < α, where α is in this analysis the value of α is 10%.

Table 7. Significance test results used logistic regression for low cost carrier passanger.

Independent Variable	df	χ^2_{count}	$\chi^2_{0.1\ table}$	*p-value*
Age	3	1,890	6,251	0,596
Gender	1	1,304	2,706	0,253

Independent Variable	df	$\chi^2{}_{count}$	$\chi^2{}_{0.1\ table}$	*p-value*
Education level	5	12,461	9,236	0,029
Job	6	10,771	10,645	0,098
Income level	1	4,341	2,706	0,037
Trip purpose	5	2,953	9,236	0,707
Fare	2	2,395	4,605	0,302
Travel time	1	0,760	2,706	0,383
Mode use to the airport	6	8,397	10,645	0,177

Shown in table 7 above shows variable income level that has a significant value of 0.03, education level value of 0,02 and job value of 0,09 or less than $\alpha < 0.1$ (The value is said to be significant because the value of sig $< \alpha$, where α is the value in this analysis the value of α is 10% or 0.1).

Table 8. Significance test results used logistic regression for Garuda passanger.

Independent Variable	Df	$\chi^2{}_{count}$	$\chi^2{}_{0.1\ table}$	*p-value*
Age	3	1,573	6,251	0,666
Gender	1	1,874	2,706	0,171
Education level	4	14,402	7,779	0,060
Job	6	3,630	10,645	0,727
Income level	1	4,127	2,706	0,042
Trip purpose	5	4,091	9,236	5,360
Fare	2	1,448	4,605	0,485
Travel time	1	0,898	2,706	0,343
Mode use to the airport	6	5,498	10,645	0,482

Shown in table 8 above shows variable income level that has a significant value of 0.04 and education level value of 0,06 or less than $\alpha < 0.1$. (The value is said to be significant because the value of sig $< \alpha$, where α is the value in this analysis the value of α is 10% or 0.1).

Table 9. Stated preference calibration results.

Coefficient/value	Low cost carrier passanger	Garuda passanger
Income level	-0.066	-0.060
Constant	0.065	0.517
α	0,03	0,04
Log likelihood function	264,910	217,055
Fare (IDR)	600.000	1.000.000
Travel time (min)	240	180

From table 9 can be seen the significant variables to influence the respondents choose high speed train - (fares and travel time is the same as the plane) is the income level IDR 5 million. From table 9 for the logit equation is obtained as follows:

$$\text{logit}(P) = \frac{p}{1\text{-}p} = \beta_0 + \beta_1(X) \tag{3}$$

$$= 0.065 - 0.066\ (\text{Income level IDR 5 million})$$

$$= -0.265$$

$$P = \frac{\exp^{\text{logit(p)}}}{1+\exp^{\text{logit(p)}}} = \frac{\exp^{-0,265}}{1+\exp^{-0,265}} \tag{4}$$

$$P = \frac{2.718^{-0,265}}{1+2.718^{-0.265}} = 0.4341 \sim 43\% \text{ (low cost carrier passanger)}$$

$$logit(P) = \frac{p}{1-p} = \beta_0 + \beta_1(X) \tag{5}$$

$$= 0.517 - 0.060 \text{ (Income level IDR 5 million)}$$

$$= 0.217$$

$$P = \frac{exp^{logit(p)}}{1+exp^{logit(p)}} = \frac{exp^{0,217}}{1+exp^{0,217}} \tag{6}$$

$$P = \frac{2.718^{0,217}}{1+2.718^{0.217}} = 0.5540 \sim 55\% \text{ (garuda passanger)}$$

So the chances of passenger plane that will move using high speed train is a income level of IDR 5 million of 43% (fare IDR 600.000 and travel time 240 min) for low cost carrier passanger and 55% for garuda passanger (fare IDR 1.000.000 and travel time 180 min).

The analysis results are based on passengers of lionair, citiling, sriwijaya and batikair airlines which are low cost carrier (LCC) airlines. Obviously for Garuda Indonesia airline has a characteristic or selection of different modes with the above model due to the existence of different independent variables that influence in the selection of modes.

5. Conclusion

The goal of this research was to analyse mode choice air demand prior to the opening of the Jakarta-Surabaya high speed train. Attributes that allegedly influenced the respondents of low cost carrier (LCC) in choosing the mode between Jakarta-Surabaya high speed train monthly income. The result obtained from the analysis showed that only 43% of low cost carrier passengers would prefer to travel by high speed train and 55% for garuda passanger would prefer to travel by high speed train.

This study had certain limitations in analyzing passengers preferences on the Jakarta-Surabaya route because the only one variable which influence the model. Also, the actual air service frequencies were shown to be much longer than assumed in this paper because waiting time in airport, boarding time, delay etc. Therefore, the interdependent relationship between the two modes air and high speed train in terms of high speed transport will be an area of continuing interest for researchers. It appears that more time is needed to see the stabilization of the operating system of high speed train before more detailed analyses can be made.

The additional variables applied in study continued are found to influence the transport mode choice behaviors of each type of passengers. The value which represents each variable's coefficient bvalue and the goodness of fit of the model showed a slightly higher significance value with the additional variables applied to the model.

6. Reference

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