Analysis of the Selection of City and Railroad Bus Transport Modes
Route to Tebing Tinggi City - Medan City

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Abstract - Transportation is needed to ensure the implementation of population mobility and goods. The large number of workers, social relations such as education and trade has caused population mobility between the cities of Tebing Tinggi and Medan to increase. This study aims to analyze the factors that influence the community in choosing a mode of transportation to travel the Tebing Tinggi-Medan route between buses and trains. The research sample was 150 passengers. The analytical method used is binary logistic regression. The results showed that the variables that influence the choice of city and railroad bus transportation modes in the city of Tebing Tinggi - Kota Medan are gender variables (X2), income (X3), transport availability (X4), comfort and suitability (X5), costs transport (X6) and travel time (X8). The community of Tebing Tinggi City prefers buses as a mode of transportation to get to Medan City because based on the availability of transportation, buses are more in demand because passengers do not have to wait for the time available, can be obtained according to the departure time desired by passengers.

Keywords - Mode of Transportation, Bus, Railway, Binary Logistic Regression

I. INTRODUCTION

Indonesia is an archipelagic country where the development of the transportation sector is designed for three purposes, namely: supporting economic movement, national stability and also reducing development inequality between regions by expanding the reach of the distribution of goods and services throughout the archipelago. (Indonesian Central Bureau of Statistics, 2016).

Domestic transportation needs continue to increase, as the population grows every year. This can be seen through the increasing number of motorized vehicles from year to year as shown below.
Table 1.1 The Development of the Number of Motor Vehicles Specified by Type, Year 2012-2016 (units) in Indonesia

<table>
<thead>
<tr>
<th>Transportation Type</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>Growth per Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car</td>
<td>10,432,259</td>
<td>11,484,514</td>
<td>12,599,038</td>
<td>13,480,973</td>
<td>14,580,666</td>
<td>8,73</td>
</tr>
<tr>
<td>The bus</td>
<td>2,273,821</td>
<td>2,286,309</td>
<td>2,398,846</td>
<td>2,420,917</td>
<td>2,486,898</td>
<td>2,66</td>
</tr>
<tr>
<td>Freight cars</td>
<td>5,286,061</td>
<td>5,615,494</td>
<td>6,235,136</td>
<td>6,611,028</td>
<td>7,063,433</td>
<td>7,52</td>
</tr>
<tr>
<td>Motorcycle</td>
<td>76,381,183</td>
<td>84,732,652</td>
<td>92,976,240</td>
<td>98,881,267</td>
<td>105,150,082</td>
<td>8,32</td>
</tr>
<tr>
<td>Amount</td>
<td>94,373,324</td>
<td>104,118,969</td>
<td>114,209,260</td>
<td>121,394,185</td>
<td>129,281,079</td>
<td>8,19</td>
</tr>
</tbody>
</table>

Source: Police of the Republic of Indonesia

In addition to motorized vehicles, land transportation also provides railroad transportation. Increase in passenger train production this is in line with the number of train passengers being transported. This can be seen in the following table.

Table 1.2 Passenger Railway Production in Java and Sumatra in 2012-2016 (Million Km-Passenger)

<table>
<thead>
<tr>
<th>Region</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>Growth per Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Java</td>
<td>16,315</td>
<td>16,218</td>
<td>19,601</td>
<td>21,463</td>
<td>20,837</td>
<td>6,31</td>
</tr>
<tr>
<td>Sumatera</td>
<td>839</td>
<td>708</td>
<td>795</td>
<td>833</td>
<td>799</td>
<td>-1,21</td>
</tr>
<tr>
<td>Amount</td>
<td>17,154</td>
<td>16,926</td>
<td>20,396</td>
<td>22,296</td>
<td>21,636</td>
<td>5,97</td>
</tr>
</tbody>
</table>

Source: PT (Persero) Kereta Api Indonesia and PT Kereta Commuter Indonesia

Table 1.3 Number of Train Transport Passengers in Java and Sumatra, 2012-2016 (Million people)

<table>
<thead>
<tr>
<th>Region</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>Growth per Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Java</td>
<td>197,8</td>
<td>212,0</td>
<td>272,6</td>
<td>320,6</td>
<td>345,8</td>
<td>14,99</td>
</tr>
<tr>
<td>Sumatera</td>
<td>4,4</td>
<td>4,0</td>
<td>4,9</td>
<td>5,3</td>
<td>6,0</td>
<td>8,06</td>
</tr>
<tr>
<td>Amount</td>
<td>202,2</td>
<td>216,0</td>
<td>277,5</td>
<td>325,9</td>
<td>351,8</td>
<td>14,85</td>
</tr>
</tbody>
</table>

Source: PT (Persero) Kereta Api Indonesia and PT Kereta Commuter Indonesia

Tebing Tinggi City is one of the city administrations of 33 Regencies / Cities in North Sumatra. It is located about 80 km from Medan City (the capital city of North Sumatra Province) and is located in the main crossing of Sumatra that connects the Eastern Cross and Central Sumatra Cross through a diagonal crossing on the Jalan Tebing Tinggi, Pematangsiantar, Parapat, Balige and Siborong-borong segments.

To get to Medan City, the people of Tebing Tinggi City are faced with a variety of transportation modes. The types of transportation available in Tebing Tinggi City include trains and buses. Where before choosing the mode of transportation, of course there are various factors that influence the community in choosing transportation modes.

This encourages the desire to examine what factors cause people to choose buses or choose...
The purpose of this study is to analyze the factors that influence the community in choosing transportation modes to travel the Tebing Tinggi - Medan route between buses and trains and analyze the probability of choosing a mode of transportation to travel the Tebing Tinggi - Medan route between buses and trains.

By using the binary logit regression model method, to analyze how much the probability of the occurrence of the response variable by its predictor variable. The response variable in binary regression consists of 2 types of variables, namely 0 and 1. The binary logit regression model is as follows:

\[
\frac{p}{1-p} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots. \beta_8 X_8
\]

Where:

\[
\frac{p}{1-p} : \text{Odd Ratio (comparison of opportunities),}
\]

\[
p \text{ state the probability of occurrence of events}
\]

\[
1-p \text{ state the probability of not occurring an event}
\]

\[
\beta_0 : \text{constants}
\]

Y = Type of transportation mode

1 = respondents took the train

0 = respondents took the bus

X_1 = Age

1 = More than 20 years

0 = Up to 20 years

X_2 = Gender

1 = Female

0 = Male

X_3 = Income (Rp/month)

X_4 = Availability of transportation modes

1 = Main Consideration

0 = Not Primary

X_5 = Comfortable and suitable

1 = Main Consideration

0 = Not Primary

X_6 = Transportation Costs

X_7 = Length of trip

II. RESULTS AND DISCUSSION

Factors Affecting the Selection of the Mode of Transportation.

Descriptive explanation of the factors that influence this research as follows:

a. Age

Based on the results of research in the field, respondents aged between the age of 20 years were 58 people, while respondents aged over 20 years were 92 people. So that it can be concluded that passengers in the transportation mode of Tebing Tinggi City to Medan City are domiciled by more than 20 years of age.

According to Butcher, et al. (1996) the socio-economic characteristics of travelers in cities, one of which is influenced by age. The age of a person can influence in determining the choice of city transportation use.

In this study, respondents aged up to 20 years are every passenger who is up to 20 years old, who has been counted to have to pay for transportation costs, including teenagers who are either students or employees. Revenue calculated at the age of up to 20 years is the average income it has each month, for students it can be called pocket money. Whereas respondents with more than 20 years of age are each passenger over the age of 21 or over.

b. Gender

Based on the results of research in the field, 74 male respondents and 76 female respondents. Men ride more trains than buses, because in this study more female respondents were found choosing to ride the bus transportation mode.

In general, gender will influence the choice of transportation modes between trains and buses. Gender is a characteristic of respondents.
c. Income

Income will affect the choice of transportation modes, that often found with increasing income, then the type of transportation chosen by passengers, will be increasingly picky or choose a better direction from all aspects. This is in accordance with the results of research in the field, respondents with income above Rp.6,000,000 prefer to ride the train because the quality has been tested according to passengers in Tebing Tinggi City. The mode of transportation of the type of train in the City of Tebing Tinggi is considered to have proven its quality because it is compared to the mode of transportation of bus types in Tebing Tinggi City. From the main aspects, namely convenience, railroad facilities are better, both in terms of stops or stations and services in the mode of transportation itself.

Revenue is the amount of income received by community members for a certain period of time as remuneration. Income can also be derived from the receipt of salaries and the business involved (Reksoprayitno, 2004).

d. Availability of Transportation

In addition to the socio-economic variables, there are also several travel attributes that influence the choice of transportation modes, one of which is the availability of transportation. The difference between trains and buses in the aspect of availability of transportation is that buses are more commonly found than by train. Because to get a train, passengers must depend on the time of departure, while to ride the bus, passengers do not need to wait for the time available, can be obtained according to the desired departure time by the passenger.

Based on the results of research in the field, respondents prefer the availability of transportation not as a primary consideration. Because, generally passengers are never in a state of urgency not to get a bus or train. This is due to the smooth availability of transportation both buses and trains in Tebing Tinggi City, except in certain circumstances or days, such as national holidays and weekends.

e. Comfortable and Suitable

Based on the results of research in the field, more respondents make comfortable and suitable factors a major consideration. This is because the trip to the city of Medan is quite time consuming so that comfort and suitability are needed in the chosen mode of transportation. The more comfortable passengers in the chosen transportation mode, the more suitable passengers will be for the transportation mode.

According to Soizick and Bastien (2008) states that there are two levels of comfort, namely the static level where the passenger sits quietly and the physical characteristics of the chair interact with a person's sitting (strength and pressure on the body and knee joint) in causing pain and causing passengers to adjust sitting position. Then the dynamic level where the subject moves in his seat to do some activities.

f. Transportation Costs

Based on the results of research in the field, the average cost incurred by passengers to board a bus is Rp. 20,000 - Rp. 30,000 while transportation costs incurred by passengers to board the train are Rp. 22,000 - Rp. 90,000. The amount of variation in costs incurred by passengers to board a train is greater than riding a bus, so respondents such as the passengers of Tebing Tinggi City prefer buses as a mode of transportation to get to Medan City.

To explain the mode of choice behavior, in addition to the socio-economic variables there are also some attributes that affect travel (Kanafani, 1983). One of the attributes of the trip is the cost of travel. Travel costs are the amount of money or fees that must be paid by passengers when boarding the selected transportation mode, from Tebing Tinggi City to Medan City.

g. Travel Duration

Based on the results of research in the field, respondents who spent up to 2 hours of travel were 55 people and respondents who spent more than 2 hours were 95 people. This means more passengers board the
bus. But not always trains arrive on time, as well as buses that don't always last more than 2 hours. This depends on the situation and conditions, such as road congestion, accidents or transportation modes.

The duration of travel is one of the factors that influence passengers in choosing the mode of transportation. Travel time is the time passengers spend to get to their destination.

The difference in the length of travel between the bus and the train is that the train must have arrived at the place according to the time set, while the bus, the passenger has not yet arrived at the destination according to the time delivered.

h. Travel Time

Based on the results of research in the field, respondents who made the travel time factor not as a primary consideration as many as 84 people and respondents who made the travel time factor become the main consideration as many as 66 people. This means that passengers do not race at the time of travel, because transportation modes tend to be easy to find and transportation mode travel time is routine or that arrival only at that time. Travel time is the arrival of transportation modes namely buses and trains going up the transportation mode from Tebing Tinggi City to Medan City.

Results of Logistic Regression Analysis

Based on the interview results, respondents who chose to ride the train were 71 respondents and those who chose to board the bus were 79 respondents. The results of processing using logistic regression analysis can be seen in Table 1.

Table 4.1. Results of Logistic Regression Analysis

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>S.E.</th>
<th>Sig.</th>
<th>Exp(B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.304</td>
<td>1.697</td>
<td>0.858</td>
<td>1.356</td>
</tr>
<tr>
<td>Gender</td>
<td>2.920</td>
<td>1.334</td>
<td>0.029</td>
<td>18.536</td>
</tr>
<tr>
<td>Income</td>
<td>0.000</td>
<td>0.000</td>
<td>0.012</td>
<td>1.000</td>
</tr>
<tr>
<td>Availability of Transportation</td>
<td>-3.870</td>
<td>1.687</td>
<td>0.022</td>
<td>0.021</td>
</tr>
<tr>
<td>comfortable and suitable</td>
<td>-5.236</td>
<td>1.860</td>
<td>0.004</td>
<td>0.005</td>
</tr>
<tr>
<td>Transportation costs</td>
<td>0.000</td>
<td>0.000</td>
<td>0.012</td>
<td>1.000</td>
</tr>
<tr>
<td>length of journey</td>
<td>48.038</td>
<td>3277.948</td>
<td>0.988</td>
<td>72851.000</td>
</tr>
<tr>
<td>Travel Time</td>
<td>-7.230</td>
<td>2.268</td>
<td>0.001</td>
<td>0.001</td>
</tr>
<tr>
<td>Constant</td>
<td>18.094</td>
<td>6.618</td>
<td>0.006</td>
<td>72139.687</td>
</tr>
<tr>
<td>G=178,740 (sig = 0.000)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log likelihood= -0.107</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Primary Data processed in 2018

From the results of the logistic regression analysis the logistic regression equation was obtained as follows:

\[ \ln \frac{p}{1-p} = 18.094 + 0.304 \times X_1 + 2.920 \times X_2 + 0.000 \times X_3 - 3.870 \times X_4 - 5.236 \times X_5 + 0.000 \times X_6 + 48.038 \times X_7 - 7.230 \times X_8 \]

At a real level of five percent (\( \alpha = 5\% \)), it is known that the variables that influence the selection of City Transportation and Railway Bus Mode Transportation in Tebing Tinggi City - Medan City are sex variables (X2), income (X3), transport availability (X4), convenient and suitable (X5), transport costs (X6) and travel time (X8). This can be seen from the value of sig < \( \alpha = 5\% \), which indicates that the variable affects the choice of transportation mode.
The coefficient value indicates the relationship between the independent variable (X) and the dependent variable (Y). The coefficient that has a positive value indicates that if the independent variable (X) increases, the dependent variable (Y) will also increase, which means the opportunity to choose the mode of transportation increases.

Odds Ratio Value (Probability)

The way to interpret the magnitude of the odd ratio for a k predictor variable is the value of Antilog of ($\beta_i$) or $\exp(\beta_i)$ for $i = 1, ..., k$. If logistic regression results have been obtained in table 4.1, then the odd ratio value can be seen in the $\exp(\beta_i)$ value in the table. So that the odd ratio and the probability for each predictor variable are obtained as follows:

Sex variable, sig value = 0.029 is smaller than $\alpha = 5\%$, then sex variable significantly influences the choice of transportation mode. The odds ratio for sex variables is 18,536, meaning that passengers with female sex have the opportunity to ride the train is 18,536 times compared to passengers with male sex. This is because the passengers who ride the most modes of transportation in this study are women.

This in line with the research of Reviline Sijabat and Anita Ratnasari R (2013) that one of the socio-economic factors that have a significant influence on modal choice is gender. The results of the study state that users of transportation modes are dominated by women, preferring to use public transportation because they can avoid fatigue. Because the purposes of the transportation mode other than for passenger transport media to get to the destination, it can also be a place for resting passengers when traveling, especially for women who are generally easier to feel tired.

The income variable, the sig value = 0.012 is smaller than $\alpha = 5\%$, then income variable has a significant effect on the choice of transportation mode. The odds ratio for income variable is 1, meaning that at each passenger income level, the opportunity to choose the mode of rail and bus transportation is the same.

In the research of Dayaning Wahyu Primasari, et al. (2013), the character variable of transportation users is income, both family income and personal income. The income variable influences the choice of transportation mode, where the higher income will affect the desire to buy a private vehicle as a means of transportation. The results of the study, respondents with income levels of less than 1 million chose to ride public transportation.

The variable availability of transport, the sig value = 0.002 is smaller than the value of $\alpha = 5\%$, then the variable availability of transportation has a significant effect on the choice of transportation mode. The odds ratio for the transport availability variable is 0.021, meaning that the opportunity for passengers to choose the train based on transportation availability factors which shows that the availability of rail transport is the main consideration of the bus is 0.021 times compared to the bus. This is because most passengers are not in a state of urgency not to get a train. Availability of the train fleet is smooth, except in certain circumstances or days, such as national holidays and weekends.

This is in line with the research of Oktaviani and Andre Yudi Saputra (2015), stating that in a transportation activity there are components that influence it. These components can be in the form of facilities and infrastructure. Means are tools which are tangible modes. The facilities used by the object or traveler must have standards, both in terms of quality and quantity. As for one of the standards of the facility is guaranteed availability.

Comfortable and suitable variables, sig = 0.004 value is smaller than $\alpha = 5\%$, then comfortable and suitable variables significantly influence the choice of transportation mode. The odds ratio for convenient and suitable variables is 0.005, meaning that the opportunity for passengers to choose a train based on convenient and suitable factors which shows that the comfort and fit factor when choosing a train is more a main consideration than a bus is 0.005 times compared to a bus. The trip to the city of Medan is quite time consuming so that comfort and suitability are needed in the chosen mode of
transportation. The more comfortable passengers in
the chosen transportation mode, the more suitable
passengers will be for the transportation mode. From
the comfortable and suitable factors, the train is the
right choice for passengers to travel to their
destination.

This is in line with Andi Wijaya's research, Gusri
Yaldi, Ph.D Ir. Hamdi Nur, MTP (2015) states that
the choice of transportation modes in urban areas is
not a random process, but is influenced by several
factors, one of which is convenience. From the
results of the study, it was obtained the reason
respondents chose to use transportation modes, one
of which was safe and comfortable.

Transportation cost variable, sig value = 0.012 is
smaller than \( \alpha = 5\% \), then transportation cost
variables have a significant effect on the choice of
transportation mode. The odds ratio for the variable
transportation costs is one, meaning that at each level
of transportation costs, the opportunity to choose the
mode of rail and bus transportation is the same.

The study of Ludfi Djakfar, Amelia Kusuma and
Akhmad Sya'ban (2010) states that the level of
satisfaction offered by each mode of transportation
can change. This is caused by changes in
characteristics such as changes in the cost of travel of
a mode due to an increase in the price of fuel oil
which will affect a person's decision. However, the
results obtained that the variable cost of travel
certainly does not affect the choice of mode. The
absence of respondents who have characteristics as
mentioned causes variables to be of no effect.

Meanwhile, in the research of Rizyak Wale
Simanjuntak and Medi S Surbakti (2012), the modes
of transportation were charged in the form of costs in
their travels. Each mode has different characteristics,
one of them in terms of costs (costs). Modes that
have lower costs do not mean having more interested
users of transportation modes.

Travel time variable, sig = 0.001 is smaller than \( \alpha
= 5\% \), then travel time variables significantly
influence the choice of transportation mode. The
odds ratio for travel time variables is 0.001, meaning
that the opportunity for passengers to choose a train
based on travel time factors shows that the travel
time factor when choosing a train is more of a main
consideration than a bus is 0.001 times compared to
a bus. For train type transportation modes, travel
times or departure times have been set or on time,
while for bus type transportation modes, the
departure time is based on the departure time of the
passenger itself, so passengers can choose the time at
any time, because on the bus, there is no official
departure schedule and there are many fleets
available.

This is in line with the research of Futri Fajarni
Oktavia and Indra Jaya Pandia (2013) stating that
travel time is one of the factors that influence the
choice of transportation modes.

Variables that do not significantly influence the
choice of transportation modes are the variables of
age and duration of travel. This is because the sig
value > \( \alpha \) value. The older a person is, the passenger
will be responsive to information, so that he will add
knowledge that will determine the attitude towards
the choice of transportation modes, for example the
amount of growth that will be used to determine
what mode of transportation to choose. Age
differences will influence the choice of transportation mode. The duration of the trip does
not become an influence in choosing a mode of
transportation because these two modes of
transportation tend not to have different travel times
to get to their destination.

Likelihood Log Value

The G test value is 178,740 greater than \( \chi^2 \alpha \), sig
with the value sig = 0.000 smaller than the value (\( \alpha =
5\% \)). This means rejecting H0 or accept H1 which
indicates that there is at least one variable that
influences the choice of transportation modes for city
and rail transport buses in the route of Tebing Tinggi
City - Medan City. The variables that influence the
choice of transportation modes are six variables,
namely gender, income, transportation availability,
comfort and suitability, transportation costs and
travel time. The other two variables (age and
duration of travel) that were not significant meant
that they did not influence the choice of transportation modes for city and rail transport buses. Route of Tebing Tinggi City - Medan City.

III. CONCLUSION

The conclusion of this study is that the variables that influence the choice of city and rail transport bus modes of route Tebing Tinggi City - Medan City are gender variables (X2), income (X3), transport availability (X4), comfortable and suitable (X5), transport costs (X6) and travel time (X8). The community of Tebing Tinggi City prefers buses as a mode of transportation to get to Medan City because based on the availability of transportation, buses are more in demand because passengers do not have to wait for the time available, can be obtained according to the departure time desired by passengers.

REFERENCES


