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The Model Of Passenger Prediction Of Ahmad Yani Airport Semarang, Route Semarang – Jakarta

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Abstract - Air transportation demand for the passengers showed an increasing number for about ±11,5% from 1993 until 1997. Within assumption the number of passengers in 2020 is known, so that the dominant parameter and to fulfill those means, can be calculated.
The Model of Air Transportation Demand for the passengers in Ahmad Yani Airport is analyzed by regression analysis, based on route of the plains, and we choose the dominant route, which is Semarang-Jakarta.
Service authority is restricted by the impact of space and time by nearest authority, which are in Solo by Adi Sumarmo Airport, in Yogyakarta by Adisucipto Airport and Cilacap by Tunggul Wulung Airport.
Based on services area and the data of social-economic condition for service area, a model of passenger demand is created for those two main routes within amount for two main route either departure or arrival as dependet variable (Y) and data of sosio-economic condition from 1988-1997 as independent variable. From the model, PDRB variable (X2) is very dominant on equation for route of Semarang-Jakarta Because of monetary crisis from the middle of 1997 until now, the model from data in 1988-1997 is only use basic to get equation with the data from 1998-1999 mend to have the valid result appropriately.
By using equations, the quantity of passengers in Ahmad Yani Airport can be predicted, the result total route in 2020 on quantity is still below than in 1997, so that all the infrastructure unnecessarily added.

Keyword: *passengers, air transportaion, route*

1. Preliminary

A. Background

Semarang as the Capital of Central Java Province has considerable potential as a place of economic activity, because it is a center of trade, industry, services, government, office, and education. On the other hand, its geographical location allows as a "transit point" for economic activities in Central and regional Java. Besides having a land transportation and seaport, Semarang has an airport where its presence also spur the economic development of the city.

Ahmad Yani Airport Semarang is a potential airport in the amount of passenger traffic services, this is shown by the number of passengers served has an average passenger growth from 1993-1997 for passengers departing an average of 11.54% per year and passengers came on average up 11.14% per year (Data PT Angkasa Pura I).
For that it is absolutely necessary a plan at the airport especially the provision of facilities that support the mobility of passengers and goods so that the service will be efficient flight, safe, convenient, and effective.

From the passenger growth of the plane both the departure and the arrival of the above average it is necessary to know what parameters determine the trip at Ahmad Yani Airport Semarang and modeled so that later we can know the prediction of the number of passengers in the future and can immediately meet the facilities infrastructure for the airport. The problems in this study are very wide, many variables affecting, among others, tariff, speed, route, mode selection, travel time, government policy, political changes etc.,

so that if the whole research will take a long observation , there is a need for restrictions in this study.

B. Restricting the problem

The problem in this study is very wide, it is necessary to do the following restrictions:

1. The determinants of the trip generation only take into account the socio-economic development in the service area of Ahmad Yani Airport Semarang.
2. The model with regression analysis only concerns the needs of air passenger transportation served by Ahmad Yani Airport Semarang for route from Semarang to Jakarta.
3. Service area served by Ahmad Yani Airport Semarang.

C. Assumption of Service Area

The service area served by an airport can not be determined, since the passenger selection to choose the aircraft to be hosted can not be determined only from the location of the aerodrome is located close to the location of the residence. However, it is also determined based on the needs of flight destinations, airline fares and the ability of passengers to pay the fare.

To limit the characteristics of domestic passenger needs a review of the socio-economic conditions of service areas is indispensable. Determination of service area boundaries is assumed to serve Central Java and Yogyakarta Special Territory with limited distance between the nearest airport, Adi Sumarmo-Solo, Adisucipto-Yogyakarta and Tunggul Wulung-Cilacap, and the difference of distance and travel time when using intermediate ground mode direct to destination compared to origin from Semarang (the time difference is taken ≥ 3 hours) then new to destination, assumed for bus with average speed 60 km / hour and executive train route Semarang-Jakarta with travel time 5 hours.
Based on the assumptions above, the service area for each of the flight routes for the Second Level Regions in Central Java against Ahmad Yani Airport Semarang, for Semarang-Jakarta route includes: Demak, Jepara, Kendal, Kudus, Pati, Purwodadi, Rembang, Salatiga , Semarang Regency and Semarang City.

2. Literature Review

A. Regression Analysis

Regression analysis technique is a technique that can be used to generate relationships in numerical form and to see how two (simple regression) or multiple (multiple regressive) variables are interconnected.
General model: $Y = a + bX$

The least squares method is used in the regression process wherein linear lines are obtained so that the least squares quantities are generated. Multiple Linear Regression Analysis can be extended to et more than one independent variable. This is important because in reality the number of free variables that cause traffic generation will affect each other.
General model: $Y = a + b1X1 + b2X2 + ... + bmXm$
Where: Y = dependent variable.
X1, X2, Xm = independent variable
B1, b2, bm = regression coefficients
a = constants
The regression model should be based on the principle of statistical assumptions as follows:

a. The variant of the value of the dependent variable must be equal to all the magnitudes of the independent variable.
b. The deviation of the value of the independent variable must not be related to each other and has a normal distribution.
c. The free variable is measurable and without error.
d. The regression of the dependent variable on the independent variable is linear (Hutchinson, 1974).

B. Previous studies

Young, (1972), based on data from 1937 to 1966, makes the model equation of the amount of air passengers per capita for the United States as follows:
Tt = - 1.98 + 1.04 It - 1.59 Ft - 0.52 Ht + 0.67Tt – 1, Young's model is basically a trip generation model with a household basis.

The FAA's transportdemand model, using an econometric model with multiple regression of annual passenger numbers from 1976 to 1987 in Washington, is as follows:
ENP = -75.01 + 1.64 CMP - 0.04 APSU + 1.98 PAT - 0.17 REL - 5,59 STR
Imam Basuki (1998), model the transport transport passengers domistik at Adisucipto Airport Yogyakarta, based on the route as follows:
a) Route of Yogya-Jakarta

Departure: **Y = 20211,3975 + 0.0282.X7**
Arrival: **Y = -4132,3422 + 0,0316.X7**

b) Route of Yogya-Surabaya

Departure: **Y = -8452,8427 + 1,6621E-05.X4 + 0.0405.X15**
Arrival: **Y = -8532,9615 + 1,8448E-05.X4 + 0,037183.X13**

Where: X7 = Gross Regional Domestic Product (GRDP) in million rupiah
X4 = Import Value (US $)
X13 = International traveler

Of the three studies compared to these studies, the results of research conducted by FAA and Imam Basuki are more realistic as they examine the annual amount of passengers based on socio-economic conditions by incorporating private labor and investment factors, and specifically for FAA studies showing the level of flight service by including the *cost* factor of travel, comparing with other modes by including car purchase factors and possible use in unexpected conditions with the inclusion of an empty variable. So the combination of the formula conveyed by FAA and Imam Basuki is relevant as the basis of this research plan.

3. Methodology

A. Data collection

This research uses primary data and secondary data. Primary data obtained directly by way of interview / questionnaire to the passenger plane yag main content is the origin and purpose to support the service area assumed upfront. While secondary data obtained from related agencies such as the Department of Air Transportation, Angkasa Pura I Semarang Branch, Central Bureau of Statistics and others that fit the needs of this study.

Secondary data is used to make quantitative model of passenger needs of Ahmad Yani Airport Semarang, while secondary data required in the study include data on the number of passengers served by Ahmad Yani Airport Semarang, Government Policy, Political changes, monetary conditions and socio economic data on the service area of Semarang Airport.

Given the limited time and cost of the data taken only the number of passengers served at Ahmad Yani Airport as well as data on socio-economic conditions.

B. Stages of the Modeling Process

There are five (5) stages of completion of the model of air passenger prediction at Semarang Airport with regression analysis, are as follows; *first*, determine the independent variables that affect the prediction of passengers then made the test, *secondly*, make the correlation matrix relationship between independent variables with statistically independent variables by using correlation coefficient (r), *third*, create a model of relationship of each independent variable with variable is not free by using simple linear regression analysis and non linear regression; *fourth*, make model of all possible free variable relation with independent variable by using multiple linear regression analysis; *fifth*, choose the model form that best suits by doing quality test of fit) that is by calculation of coefficient of determination (R2), test of T-test significance and F-test.

4. Data Analysis

A. Relationship between Variables

The common measure used to measure the strength of the relationship is the correlation coefficient of ®. The coefficient between the independent variable and the dependent variable will form the correlation matrix. From the correlation matrix can be known the level of relationship between independent variables with independent variables which is useful to analyze the strength level of the relationship, otherwise it can be known the relationship between independent variables, so in the determination of equations with variables more than one selected independent variables that have a correlation is not strong in one equation. By using this correlation matrix can be made form of possible regression equation of independent variable.

B. Calculating Percentage Deviation Regression Model

In this calculation coefficient value is selected value of value> 0.9, so that from the alternative models that there can be scaled again amount. Then from the value of the dependent variable the equation is the value compared to the value of the dependent variable of the observation result. In the calculations here the year of observation was taken from 1988 to 1997 for ten years of observation. The average value of a good percentage of deviation is small or close to zero.

C. Determination of Selected Regression Equation Model

There are six (6) criteria for choosing the equation model that is considered the most representative is as follows: *first*, the largest value of determination coefficient (R2), because with this value it can be seen how much variation of dependent variable can be represented by the regression equation; *second*, the value of the coefficient of free variable equation must have a logical value. With the understanding of the value of the independent variable must be positive, because if it has a negative value contains logically unacceptable; *third*, the value of each coefficient of equation is not too big difference, because if one of the coefficients of the relative equation of the other will be interpreted that there are actually other determinants that can not be modeled by the independent variable; *fourth*, the value of t arithmetic, with the value of t this can be seen how much influence coefficient of free variable equation affect the regression line; *fifth*, the value of F arithmetic, with the value of F is at a certain level of confidence can be seen how much variation of regression line equation can be represented by independent

variables that make it; *sixth*, the smaller the percentage of deviation means the accuracy of the regression model is getting better.

Analyze whether the independent variable that becomes the determinant in the equation of the selected regression line is logically acceptable.

D. Model of Passenger Flight Regression Regression

1) Departure of Semarang-Jakarta Route

From this alternative examined the percentage deviation of regression equation by using observation data from 1988 s / d 1997. In this case selected the equation of regression model for departure route Semarang - Jakarta, are:

Y = 69949,9297 + 0.0117.X2

Where, X2 = Gross Regional Domestic Product /GRDP (in millions of rupiah)

This equation has the value of coefficient of determination (R2) = 0,9624, which can be interpreted that 96,24% variation of passenger passage of Semarang-Jakarta route can be represented by this equation. With the degree of freedom 8, the value F = 204.67> from F table (5.32), can be interpreted that 95% of variations that occur on the departure of passengers this route can be explained by the value of GRDP. The value of t arithmetic X2 = 14.306> t table value (1.86) for degrees of freedom 8 and 95% confidence level, mean value of coefficient X2 means for this regression equation. This model equation means that the departure level of Semarang-Jakarta route plane is determined by GRDP value, that is the level of prosperity of the service area's population.

2) The arrival of Semarang-Jakarta route

From the alternative equation of regression model checked the percentage of deviation of regression equation by using observation data from 1988 until 1997, selected the smallest percentage by considering the relevance and result of equation of regression model for arrival of Semarang-Jakarta route chosen:

Y = 64709,9149 + 0.0127.X2

Where, X2 = GRDP (in millions of rupiah)

This equation has the coefficient of determination (R2) = 0.9176, according to the book of Regression and Correlation Analysis Technique (Sudjana, 1983) about multiple linier regression significance test it can be interpreted that 97,16% variation of passenger departure of Semarang-Jakarta route can be represented with this equation. With the degree of freedom 8, the value F = 273.336> from F table (5.32), can be interpreted that 95% of variations that occur on the departure of passengers this route can be explained by the value of GRDP.

The value of t arithmetic X2 = 16.533> t table value (1.86) for degrees of freedom 8 and 95% confidence level, meaning X2 coefficient value means for this regression equation.

This model equation means that the arrival rate of the Semarang-Jakarta route plane is determined by the value of GRDP which is the level of prosperity of the service area's population.

E. Passenger Prediction Year 2020

To predict passengers by 2020, it is necessary to first calculate the projection by 2020 from the independent variables found in the model equations obtained.

Assuming that the prevailing trend in the past will continue to apply in the future, so that from the time series data of independent variables is calculated in advance the average growth per year with the formula:

$$(1 + i)^n = Xn / X_0$$

where, i = growth per year (%)
n = number of years of observation
Xn = end observation data
X_0 = initial observation data

F. Semarang-Jakarta route

The independent variables affecting departure both on Semarang-Jakarta route and Semarang-Surabaya route are X2 (GRDP). For the calculation then sought projection of the independent variables for the year 2020 by calculating the growth of data from 1998 to 1999, while the additional data GRDP year 1998-1999 for service area route Semarang-Jakarta in 1997-1998 rose by 7.16% and in 1998-1999 rose again by 6.63%.
In 1988 and 1999, passenger aircraft experienced a significant decline, so for the next calculation should be used data of 1998 and 1999 to get good prediction results in the year 2020 will be. The data of 1998-1999 are listed in Table 1.1.

Table.1. GRDP, Service Area Route Semarang-Jakarta, Year 1998-1999

		Tahun	
Service Area	Independent	1998	1999
Rute Smg-Jkt	GRDP	23576459	25140837

PDRB in 1998-1999 for Semarang-Jakarta route increased by 6.35%. So with the growth formula obtained

$X2\ (GRDP)_{2005} = X_{1997}\ (1 + i)^{2020-1999}$

But previously calculated first with the equation Y = 0.0117.X2 + b, for the data of 1998 and 1999, from the base trend Y = 0.0117.X2 + 69949,9297 obtained from data processing 1988/1997.
The equation for 1998

141370 = 275844,5687 + b1

b1 = - 134474,569 → **Y = 0.0117.X2 - 134475**

The equation for 1999

124237 = 294147,7957 + b2

b2 = - 169910,796 → **Y = 0.0117.X2 – 169911**

by way of the same calculation obtained new equations for the route Semarang-Jakarta, as follows:

Departure,
- The equation of 1998 → **Y = 0.0117.X2 - 169911**
- Equation of year 1999 → **Y = 0,0117.X2 - 134475**

Arrival,
- The equation of 1998 → **Y = 0.0127.X2 - 123478**
- The equation of 1999 → **Y = 0.0127.X2 – 186599**

All prediction calculations of departure and arrival numbers of Semarang-Jakarta flight passengers for optimistic and pessimistic are shown in Table 2.2 and Table 3, then compared with actual passenger condition, that is, with both passenger and departure passenger data for each route on year 2000 and calculated the percentage of deviation.

Table.2. Calculation of Results of Passenger Prediction Departure of Semarang-Jakarta Route

Year	(1+i)	Projection	Passenger Prediction		Passanger	% deviation	
		GRDP	Optimis	Pesimis	Actual	Optimis	Pesimis
2000	1,0664	26809017,46	179191	143755	166234	7,7944	-13,5227
2001	1,1371	28587887,11	200004	164567			
2002	1,2126	30484790,83	222197	186761			
2003	1,2930	32507560,58	245864	210428			
2004	1,3788	34664547,99	271101	235664			
2005	1,4703	36964658,87	298012	262576			
2020	3,7085	93235631,3	920946	888504			

Table.3. Calculation of Results of Passenger Prediction Arrival of Semarang-Jakarta Route

Tahun	(1+i)	Projection	Passenger Prediction		Passanger	% deviation	
		GRDP	Optimis	Pesimis	Actual	Optimis	Pesimis
2000	1,0664	26809017,46	193748	153876	175943	10,1200	-12,5422
2001	1,1371	28587887,11	216340	176468			
2002	1,2126	30484790,83	240431	200558			
2003	1,2930	32507560,58	266120	226247			
2004	1,3788	34664547,99	293514	253641			
2005	1,4703	36964658,87	322725	282853			
2020	3,7085	93235631,3	1060615	997494			

The total optimistic prediction as well as pessimistic airplane passengers for Semarang-Jakarta route both departure and arrival served by Ahmad Yani Airport Semarang are assumed to be linear with fixed growth for each independent variable. While the basic growth figures obtained from the growth rate in 1998-1999. The results of the prediction calculation are listed in Table.4.

	Tahun 2000				Tahun 2020			
Rute	Keberangkatan		Kedatangan		Keberangkatan		Kedatangan	
	Optimis	Pesimis	Optimis	Pesimis	Optimis	Pesimis	Optimis	Pesimis
Jakarta	179191	143755	193748	153876	920946	888504	1060615	997494

5. Conclusions And Suggestion

A. Conclusion

1. Airplane passengers for departure and arrival of Semarang-Jakarta route, influenced by Gross Regional Domestic Product (GRDP), which reflects the route of this route is greatly influenced by the level of welfare of the community in the service area served by Ahmad Yani Airport Semarang.

2. The model of regression equation chosen and considered to represent the needs of passengers at Ahmad Yani Airport Semarang, in addition to using statistical requirements also with approaches and assumptions logically, this is because if only using statisktik analysis alone can occur an error in the regression equation selected later on.

B. Suggestion

It is necessary to develop and further research with other factors such as tariff, government policy, and include socio-economic condition, demography from the destination area of flight so that the model of passenger requirement obtained can be used in various conditions so that the prediction result of the passenger of the plane will be can approach actual results in the field.

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