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Judul: A Simulated Policy towards Green Public Transportation in a Metropolitan in Indonesia

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## 1 Fwd: [IJEEP] Submission Acknowledgement

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Sat, Oct 29, 2022 at 1:29 PM

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Amin Pujiati:

Thank you for submitting the manuscript, "A Simulated Policy towards Green Public Transportation in a Metropolitan in Indonesia" to International Journal of Energy Economics and Policy. With the online journal management system that we are using, you will be able to track its progress through the editorial process by logging in to the journal web site:

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If you have any questions, please contact me. Thank you for considering this journal as a venue for your work.

Ilhan OZTURK



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I am happy to inform you that your paper entitled "A Simulated Policy Towards Green Public Transportation in a Metropolitan in Indonesia" has been accepted for publication in IJEEP for the next issue. Your paper will be send to you for final proof check very soon.

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Prof.Dr. Ilhan OZTURK  
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# ATTACHMENT LAMPIRAN

# A Simulated Policy Towards Green Public Transportation in a Metropolitan in Indonesia

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## ABSTRACT

The need for mode of transportation is proportional with urban population growth. The dependence of people using private transportation causes many problems. In addition to congestion, it can create environmental problems such as air quality deterioration and pollution in the cities. Learning to be in this research is the process of individual learning to move from private transportation to public transportation. The purpose of this study is to predict and opportunities for private decision using the public transportation toward green transportation in Semarang city. This research is designed using a quantitative approach. Respondents in this study were workers. Data collection methods with questionnaires. The samples are collected using proportional sampling technique. Data are analyzed with binary logistic regression. The results showed that the accessibility and tariff variables are significantly influence to predict private decision for using public transportation as an effort toward green transportation. Based on the policy simulation, the opportunity of using public transportation will be higher if the distance is closer and reachable. It will be getting lower if the tariff is raised when the other variables are constant. Therefore, to influence private decisions using the public transportation, the government must be oriented towards reachable distance and tariff.

**Keywords:** Green Transportation, Sustainability, Opportunity, Environmental, Policy

**JEL Classifications:** O18, R48, Q56

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## 1. INTRODUCTION

Population growth influences the growth of an area, either rural or urban. Growing population on one hand increases the human resources as capital for development. On the other hand, however, it requires more necessary facilities and infrastructures including the need for in-urban travel. The bigger the population, the need for transportation will also get higher. Transportation is an effort to move goods and people from a place of origin to a destination (Nasution 2004). Transportation service is a facility which cannot be separated from and the need of the society to support their activities. However, urban transportation currently has various problems as the result of the society's increasing dependency on private vehicles, both car and motorcycle. The society's high dependency on private vehicles will cause traffic congestion and pollution, which will lead to environmental damage. According to (Naganathan dan Chong 2017), transportation has an important role for goods and services delivery flow, to create employment and drive economic growth rate. However, we cannot deny that transportation also has adverse impact on the environment, in the form of environmental

pollution. Yu *et al* (2018) state that high number of populations in urban area resulted from migration will have adverse impact on the quality of the urban environment.

Jiang *et al* (2018) states that generally the need for traffic in urban area always increases faster than available traffic capacity, thus it will create various transportation problems. The high number of private vehicle users will cause various problems like traffic congestion. Traffic congestion is an imbalance condition between road capacity and the number of vehicles passing the road. In addition, increasing number of vehicles will also have impact on the traffic, in which there are many traffic accidents, endangering road users (Zhou, Wang and Wu 2018). Besides impacts on traffic congestion and accident, the numerous numbers of private vehicle users will lead to environmental pollution and air pollution and noise pollution (Park, et al. 2018). (Gusnita 2010) states that these vehicles' Fuel Oil (BBM) contains lead which contributes a great amount of pollution to air and health quality. As stated by (Labib, et al. 2018), the decreasing air quality in urban area is caused by the increasing usages of motor vehicles, disincentive to fuel oil-free (FFT) transportation, and decreasing urban green area.

The responsibility of maintaining and caring for the environment is not only the responsibility of the government. Individuals as members of society also have the same obligations. This is in accordance with the opinion of (La Trobe dan Acott 2000) and (Reif 2015) that environmental problems cannot only be solved technically, but the more important matter is how to change the mindset, awareness and responsible behavior to actively participate in managing the environment. Public awareness in supporting environmental development such as the use of green transportation requires education based on learning. (Liem dan Martin 2015) also showed the important roles of social and personal norms to foster pro-environment behavior.

Learning becomes one of the pillars in education that can improve the process of individualization in society, while at the same time increasing social interaction that is very supportive of development. The intended learning is the process of awakening individuals as a member of society to move from private transportation to public transportation. Public transportation is a process towards green transportation. This was confirmed by (Delors 2013) and (Amini 2015) that stated if we want to solve all the risks faced, education is the only solution: education as a way to gain knowledge but also assessment, as an apprenticeship in independence before we assume responsibility, and as a school tolerance that teaches us how to coexist with other people, wherever they come from. (Ozden 2008) also stated many people believe that environmental education is the most important factor to prevent environmental problems.

Central Java is a province with the highest percentage of migration number increase in Java Island. The increase of incoming migration number into Central Java is 71.89 percent (BPS 2017). This increasing population will certainly have impacts on environmental issues. The high total population of Central Java Province is caused by the growth of population of each regency and city, which increases annually. Semarang City is the capital city of Central Java Province with 1,729.42 thousand population. This number makes Semarang City a city with the highest population among the other cities in Central Java. Semarang City's high population is also followed with high flow of incoming migration of 472,777 (BPSb 2017). Semarang City is chosen to be a migration destination because of it has an attraction as a city of trades, services, industries, and education. This incoming migration to the city will increase its population annually.

The population growth rate increases 0.70 percent from 2012-2016. An area's population growth and economic growth cause increasing movement of people, goods and services in the area and its surroundings. As the capital city of Central Java Province, Semarang City must be able to fulfill the needs and demand for goods and services, both of the city itself



and its surrounding areas. This, therefore, requires transportation to support the activities. Generally, there are two types of mode of passenger transportation: private vehicle and public vehicle. Private vehicle is one for non-public use and owned by individual, while public vehicle or transport is one to be utilized by the public. The number of private vehicles and public vehicles in Semarang City in the last five years always increases. Despite continuously increasing, the number of private vehicles is higher than that of public vehicles annually. In 2017, the number of private vehicles in Semarang City is 1,981,208 or 99.59 percent and the number of public transportations is 8,207 or 0.41 percent (Badan Pengelola Pendapatan Daerah (BPPD) 2018)

Transportation in big cities like Semarang City is one of the sources of pollution, in which 70% of urban air pollution is caused by motor vehicle activities (Kusminingrum dan Gunawan 2008). With various existing problems caused by transportation, a solution is required to overcome it in order to create a sustainable and environmentally-friendly transportation. A sustainable transportation is, according to *Organization for Economic Cooperation and Development* (OECD), in (Gusnita 2010), transportation which does not harm ecosystem and public health and fulfills the need for mobility. This sustainable transportation is often called *green transportation*, which is an effort to fulfill current generation's need for mobility and transportation without prejudice to future generation's ability to fulfill their need for mobility. However, it is not easy to realize a sustainable transportation. The research conducted by (Shankar 2018) states that the constraints often faced in realizing a sustainable transportation are the financial resource, awareness and behavior of every person in using an environmentally-friendly transportation. In addition, that there is no binding rule of law on sustainable transportation implementation in urban area also inhibit such sustainable transportation implementation (Kurapati, et al. 2018).

Theoretically, a sustainable transportation must fulfill 3 aspects: environmental, economic, and social aspects. In environmental aspect, a sustainable transportation does not cause air, water, and soil pollution and does not use resources excessively. In economic aspect, a sustainable transportation is affordable for the public and may fulfill the need for operating costs of urban productive transportation. In social aspect, a sustainable transportation may support realization of healthy social environment, minimize noise and traffic congestion, and may improve social justice and well-being. Meanwhile, (Brotodewo 2010) proposes that an approach often used to create green transportation is to use public transport instead of using private vehicle. Meanwhile, according to RPJMD of Semarang City 2016-2021, sustainable transportation development will be focused on provision of environmentally-friendly public transportation (BRT, monorail/MRT).

Bus-based public transport like *Bus Rapid Transit* (BRT) is an appropriate means of public transportation to be applied in Semarang City. *Bus Rapid Transit* (BRT) or known as Trans Semarang is one public transportation managed by BLU Trans Semarang with a purpose to reduce traffic congestion in Semarang City. Despite still using Fuel Oil (BBM) which may cause negative impact on the environment, at least, however, using public transportation like BRT will minimize vehicle movement and reduce motor vehicle usage. Since the operation of BRT Trans Semarang in 2010, many people have utilized it to support their daily activities to go to school, to work, to market, etc. The number of BRT Trans Semarang continuously increases. BRT Trans Semarang users are divided into two groups: public and students. The public is dominated by workers, considering that working is the main purpose of movement. In 2017, the percentage of public users' increase is lower. Public users only increase 11.92 percent, while student users increase 37.84 percent. That the increase of BRT Trans Semarang public users is lower than that of student users is caused by some factors that influence individual's decision whether or not to use BRT Trans Semarang. Public transportation is a process towards green transportation.

If the decision to use BRT Trans Semarang is associated with factors influencing selection of mode of transportation according to (Tamin 2000), then the factor may be classified based on road user characteristic, movement characteristic, facility characteristic, and city or zone characteristic. Income, vehicle ownership, distance, accessibility, and tariff are factors that may represent each factor based on the respective characteristic. By examining the reliable factors to predict workers' decision to use BRT Trans Semarang, business actors may continuously their service quality to fulfill consumers' desire. It will attract workers, as a member of society to use environmentally-friendly transportation and reduce the private transportation. Making it a habit becomes very important for the success of the learning process (Zaenuri, et al. 2017) because awareness should start from ourselves, from now on without having to wait for the right moment to do so (Power 2004). When it becomes a habit, it shows that someone has changed his mind set and already has the awareness to use public transportation. Although it requires a long time and learning process for individuals in the community, the results are in accordance with the expected goals of green transportation. This opinion related with (Reif 2015) that it requires a long process and the outcome cannot be seen immediately, the solution of environmental problems through the development of responsible behavior. Previous research on sustainable transportation has been widely conducted, but no one has yet researched the opportunity factors that influence an individual's decision to switch from conventional transportation to sustainable transportation with policy simulations. Therefore, it is important to conduct research predicting the factors that influence and the chances of people's decisions using public transportation towards sustainable transportation in Semarang. Based on the subject matter, the purpose of this research is to predict and opportunities for private decisions using the public transportation toward green transportation.

## 2. METHODS

This descriptive research employs a quantitative approach. This research's samples are collected using *proportional sampling* technique. 100 respondents are obtained as its samples. The respondents who work in 5 districts in Semarang City including Mijen, Candisari, Semarang Utara, Semarang Tengah, and Gunungpati. The data used in this research are primary data and secondary data. The primary data are obtained by distributing questionnaires to 100 respondents previously determined from the five districts under certain criteria. The secondary data are obtained from journals, books, electronic media, and data issued by relevant departments such as the Central Statistics, Department of Transportation. Data are analyzed with the logit model (*binary logistic regression*). The logit model analysis method is employed when the dependent variable (response) is binary variable/ dichotomy. The logit model in the research of people's decision to use BRT Trans Semarang is formulated in Equation 1 as follows:

$$Li = \ln\left(\frac{pi}{1-pi}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + ui$$

.....(1)

In which:

- Li =  $\ln\left(\frac{pi}{1-pi}\right)$  = decision to use BRT Trans Semarang, 1 = if willing to use BRT Trans Semarang and 0 = if unwilling to use BRT Trans Semarang
- $\beta_0$  = constant
- $\beta_1, \beta_2, \dots, \beta_5$  = estimation coefficient
- $X_1$  = income
- $X_2$  = vehicle ownership
- $X_3$  = distance
- $X_4$  = accessibility
- $X_5$  = tariff
- ui = error term

The decision to use public transportation (BRT Trans Semarang) variable is described through respondent's decision whether or not to be willing to use public transportation. This variable is measured using two categories: 0 for respondent's decision to be unwilling to use public transportation and 1 for respondent's decision to be willing to use public transportation. Income is the total money received by a person within a certain period, commonly on a monthly basis. The income meant in this research is one derived from respondent's main job or side job. The income variable is measured using two categories: 1 if the income is up to IDR2,310,000.00 and 0 if the income is more than IDR 2,310,000.00 pursuant to the city minimum wage. Vehicle ownership is measured based on private motor vehicle ownership, either motorcycle or car. The private vehicle ownership variable is measured with two categories: 0 if respondent has more than 1 private vehicle and 1 if respondent has up to 1 private vehicle. Distance is a relative distance measurement for respondent from his/her residence to work place. The residence distance variable is measured with two categories: 0 if respondent's residence distance is up to 5 km and 1 if respondent's residence distance is more than 5 km. Accessibility is the easiness of access to BRT Trans Semarang stop. The criteria of accessibility level may be viewed according to the distance to BRT Trans Semarang stop, time to get to BRT Trans Semarang stop, and the easiness of how to get to BRT Trans Semarang stop from respondent's house. The accessibility variable in this research is measured using two categories: 0 if respondent finds it difficult to get to BRT Trans Semarang and 1 if respondent finds it easy to get to BRT Trans Semarang. The tariff designated for a type of transportation will influence consumers' willingness to use it. This tariff variable is used to examine whether or not tariff is the main consideration for the public to decide to use BRT Trans Semarang. The tariff variable is measured with two categories: 0 if tariff is not taken as the main consideration for the public to use BRT Trans Semarang and 1 if tariff is taken as the main consideration for the public to use BRT Trans Semarang. To test the appropriateness of logistic regression model to the data, some statistic tests are employed: Regression Goodness of Fit Test with *Hosmer and Lemeshow test*, Overall Model Fit test with *likelihood ratio and Omnibus Tests of Model Coefficients* test, and Determination uji Coefficient of Determination using *Negalkerke's R Square*. Wald Test is employed for Partial Test.

### 3. RESULTS AND DISCUSSION

#### Goodness of Fit Test Results

A good logistic regression model takes place when there is no difference between data derived from observation and data derived from prediction. The test results show the significance value of *Hosmer and Lemeshow's goodness of fit test* is 0.704. The value is higher than the statistic *fit test* (0.05), which means that the zero hypothesis is accepted, thus the model is able to predict its observation value or we may state that the model is acceptable since it conforms to the observation data.

#### Overall Model Fit Test Results

*Omnibus Tests of Model Coefficients* shows that the *chi-square* value is 70.113. The highest *chi-square* of 70.113 is the difference of  $-2 \log \text{likelihood}$  before independent variables are included into the model (137.628) subtracted with  $-2 \log \text{likelihood}$  after independent variables are included into the model (67.515). The *chi-square* of 70.113 is higher than the *chi-square* of table on df 5 with significance level 0.05, which is 11.070. Since *chi-square* count value  $>$  table *chi-square* value, addition of independent variables will provide real impact on the model or, in other words, the model is fit. This also means that the decision to use BRT Trans Semarang may be predicted according to the income, vehicle ownership, distance, accessibility, and tariff variables.

### Coefficient of Determination Test Results (*Nagelkerke's R Square*)

Cox and snell's R square is a measurement which tries to imitate the R<sup>2</sup> measurement on multiple regression which is based on likelihood estimation technique with maximum value less than 1 (one). Nagelkerke's R square is a modification of cox and snell's coefficient to ensure that the values vary from 0 (zero) to 1 (one). *Nagelkerke's R square* value is 0.674 (67.4%). This shows that the independent variables in this research are only able to explain the dependent variable of 67.4%, while the remaining 32.6% is explained by other variables beyond this research.

### Partial Test Results (Wald Test)

This test is employed to examine whether or not the independent variables included into the model influence the dependent variables. This test may also be stated as a hypothesis test. The results of Wald test may be viewed in Table1 below:

**Table 1.** Variables in the Equation

Variable	B	Wald	Sig.	Exp (B)
Step 1 <sup>a</sup> X1	-.975	2.144	.143	.377
X2	.949	1.723	.189	2.584
X3	.440	.467	.494	1.553
X4	3.665	18.583	.000	39.041
X5	2.384	12.784	.000	10.851
Constant	-4.225	18.758	.000	.015

Source: Processed primary data, 2018

The data processing results in Table 2 may be explained using the following logistic regression equation:

$$\ln \left( \frac{p}{1-p} \right) = -4.225 - 0.975 \text{ Income} + 0.949 \text{ Vehicle Ownership} + 0.440 \text{ Distance} + 3.665 \text{ Accessibility} + 2.384 \text{ tariff} + \mu$$

The parameter used for partial test in this research is to compare significance value with significance level 5%. According to the processing results as listed in Table 2 above, we may conclude that the income variable has coefficient value of -0.975 and in *binary logistic regression* estimation has significance level of 0.143. This shows that significance value (0.143) > significance level ( $\alpha = 0.05$ ), which means that income variable is insignificant and unreliable to predict worker's decision to determine whether or not they will public transportation BRT Trans Semarang. In other words, this shows that there is no difference in the opportunity between decision to be willing to or decision not to be willing to use public transportation BRT Trans Semarang based on worker's income rate. This negative and insignificant relationship shows that higher income will insignificantly decrease the probability of worker's decision to use public transportation BRT Trans Semarang and, lower income will insignificantly increase the probability of worker's decision to use public transportation BRT Trans Semarang.

This negative relationship between income and decision to use public transportation conforms to the research conducted by (P. Susongko 2018) which reveals that the use of

transportation to go to work is influenced by socio-economic factors (education, position, income). Income variable is insignificant and unreliable to predict worker's decision to determine whether or not they will public transportation BRT Trans Semarang, which may be explained with the existing phenomena in the research. Although an individual has low income but with relatively low needs, he will be able to buy more than one private vehicle, which will thus influence his decision to use public transportation BRT Trans Semarang and would prefer to use private vehicle. Similarly, an individual with higher income but with higher necessity will only be able to buy one vehicle, thus the need for vehicle for each family member will not be satisfied. This will influence his decision to use public transportation BRT Trans Semarang.

The vehicle ownership variable has coefficient value of 0.949 and in *binary logistic regression* estimation has significance level of 0.189. This shows that significance value (0.189) > significance level ( $\alpha = 0.05$ ), which means that vehicle ownership variable is insignificant and unreliable to predict worker's decision to determine whether or not they will public transportation BRT Trans Semarang. This positive and insignificant relationship shows that higher vehicle ownership will insignificantly increase the probability of worker's decision to use public transportation BRT Trans Semarang and, lower vehicle ownership will insignificantly decrease the probability of worker's decision to use public transportation BRT Trans Semarang

The results of this research do not conform to the research conducted by (Warman, Firdaus dan Yusnita 2014) which finds that vehicle ownership negatively influences decision to use public transportation. However, they conform to the research conducted by (Chuen, Yusoff dan Karim 2014) which shows that vehicle ownership has positive and significant relationship with decision to use public transportation online. The non-conformance between the research results and the theories and previous researches may be explained with the phenomena in the research showing that vehicle ownership is not a reason for a worker to use public transportation BRT Trans Semarang. Higher or lower number of worker's vehicle ownership does not influence the probability of his decision whether or not to be willing use public transportation BRT Trans Semarang. For example, when an individual has more than one private vehicle in the family, he will keep using public transportation BRT Trans Semarang since the number of private vehicles in possession does not meet the need of his family members and also since he is unable to drive private vehicle, either motorcycle or car.

The distance variable has coefficient value of 0.440 and in *binary logistic regression* estimation has significance level of 0.494. This shows that significance value (0,494) > significance level ( $\alpha = 0.05$ ), which means that distance variable is insignificant and unreliable to predict worker's decision to determine whether or not they will public transportation BRT Trans Semarang. This positive and insignificant relationship shows that a longer distance a worker take to get to work will insignificantly increase the probability of his decision to use public transportation BRT Trans Semarang. The insignificant relationship conforms to the theory of (Tamin 2000) stating that one factor to influence choice of mode of transportation based on movement characteristic is travel distance.

The result of distance variable analysis is insignificant and unreliable to predict worker's decision to determine whether or not they will use public transportation BRT Trans Semarang. This may be explained with the phenomena in the research which shows that when the distance to travel to get to work increases, it is uncertain that the probability of worker's decision to use public transportation BRT Trans Semarang will also increase. When the distance to travel to get to work decreases, it is also uncertain that the probability of worker's decision to use public transportation BRT Trans Semarang will also decrease, since the decision to use public transportation BRT Trans Semarang for the workers in this research is not caused by whether or not the distance to take is long, but which transportation is deemed effective to get to work.

The accessibility variable has coefficient value of 3.665 and in *binary logistic regression* estimation has significance level of 0.000. This shows that significance value (0,000) < significance level ( $\alpha = 0.05$ ), which means that significance accessibility is significant and reliable to predict worker's decision to determine whether or not they will public transportation BRT Trans Semarang. The positive coefficient mark (+) shows that there is positive or parallel relationship between accessibility and probability of worker's decision to use public transportation BRT Trans Semarang. The higher the accessibility to bus stop, the probability of worker's decision to use public transportation BRT Trans Semarang will be higher, when the accessibility to bus stop is lower, the probability of worker's decision to use public transportation BRT Trans Semarang will be lower.

The accessibility of bus stop becomes worker's consideration to use public transportation BRT Trans Semarang, that if it is too long to get to the bus stop, he will find it difficult and his travel to get to work will be ineffective. This positive relationship between accessibility and the probability of worker's decision to use public transportation conforms to the research conducted by (Azali 2018), which reveals that accessibility positively and significantly influences choice of mode of BRT. Better perception of the accessibility of BRT will increase the probability of choice of BRT. As stated by Yu *et al* (2018), easiness in accessing public transportation will be the ground for the public to choose public transportation instead of private transportation.

The tariff variable has coefficient value of 2.384 and in *binary logistic regression* estimation has significance level of 0.000. This shows that significance value (0,000) < significance level ( $\alpha = 0.05$ ), which means that tariff variable is significant and reliable to predict worker's decision to determine whether or not they will public transportation BRT Trans Semarang. Meanwhile, the positive coefficient mark (+) shows that there is positive or parallel relationship between tariff and the probability of worker's decision to use public transportation BRT Trans Semarang. When worker's tariff perception becomes the main consideration to use public transportation, the probability of worker's decision to use public transportation depends on the designated tariff. This result conforms to the research conducted by (Rahmani, Anggraini dan Caesarina 2018) which finds that there is positive relationship between tariff and people's preference to use public transportation service, thus people's perception of very affordable tariff or in this case making tariff the main consideration will enhance people's preference to use public transportation service.

An analysis using *binary logistic regression* may also be used to create simulation of worker's each opportunity in determining whether or not they will public transportation BRT Trans Semarang. This may be conducted by inserting existing data into the equation and ignoring insignificant independent variables. Therefore, variables which may be used to create simulation of worker's each opportunity are the accessibility and tariff variables (table 2). From the analysis results, the following logistic regression model equation is obtained:

$$\text{Ln} \left( \frac{p}{1-p} \right) = - 4.225 + 3.665 \text{ Accessibility} + 2.384 \text{ Tariff}$$

First simulation, the accessibility to bus stop averagely takes 160 meters or 40% (percentage of 160 meters divided by the longest distance, 400 meters) and tariff of IDR3,500.00 which becomes the main consideration of 37% (percentage of tariff perception IDR 3,500.00 as the main consideration).

Based on the calculation results of each opportunity of classification of decision to use BRT Trans Semarang is 0.2778 or 27.78% and the opportunity of unwillingness to use BRT Trans Semarang is 0.7222 or 72.22%. The policy simulation may be modified in order to obtain which of the opportunities is the highest to enable implementation towards green

transportation. Second simulation, in case of increase of accessibility, in which the distance to get to bus stop gets closer and the tariff is fixed.

**Table 2.** Results of Simulation of Opportunity of Willingness and Unwillingness to Public Transportation

Simulation	Opportunity (%)		Change (%)		Description
	Willing	Unwilling			
First	27.78	72.22	-	-	-
Second	38.52	61.48	7.5	10.74	There is an increase of opportunity of willingness to use public transportation in case of increasing accessibility. Change in opportunity is higher than change in accessibility
Third	14.15	85.85	28.57	24.37	There is a decrease of opportunity of willingness to use public transportation in case of increasing tariff. Change in opportunity is lower than change in tariff

If the accessibility gets closer, initial distance 160 meters to 130 meters or 32.50% (percentage of distance 130 meters divided by the longest distance to get to bus stop, which is 400 meters), while the tariff is fixed IDR3,500.00. This change will cause difference in the opportunity to use public transportation. Based on the calculation results of each opportunity of classification of decision to use BRT Trans Semarang in the second simulation, we may view that the opportunity of willingness to use BRT Trans Semarang is 0.3852 or 38.52% and the opportunity of unwillingness to use BRT Trans Semarang is 0.6148 or 61.48%. This shows that if the access to bus stop is closer, worker's opportunity to use public transportation will be higher of 38.52%, which means that there is an increase of opportunity of 10.74% (38.52% - 27.78%) derived from increasing the accessibility, thus the distance to get to bus stop is closer of 7.5 % (40%-32.5%).

Further, in case of change of tariff variable from IDR3,500.00 to IDR4,000.00 or increasing of IDR500.00 while the accessibility is fixed, worker's opportunity to use public transportation changes. This change may be viewed in the detailed calculation. A tariff increase of IDR500.00 or 65.57% (percentage of tariff increase nominal divided by designated tariff) while the accessibility is fixed of 130 meters or 32.50%, the opportunity of decision to use public transportation BRT Trans Semarang will decrease to 0.1415 or 14.15%, while the opportunity not to use public transportation BRT Trans Semarang will increase to 0.8585 or 85.85%.

The third simulation shows that if there is only an increase of tariff variable while the other variables are fixed, the opportunity of decision to use public transportation BRT Trans Semarang will decrease to 0.1415 or 14.15%, while the opportunity of decision not to use public transportation BRT Trans Semarang will increase to 0.8585 or 85.85%. Based on Table 2, we may examine that worker's opportunity to decide to use public transportation BRT Trans Semarang will increase in line with increasing accessibility and will decrease in line with increasing tariff. Therefore, the opportunity of willingness to use public transportation BRT Trans Semarang will be higher when the accessibility variable increases, instead of increasing the tariff variable. Similarly, other various conditions may be calculated with the results of logistic regression equation estimation above. Some scenarios above may be useful as the

ground for decision or policy making for public transportation issues, especially BRT Trans Semarang.

#### 4. CONCLUSION

Based on the research results and discussion, the individual's awareness to switch from private transportation to public transportation to the green transportation is a learning process that is not easy. It is seen that only accessibility and tariffs influence individual decisions in using transportation. While income, vehicle ownership and distance are not significant. Based in the policy simulation, the opportunity of using public transportation will be higher the access is easier. It will be getting lower if the tariff is raised when the other variables are constant. Therefore, to influence private decisions using the public transportation, the government must be oriented towards reachable distance and tariffs.

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# **A Simulated Policy Towards Green Public Transportation in a Metropolitan in Indonesia**

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## **ABSTRACT**

The need for mode of transportation is proportional with urban population growth. The dependence of people using private transportation causes many problems. In addition to congestion, it can create environmental problems such as air quality deterioration and pollution in the cities. Learning to be in this research is the process of individual learning to move from private transportation to public transportation. The purpose of this study is to predict and opportunities for private decision using the public transportation toward green transportation in Semarang city. This research is designed using a quantitative approach. Respondents in this study were workers. Data collection methods with questionnaires. The samples are collected using proportional sampling technique. Data are analyzed with binary logistic regression. The results showed that the accessibility and tariff variables are significantly influence to predict private decision for using public transportation as an effort toward green transportation. Based on the policy simulation, the opportunity of using public transportation will be higher if the distance is closer and reachable. It will be getting lower if the tariff is raised when the other variables are constant. Therefore, to influence private decisions using the public transportation, the government must be oriented towards reachable distance and tariff.

**Keywords:** Green Transportation, Sustainability, Opportunity, Environmental, Policy

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## **1. INTRODUCTION**

Population growth influences the growth of an area, either rural or urban. Growing population on one hand increases the human resources as capital for development. On the other hand, however, it requires more necessary facilities and infrastructures including the need for in-urban travel. The bigger the population, the need for transportation will also get higher. Transportation is an effort to move goods and people from a place of origin to a destination (Nasution 2004). Transportation service is a facility which cannot be separated from and the need of the society to support their activities. However, urban transportation currently has various problems as the result of the society's increasing dependency on private vehicles, both car and motorcycle. The society's high dependency on private vehicles will cause traffic congestion and pollution, which will lead to environmental damage. According to (Naganathan dan Chong 2017), transportation has an important role for goods and services delivery flow, to create employment and drive economic growth rate. However, we cannot deny that transportation also has adverse impact on the environment, in the form of environmental

pollution. Yu *et al* (2018) state that high number of populations in urban area resulted from migration will have adverse impact on the quality of the urban environment.

Jiang *et al* (2018) states that generally the need for traffic in urban area always increases faster than available traffic capacity, thus it will create various transportation problems. The high number of private vehicle users will cause various problems like traffic congestion. Traffic congestion is an imbalance condition between road capacity and the number of vehicles passing the road. In addition, increasing number of vehicles will also have impact on the traffic, in which there are many traffic accidents, endangering road users (Zhou, Wang and Wu 2018). Besides impacts on traffic congestion and accident, the numerous numbers of private vehicle users will lead to environmental pollution and air pollution and noise pollution (Park, et al. 2018). (Gusnita 2010) states that these vehicles' Fuel Oil (BBM) contains lead which contributes a great amount of pollution to air and health quality. As stated by (Labib, et al. 2018), the decreasing air quality in urban area is caused by the increasing usages of motor vehicles, disincentive to fuel oil-free (FFT) transportation, and decreasing urban green area.

The responsibility of maintaining and caring for the environment is not only the responsibility of the government. Individuals as members of society also have the same obligations. This is in accordance with the opinion of (La Trobe dan Acott 2000) and (Reif 2015) that environmental problems cannot only be solved technically, but the more important matter is how to change the mindset, awareness and responsible behavior to actively participate in managing the environment. Public awareness in supporting environmental development such as the use of green transportation requires education based on learning. (Liem dan Martin 2015) also showed the important roles of social and personal norms to foster pro-environment behavior.

Learning becomes one of the pillars in education that can improve the process of individualization in society, while at the same time increasing social interaction that is very supportive of development. The intended learning is the process of awakening individuals as a member of society to move from private transportation to public transportation. Public transportation is a process towards green transportation. This was confirmed by (Delors 2013) and (Amini 2015) that stated if we want to solve all the risks faced, education is the only solution: education as a way to gain knowledge but also assessment, as an apprenticeship in independence before we assume responsibility, and as a school tolerance that teaches us how to coexist with other people, wherever they come from. (Ozden 2008) also stated many people believe that environmental education is the most important factor to prevent environmental problems.

Central Java is a province with the highest percentage of migration number increase in Java Island. The increase of incoming migration number into Central Java is 71.89 percent (BPS 2017). This increasing population will certainly have impacts on environmental issues. The high total population of Central Java Province is caused by the growth of population of each regency and city, which increases annually. Semarang City is the capital city of Central Java Province with 1,729.42 thousand population. This number makes Semarang City a city with the highest population among the other cities in Central Java. Semarang City's high population is also followed with high flow of incoming migration of 472,777 (BPSb 2017). Semarang City is chosen to be a migration destination because of it has an attraction as a city of trades, services, industries, and education. This incoming migration to the city will increase its population annually.

The population growth rate increases 0.70 percent from 2012-2016. An area's population growth and economic growth cause increasing movement of people, goods and services in the area and its surroundings. As the capital city of Central Java Province, Semarang City must be able to fulfill the needs and demand for goods and services, both of the city itself

and its surrounding areas. This, therefore, requires transportation to support the activities. Generally, there are two types of mode of passenger transportation: private vehicle and public vehicle. Private vehicle is one for non-public use and owned by individual, while public vehicle or transport is one to be utilized by the public. The number of private vehicles and public vehicles in Semarang City in the last five years always increases. Despite continuously increasing, the number of private vehicles is higher than that of public vehicles annually. In 2017, the number of private vehicles in Semarang City is 1,981,208 or 99.59 percent and the number of public transportations is 8,207 or 0.41 percent (Badan Pengelola Pendapatan Daerah (BPPD) 2018)

Transportation in big cities like Semarang City is one of the sources of pollution, in which 70% of urban air pollution is caused by motor vehicle activities (Kusminingrum dan Gunawan 2008). With various existing problems caused by transportation, a solution is required to overcome it in order to create a sustainable and environmentally-friendly transportation. A sustainable transportation is, according to *Organization for Economic Cooperation and Development* (OECD), in (Gusnita 2010), transportation which does not harm ecosystem and public health and fulfills the need for mobility. This sustainable transportation is often called *green transportation*, which is an effort to fulfill current generation's need for mobility and transportation without prejudice to future generation's ability to fulfill their need for mobility. However, it is not easy to realize a sustainable transportation. The research conducted by (Shankar 2018) states that the constraints often faced in realizing a sustainable transportation are the financial resource, awareness and behavior of every person in using an environmentally-friendly transportation. In addition, that there is no binding rule of law on sustainable transportation implementation in urban area also inhibit such sustainable transportation implementation (Kurapati, et al. 2018).

Theoretically, a sustainable transportation must fulfill 3 aspects: environmental, economic, and social aspects. In environmental aspect, a sustainable transportation does not cause air, water, and soil pollution and does not use resources excessively. In economic aspect, a sustainable transportation is affordable for the public and may fulfill the need for operating costs of urban productive transportation. In social aspect, a sustainable transportation may support realization of healthy social environment, minimize noise and traffic congestion, and may improve social justice and well-being. Meanwhile, (Brotodewo 2010) proposes that an approach often used to create green transportation is to use public transport instead of using private vehicle. Meanwhile, according to RPJMD of Semarang City 2016-2021, sustainable transportation development will be focused on provision of environmentally-friendly public transportation (BRT, monorail/MRT).

Bus-based public transport like *Bus Rapid Transit* (BRT) is an appropriate means of public transportation to be applied in Semarang City. *Bus Rapid Transit* (BRT) or known as Trans Semarang is one public transportation managed by BLU Trans Semarang with a purpose to reduce traffic congestion in Semarang City. Despite still using Fuel Oil (BBM) which may cause negative impact on the environment, at least, however, using public transportation like BRT will minimize vehicle movement and reduce motor vehicle usage. Since the operation of BRT Trans Semarang in 2010, many people have utilized it to support their daily activities to go to school, to work, to market, etc. The number of BRT Trans Semarang continuously increases. BRT Trans Semarang users are divided into two groups: public and students. The public is dominated by workers, considering that working is the main purpose of movement. In 2017, the percentage of public users' increase is lower. Public users only increase 11.92 percent, while student users increase 37.84 percent. That the increase of BRT Trans Semarang public users is lower than that of student users is caused by some factors that influence individual's decision whether or not to use BRT Trans Semarang. Public transportation is a process towards green transportation.

If the decision to use BRT Trans Semarang is associated with factors influencing selection of mode of transportation according to (Tamin 2000), then the factor may be classified based on road user characteristic, movement characteristic, facility characteristic, and city or zone characteristic. Income, vehicle ownership, distance, accessibility, and tariff are factors that may represent each factor based on the respective characteristic. By examining the reliable factors to predict workers' decision to use BRT Trans Semarang, business actors may continuously their service quality to fulfill consumers' desire. It will attract workers, as a member of society to use environmentally-friendly transportation and reduce the private transportation. Making it a habit becomes very important for the success of the learning process (Zaenuri, et al. 2017) because awareness should start from ourselves, from now on without having to wait for the right moment to do so (Power 2004). When it becomes a habit, it shows that someone has changed his mind set and already has the awareness to use public transportation. Although it requires a long time and learning process for individuals in the community, the results are in accordance with the expected goals of green transportation. This opinion related with (Reif 2015) that it requires a long process and the outcome cannot be seen immediately, the solution of environmental problems through the development of responsible behavior. Previous research on sustainable transportation has been widely conducted, but no one has yet researched the opportunity factors that influence an individual's decision to switch from conventional transportation to sustainable transportation with policy simulations. Therefore, it is important to conduct research predicting the factors that influence and the chances of people's decisions using public transportation towards sustainable transportation in Semarang. Based on the subject matter, the purpose of this research is to predict and opportunities for private decisions using the public transportation toward green transportation.

## 2. METHODS

This descriptive research employs a quantitative approach. This research's samples are collected using *proportional sampling* technique. 100 respondents are obtained as its samples. The respondents who work in 5 districts in Semarang City including Mijen, Candisari, Semarang Utara, Semarang Tengah, and Gunungpati. The data used in this research are primary data and secondary data. The primary data are obtained by distributing questionnaires to 100 respondents previously determined from the five districts under certain criteria. The secondary data are obtained from journals, books, electronic media, and data issued by relevant departments such as the Central Statistics, Department of Transportation. Data are analyzed with the logit model (*binary logistic regression*). The logit model analysis method is employed when the dependent variable (response) is binary variable/ dichotomy. The logit model in the research of people's decision to use BRT Trans Semarang is formulated in Equation 1 as follows:

$$Li = \ln\left(\frac{pi}{1-pi}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + ui$$

.....(1)

In which:

- Li =  $\ln\left(\frac{pi}{1-pi}\right)$  = decision to use BRT Trans Semarang, 1 = if willing to use BRT Trans Semarang and 0 = if unwilling to use BRT Trans Semarang
- $\beta_0$  = constant
- $\beta_1, \beta_2, \dots, \beta_5$  = estimation coefficient
- $X_1$  = income
- $X_2$  = vehicle ownership
- $X_3$  = distance
- $X_4$  = accessibility
- $X_5$  = tariff
- ui = error term

The decision to use public transportation (BRT Trans Semarang) variable is described through respondent's decision whether or not to be willing to use public transportation. This variable is measured using two categories: 0 for respondent's decision to be unwilling to use public transportation and 1 for respondent's decision to be willing to use public transportation. Income is the total money received by a person within a certain period, commonly on a monthly basis. The income meant in this research is one derived from respondent's main job or side job. The income variable is measured using two categories: 1 if the income is up to IDR2,310,000.00 and 0 if the income is more than IDR 2,310,000.00 pursuant to the city minimum wage. Vehicle ownership is measured based on private motor vehicle ownership, either motorcycle or car. The private vehicle ownership variable is measured with two categories: 0 if respondent has more than 1 private vehicle and 1 if respondent has up to 1 private vehicle. Distance is a relative distance measurement for respondent from his/her residence to work place. The residence distance variable is measured with two categories: 0 if respondent's residence distance is up to 5 km and 1 if respondent's residence distance is more than 5 km. Accessibility is the easiness of access to BRT Trans Semarang stop. The criteria of accessibility level may be viewed according to the distance to BRT Trans Semarang stop, time to get to BRT Trans Semarang stop, and the easiness of how to get to BRT Trans Semarang stop from respondent's house. The accessibility variable in this research is measured using two categories: 0 if respondent finds it difficult to get to BRT Trans Semarang and 1 if respondent finds it easy to get to BRT Trans Semarang. The tariff designated for a type of transportation will influence consumers' willingness to use it. This tariff variable is used to examine whether or not tariff is the main consideration for the public to decide to use BRT Trans Semarang. The tariff variable is measured with two categories: 0 if tariff is not taken as the main consideration for the public to use BRT Trans Semarang and 1 if tariff is taken as the main consideration for the public to use BRT Trans Semarang. To test the appropriateness of logistic regression model to the data, some statistic tests are employed: Regression Goodness of Fit Test with *Hosmer and Lemeshow test*, Overall Model Fit test with *likelihood ratio and Omnibus Tests of Model Coefficients* test, and Determination uji Coefficient of Determination using *Negalkerke's R Square*. Wald Test is employed for Partial Test.

### 3. RESULTS AND DISCUSSION

#### Goodness of Fit Test Results

A good logistic regression model takes place when there is no difference between data derived from observation and data derived from prediction. The test results show the significance value of *Hosmer and Lemeshow's goodness of fit test* is 0.704. The value is higher than the statistic *fit test* (0.05), which means that the zero hypothesis is accepted, thus the model is able to predict its observation value or we may state that the model is acceptable since it conforms to the observation data.

#### Overall Model Fit Test Results

*Omnibus Tests of Model Coefficients* shows that the *chi-square* value is 70.113. The highest *chi-square* of 70.113 is the difference of *-2 log likelihood* before independent variables are included into the model (137.628) subtracted with *-2 log likelihood* after independent variables are included into the model (67.515). The *chi-square* of 70.113 is higher than the *chi-square* of table on df 5 with significance level 0.05, which is 11.070. Since *chi-square* count value > table *chi-square* value, addition of independent variables will provide real impact on the model or, in other words, the model is fit. This also means that the decision to use BRT Trans Semarang may be predicted according to the income, vehicle ownership, distance, accessibility, and tariff variables.

### Coefficient of Determination Test Results (*Nagelkerke's R Square*)

Cox and snell's R square is a measurement which tries to imitate the R<sup>2</sup> measurement on multiple regression which is based on likelihood estimation technique with maximum value less than 1 (one). Nagelkerke's R square is a modification of cox and snell's coefficient to ensure that the values vary from 0 (zero) to 1 (one). *Nagelkerke's R square* value is 0.674 (67.4%). This shows that the independent variables in this research are only able to explain the dependent variable of 67.4%, while the remaining 32.6% is explained by other variables beyond this research.

### Partial Test Results (Wald Test)

This test is employed to examine whether or not the independent variables included into the model influence the dependent variables. This test may also be stated as a hypothesis test. The results of Wald test may be viewed in Table1 below:

**Table 1.** Variables in the Equation

Variable	B	Wald	Sig.	Exp (B)
Step 1 <sup>a</sup> X1	-.975	2.144	.143	.377
X2	.949	1.723	.189	2.584
X3	.440	.467	.494	1.553
X4	3.665	18.583	.000	39.041
X5	2.384	12.784	.000	10.851
Constant	-4.225	18.758	.000	.015

Source: Processed primary data, 2018

The data processing results in Table 2 may be explained using the following logistic regression equation:

$$\ln \left( \frac{p}{1-p} \right) = -4.225 - 0.975 \text{ Income} + 0.949 \text{ Vehicle Ownership} + 0.440 \text{ Distance} + 3.665 \text{ Accessibility} + 2.384 \text{ tariff} + \mu$$

The parameter used for partial test in this research is to compare significance value with significance level 5%. According to the processing results as listed in Table 2 above, we may conclude that the income variable has coefficient value of -0.975 and in *binary logistic regression* estimation has significance level of 0.143. This shows that significance value (0.143) > significance level ( $\alpha = 0.05$ ), which means that income variable is insignificant and unreliable to predict worker's decision to determine whether or not they will public transportation BRT Trans Semarang. In other words, this shows that there is no difference in the opportunity between decision to be willing to or decision not to be willing to use public transportation BRT Trans Semarang based on worker's income rate. This negative and insignificant relationship shows that higher income will insignificantly decrease the probability of worker's decision to use public transportation BRT Trans Semarang and, lower income will insignificantly increase the probability of worker's decision to use public transportation BRT Trans Semarang.

This negative relationship between income and decision to use public transportation conforms to the research conducted by (P. Susongko 2018) which reveals that the use of

transportation to go to work is influenced by socio-economic factors (education, position, income). Income variable is insignificant and unreliable to predict worker's decision to determine whether or not they will public transportation BRT Trans Semarang, which may be explained with the existing phenomena in the research. Although an individual has low income but with relatively low needs, he will be able to buy more than one private vehicle, which will thus influence his decision to use public transportation BRT Trans Semarang and would prefer to use private vehicle. Similarly, an individual with higher income but with higher necessity will only be able to buy one vehicle, thus the need for vehicle for each family member will not be satisfied. This will influence his decision to use public transportation BRT Trans Semarang.

The vehicle ownership variable has coefficient value of 0.949 and in *binary logistic regression* estimation has significance level of 0.189. This shows that significance value (0.189) > significance level ( $\alpha = 0.05$ ), which means that vehicle ownership variable is insignificant and unreliable to predict worker's decision to determine whether or not they will public transportation BRT Trans Semarang. This positive and insignificant relationship shows that higher vehicle ownership will insignificantly increase the probability of worker's decision to use public transportation BRT Trans Semarang and, lower vehicle ownership will insignificantly decrease the probability of worker's decision to use public transportation BRT Trans Semarang

The results of this research do not conform to the research conducted by (Warman, Firdaus dan Yusnita 2014) which finds that vehicle ownership negatively influences decision to use public transportation. However, they conform to the research conducted by (Chuen, Yusoff dan Karim 2014) which shows that vehicle ownership has positive and significant relationship with decision to use public transportation online. The non-conformance between the research results and the theories and previous researches may be explained with the phenomena in the research showing that vehicle ownership is not a reason for a worker to use public transportation BRT Trans Semarang. Higher or lower number of worker's vehicle ownership does not influence the probability of his decision whether or not to be willing use public transportation BRT Trans Semarang. For example, when an individual has more than one private vehicle in the family, he will keep using public transportation BRT Trans Semarang since the number of private vehicles in possession does not meet the need of his family members and also since he is unable to drive private vehicle, either motorcycle or car.

The distance variable has coefficient value of 0.440 and in *binary logistic regression* estimation has significance level of 0.494. This shows that significance value (0,494) > significance level ( $\alpha = 0.05$ ), which means that distance variable is insignificant and unreliable to predict worker's decision to determine whether or not they will public transportation BRT Trans Semarang. This positive and insignificant relationship shows that a longer distance a worker take to get to work will insignificantly increase the probability of his decision to use public transportation BRT Trans Semarang. The insignificant relationship conforms to the theory of (Tamin 2000) stating that one factor to influence choice of mode of transportation based on movement characteristic is travel distance.

The result of distance variable analysis is insignificant and unreliable to predict worker's decision to determine whether or not they will use public transportation BRT Trans Semarang. This may be explained with the phenomena in the research which shows that when the distance to travel to get to work increases, it is uncertain that the probability of worker's decision to use public transportation BRT Trans Semarang will also increase. When the distance to travel to get to work decreases, it is also uncertain that the probability of worker's decision to use public transportation BRT Trans Semarang will also decrease, since the decision to use public transportation BRT Trans Semarang for the workers in this research is not caused by whether or not the distance to take is long, but which transportation is deemed effective to get to work.



The accessibility variable has coefficient value of 3.665 and in *binary logistic regression* estimation has significance level of 0.000. This shows that significance value (0,000) < significance level ( $\alpha = 0.05$ ), which means that significance accessibility is significant and reliable to predict worker's decision to determine whether or not they will public transportation BRT Trans Semarang. The positive coefficient mark (+) shows that there is positive or parallel relationship between accessibility and probability of worker's decision to use public transportation BRT Trans Semarang. The higher the accessibility to bus stop, the probability of worker's decision to use public transportation BRT Trans Semarang will be higher, when the accessibility to bus stop is lower, the probability of worker's decision to use public transportation BRT Trans Semarang will be lower.

The accessibility of bus stop becomes worker's consideration to use public transportation BRT Trans Semarang, that if it is too long to get to the bus stop, he will find it difficult and his travel to get to work will be ineffective. This positive relationship between accessibility and the probability of worker's decision to use public transportation conforms to the research conducted by (Azali 2018), which reveals that accessibility positively and significantly influences choice of mode of BRT. Better perception of the accessibility of BRT will increase the probability of choice of BRT. As stated by Yu *et al* (2018), easiness in accessing public transportation will be the ground for the public to choose public transportation instead of private transportation.

The tariff variable has coefficient value of 2.384 and in *binary logistic regression* estimation has significance level of 0.000. This shows that significance value (0,000) < significance level ( $\alpha = 0.05$ ), which means that tariff variable is significant and reliable to predict worker's decision to determine whether or not they will public transportation BRT Trans Semarang. Meanwhile, the positive coefficient mark (+) shows that there is positive or parallel relationship between tariff and the probability of worker's decision to use public transportation BRT Trans Semarang. When worker's tariff perception becomes the main consideration to use public transportation, the probability of worker's decision to use public transportation depends on the designated tariff. This result conforms to the research conducted by (Rahmani, Anggraini dan Caesarina 2018) which finds that there is positive relationship between tariff and people's preference to use public transportation service, thus people's perception of very affordable tariff or in this case making tariff the main consideration will enhance people's preference to use public transportation service.

An analysis using *binary logistic regression* may also be used to create simulation of worker's each opportunity in determining whether or not they will public transportation BRT Trans Semarang. This may be conducted by inserting existing data into the equation and ignoring insignificant independent variables. Therefore, variables which may be used to create simulation of worker's each opportunity are the accessibility and tariff variables (table 2). From the analysis results, the following logistic regression model equation is obtained:

$$\text{Ln} \left( \frac{p}{1-p} \right) = - 4.225 + 3.665 \text{ Accessibility} + 2.384 \text{ Tariff}$$

First simulation, the accessibility to bus stop averagely takes 160 meters or 40% (percentage of 160 meters divided by the longest distance, 400 meters) and tariff of IDR3,500.00 which becomes the main consideration of 37% (percentage of tariff perception IDR 3,500.00 as the main consideration).

Based on the calculation results of each opportunity of classification of decision to use BRT Trans Semarang is 0.2778 or 27.78% and the opportunity of unwillingness to use BRT Trans Semarang is 0.7222 or 72.22%. The policy simulation may be modified in order to obtain which of the opportunities is the highest to enable implementation towards green

transportation. Second simulation, in case of increase of accessibility, in which the distance to get to bus stop gets closer and the tariff is fixed.

**Table 2.** Results of Simulation of Opportunity of Willingness and Unwillingness to Public Transportation

Simulation	Opportunity (%)		Change (%)		Description
	Willing	Unwilling			
First	27.78	72.22	-	-	-
Second	38.52	61.48	7.5	10.74	There is an increase of opportunity of willingness to use public transportation in case of increasing accessibility. Change in opportunity is higher than change in accessibility
Third	14.15	85.85	28.57	24.37	There is a decrease of opportunity of willingness to use public transportation in case of increasing tariff. Change in opportunity is lower than change in tariff

If the accessibility gets closer, initial distance 160 meters to 130 meters or 32.50% (percentage of distance 130 meters divided by the longest distance to get to bus stop, which is 400 meters), while the tariff is fixed IDR3,500.00. This change will cause difference in the opportunity to use public transportation. Based on the calculation results of each opportunity of classification of decision to use BRT Trans Semarang in the second simulation, we may view that the opportunity of willingness to use BRT Trans Semarang is 0.3852 or 38.52% and the opportunity of unwillingness to use BRT Trans Semarang is 0.6148 or 61.48%. This shows that if the access to bus stop is closer, worker's opportunity to use public transportation will be higher of 38.52%, which means that there is an increase of opportunity of 10.74% (38.52% - 27.78%) derived from increasing the accessibility, thus the distance to get to bus stop is closer of 7.5 % (40%-32.5%).

Further, in case of change of tariff variable from IDR3,500.00 to IDR4,000.00 or increasing of IDR500.00 while the accessibility is fixed, worker's opportunity to use public transportation changes. This change may be viewed in the detailed calculation. A tariff increase of IDR500.00 or 65.57% (percentage of tariff increase nominal divided by designated tariff) while the accessibility is fixed of 130 meters or 32.50%, the opportunity of decision to use public transportation BRT Trans Semarang will decrease to 0.1415 or 14.15%, while the opportunity not to use public transportation BRT Trans Semarang will increase to 0.8585 or 85.85%.

The third simulation shows that if there is only an increase of tariff variable while the other variables are fixed, the opportunity of decision to use public transportation BRT Trans Semarang will decrease to 0.1415 or 14.15%, while the opportunity of decision not to use public transportation BRT Trans Semarang will increase to 0.8585 or 85.85%. Based on Table 2, we may examine that worker's opportunity to decide to use public transportation BRT Trans Semarang will increase in line with increasing accessibility and will decrease in line with increasing tariff. Therefore, the opportunity of willingness to use public transportation BRT Trans Semarang will be higher when the accessibility variable increases, instead of increasing the tariff variable. Similarly, other various conditions may be calculated with the results of logistic regression equation estimation above. Some scenarios above may be useful as the

ground for decision or policy making for public transportation issues, especially BRT Trans Semarang.

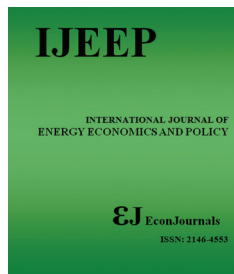
#### 4. CONCLUSION

Based on the research results and discussion, the individual's awareness to switch from private transportation to public transportation to the green transportation is a learning process that is not easy. It is seen that only accessibility and tariffs influence individual decisions in using transportation. While income, vehicle ownership and distance are not significant. Based in the policy simulation, the opportunity of using public transportation will be higher the access is easier. It will be getting lower if the tariff is raised when the other variables are constant. Therefore, to influence private decisions using the public transportation, the government must be oriented towards reachable distance and tariffs.

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## A Simulated Policy towards Green Public Transportation in a Metropolitan in Indonesia

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### ABSTRACT

The need for mode of transportation is proportional with urban population growth. The dependence of people using private transportation causes many problems. In addition to congestion, it can create environmental problems such as air quality deterioration and pollution in the cities. Learning to be in this research is the process of individual learning to move from private transportation to public transportation. The purpose of this study is to predict and opportunities for private decision using the public transportation toward green transportation in Semarang city. This research is designed using a quantitative approach. Respondents in this study were workers. Data collection methods with questionnaires. The samples are collected using proportional sampling technique. Data are analyzed with binary logistic regression. The results showed that the accessibility and tariff variables are significantly influence to predict private decision for using public transportation as an effort toward green transportation. Based on the policy simulation, the opportunity of using public transportation will be higher if the distance is closer and reachable. It will be getting lower if the tariff is raised when the other variables are constant. Therefore, to influence private decisions using the public transportation, the government must be oriented towards reachable distance and tariff.

**Keywords:** Green Transportation, Sustainability, Opportunity, Environmental, Policy

**JEL Classifications:** ???

### 1. INTRODUCTION

Population growth influences the growth of an area, either rural or urban. Growing population on one hand increases the human resources as capital for development. On the other hand, however, it requires more necessary facilities and infrastructures including the need for in-urban travel. The bigger the population, the need for transportation will also get higher. Transportation is an effort to move goods and people from a place of origin to a destination (Nasution, 2004). Transportation service is a facility which cannot be separated from and the need of the society to support their activities. However, urban transportation currently has various problems as the result of the society's increasing dependency on private vehicles, both car and motorcycle. The society's high dependency on private vehicles will cause traffic congestion and pollution, which will lead to environmental damage. According to

(Naganathan dan Chong, 2017), transportation has an important role for goods and services delivery flow, to create employment and drive economic growth rate. However, we cannot deny that transportation also has adverse impact on the environment, in the form of environmental pollution. Yu et al. (2018) state that high number of populations in urban area resulted from migration will have adverse impact on the quality of the urban environment.

Jiang et al. (2018) states that generally the need for traffic in urban area always increases faster than available traffic capacity, thus it will create various transportation problems. The high number of private vehicle users will cause various problems like traffic congestion. Traffic congestion is an imbalance condition between road capacity and the number of vehicles passing the road. In addition, increasing number of vehicles will also have impact on the traffic, in which there are many traffic accidents,

endangering road users (Zhou et al. 2018). Besides impacts on traffic congestion and accident, the numerous numbers of private vehicle users will lead to environmental pollution and air pollution and noise pollution (Park et al., 2018). (Gusnita 2010) states that these vehicles' Fuel Oil (BBM) contains lead which contributes a great amount of pollution to air and health quality. As stated by (Labib et al., 2018), the decreasing air quality in urban area is caused by the increasing usages of motor vehicles, disincentive to fuel oil-free transportation, and decreasing urban green area.

The responsibility of maintaining and caring for the environment is not only the responsibility of the government. Individuals as members of society also have the same obligations. This is in accordance with the opinion of (La Trobe dan Acott, 2000) and (Reif, 2015) that environmental problems cannot only be solved technically, but the more important matter is how to change the mindset, awareness and responsible behavior to actively participate in managing the environment. Public awareness in supporting environmental development such as the use of green transportation requires education based on learning. (Liem dan Martin, 2015) also showed the important roles of social and personal norms to foster pro-environment behavior.

Learning becomes one of the pillars in education that can improve the process of individualization in society, while at the same time increasing social interaction that is very supportive of development. The intended learning is the process of awakening individuals as a member of society to move from private transportation to public transportation. Public transportation is a process towards green transportation. This was confirmed by (Delors, 2013) and (Amini, 2015) that stated if we want to solve all the risks faced, education is the only solution: education as a way to gain knowledge but also assessment, as an apprenticeship in independence before we assume responsibility, and as a school tolerance that teaches us how to coexist with other people, wherever they come from. (Ozden, 2008) also stated many people believe that environmental education is the most important factor to prevent environmental problems.

Central Java is a province with the highest percentage of migration number increase in Java Island. The increase of incoming migration number into Central Java is 71.89% (BPS, 2017). This increasing population will certainly have impacts on environmental issues. The high total population of Central Java Province is caused by the growth of population of each regency and city, which increases annually. Semarang City is the capital city of Central Java Province with 1,729.42 thousand population. This number makes Semarang City a city with the highest population among the other cities in Central Java. Semarang City's high population is also followed with high flow of incoming migration of 472,777 (BPSb, 2017). Semarang City is chosen to be a migration destination because of it has an attraction as a city of trades, services, industries, and education. This incoming migration to the city will increase its population annually.

The population growth rate increases 0.70% from 2012 to 2016. An area's population growth and economic growth cause increasing movement of people, goods and services in the area

and its surroundings. As the capital city of Central Java Province, Semarang City must be able to fulfill the needs and demand for goods and services, both of the city itself and its surrounding areas. This, therefore, requires transportation to support the activities. Generally, there are two types of mode of passenger transportation: private vehicle and public vehicle. Private vehicle is one for non-public use and owned by individual, while public vehicle or transport is one to be utilized by the public. The number of private vehicles and public vehicles in Semarang City in the last five years always increases. Despite continuously increasing, the number of private vehicles is higher than that of public vehicles annually. In 2017, the number of private vehicles in Semarang City is 1,981,208 or 99.59% and the number of public transportations is 8,207 or 0.41% (Badan Pengelola Pendapatan Daerah, 2018).

Transportation in big cities like Semarang City is one of the sources of pollution, in which 70% of urban air pollution is caused by motor vehicle activities (Kusminingrum dan Gunawan, 2008). With various existing problems caused by transportation, a solution is required to overcome it in order to create a sustainable and environmentally-friendly transportation. A sustainable transportation is, according to Organization for Economic Cooperation and Development, in (Gusnita, 2010), transportation which does not harm ecosystem and public health and fulfills the need for mobility. This sustainable transportation is often called green transportation, which is an effort to fulfill current generation's need for mobility and transportation without prejudice to future generation's ability to fulfill their need for mobility. However, it is not easy to realize a sustainable transportation. The research conducted by (Shankar, 2018) states that the constraints often faced in realizing a sustainable transportation are the financial resource, awareness and behavior of every person in using an environmentally-friendly transportation. In addition, that there is no binding rule of law on sustainable transportation implementation in urban area also inhibit such sustainable transportation implementation (Kurapati et al., 2018).

Theoretically, a sustainable transportation must fulfill 3 aspects: environmental, economic, and social aspects. In environmental aspect, a sustainable transportation does not cause air, water, and soil pollution and does not use resources excessively. In economic aspect, a sustainable transportation is affordable for the public and may fulfill the need for operating costs of urban productive transportation. In social aspect, a sustainable transportation may support realization of healthy social environment, minimize noise and traffic congestion, and may improve social justice and well-being. Meanwhile, (Brotodewo, 2010) proposes that an approach often used to create green transportation is to use public transport instead of using private vehicle. Meanwhile, according to RPJMD of Semarang City 2016–2021, sustainable transportation development will be focused on provision of environmentally-friendly public transportation (BRT, monorail/MRT).

Bus-based public transport like Bus rapid transit (BRT) is an appropriate means of public transportation to be applied in Semarang City. BRT or known as Trans Semarang is one public transportation managed by BLU Trans Semarang with a purpose to reduce traffic congestion in Semarang City. Despite still

using Fuel Oil (BBM) which may cause negative impact on the environment, at least, however, using public transportation like BRT will minimize vehicle movement and reduce motor vehicle usage. Since the operation of BRT Trans Semarang in 2010, many people have utilized it to support their daily activities to go to school, to work, to market, etc. The number of BRT Trans Semarang continuously increases. BRT Trans Semarang users are divided into two groups: public and students. The public is dominated by workers, considering that working is the main purpose of movement. In 2017, the percentage of public users' increase is lower. Public users only increase 11.92 percent, while student users increase 37.84%. That the increase of BRT Trans Semarang public users is lower than that of student users is caused by some factors that influence individual's decision whether or not to use BRT Trans Semarang. Public transportation is a process towards green transportation.

If the decision to use BRT Trans Semarang is associated with factors influencing selection of mode of transportation according to (Tamin, 2000), then the factor may be classified based on road user characteristic, movement characteristic, facility characteristic, and city or zone characteristic. Income, vehicle ownership, distance, accessibility, and tariff are factors that may represent each factor based on the respective characteristic. By examining the reliable factors to predict workers' decision to use BRT Trans Semarang, business actors may continuously their service quality to fulfill consumers' desire. It will attract workers, as a member of society to use environmentally-friendly transportation and reduce the private transportation. Making it a habit becomes very important for the success of the learning process (Zaenuri et al., 2017) because awareness should start from ourselves, from now on without having to wait for the right moment to do so (Power, 2004). When it becomes a habit, it shows that someone has changed his mind set and already has the awareness to use public transportation. Although it requires a long time and learning process for individuals in the community, the results are in accordance with the expected goals of green transportation. This opinion related with (Reif, 2015) that it requires a long process and the outcome cannot be seen immediately, the solution of environmental problems through the development of responsible behavior. Previous research on sustainable transportation has been widely conducted, but no one has yet researched the opportunity factors that influence an individual's decision to switch from conventional transportation to sustainable transportation with policy simulations. Therefore, it is important to conduct research predicting the factors that influence and the chances of people's decisions using public transportation towards sustainable transportation in Semarang. Based on the subject matter, the purpose of this research is to predict and opportunities for private decisions using the public transportation toward green transportation.

## 2. METHODS

This descriptive research employs a quantitative approach. This research's samples are collected using proportional sampling technique. 100 respondents are obtained as its samples. The respondents who work in 5 districts in Semarang City including

Mijen, Candisari, Semarang Utara, Semarang Tengah, and Gunungpati. The data used in this research are primary data and secondary data. The primary data are obtained by distributing questionnaires to 100 respondents previously determined from the five districts under certain criteria. The secondary data are obtained from journals, books, electronic media, and data issued by relevant departments such as the Central Statistics, Department of Transportation. Data are analyzed with the logit model (binary logistic regression). The logit model analysis method is employed when the dependent variable (response) is binary variable/dichotomy. The logit model in the research of people's decision to use BRT Trans Semarang is formulated in Equation 1 as follows:

$$Li = \ln \left( \frac{pi}{1 - pi} \right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + ui \quad (1)$$

In which:

- $Li = \ln \left( \frac{pi}{1 - pi} \right)$  = decision to use BRT Trans Semarang, 1 = if willing to use BRT Trans Semarang and 0 = if unwilling to use BRT Trans Semarang
- $\beta_0$  = constant
- $\beta_1, \beta_2, \beta_3$  = estimation coefficient
- $X_1$  = income
- $X_3$  = distance
- $X_4$  = accessibility
- $X_5$  = tariff
- $Ui$  = error term

The decision to use public transportation (BRT Trans Semarang) variable is described through respondent's decision whether or not to be willing to use public transportation. This variable is measured using two categories: 0 for respondent's decision to be unwilling to use public transportation and 1 for respondent's decision to be willing to use public transportation. Income is the total money received by a person within a certain period, commonly on a monthly basis. The income meant in this research is one derived from respondent's main job or side job. The income variable is measured using two categories: 1 if the income is up to IDR 2,310,000.00 and 0 if the income is more than IDR 2,310,000.00 pursuant to the city minimum wage. Vehicle ownership is measured based on private motor vehicle ownership, either motorcycle or car. The private vehicle ownership variable is measured with two categories: 0 if respondent has more than 1 private vehicle and 1 if respondent has up to 1 private vehicle. Distance is a relative distance measurement for respondent from his/her residence to work place. The residence distance variable is measured with two categories: 0 if respondent's residence distance is up to 5 km and 1 if respondent's residence distance is more than 5 km. Accessibility is the easiness of access to BRT Trans Semarang stop. The criteria of accessibility level may be viewed according to the distance to BRT Trans Semarang stop, time to get to BRT Trans Semarang stop, and the easiness of how to get to BRT Trans Semarang stop from respondent's house. The accessibility variable in this research is measured using two categories: 0 if respondent finds it difficult to get to BRT Trans Semarang and 1 if respondent finds it easy to get to BRT Trans Semarang. The tariff designated for a type of transportation will influence consumers' willingness to use it. This tariff variable is used to examine whether

or not tariff is the main consideration for the public to decide to use BRT Trans Semarang. The tariff variable is measured with two categories: 0 if tariff is not taken as the main consideration for the public to use BRT Trans Semarang and 1 if tariff is taken as the main consideration for the public to use BRT Trans Semarang. To test the appropriateness of logistic regression model to the data, some statistic tests are employed: Regression Goodness of Fit Test with *Hosmer and Lemeshow test*, Overall Model Fit test with *likelihood ratio and Omnibus Tests of Model Coefficients test*, and Determination uji Coefficient of Determination using *Nagelkerke's R Square*. Wald Test is employed for Partial Test.

### 3. RESULTS AND DISCUSSION

#### 3.1. Goodness of Fit Test Results

A good logistic regression model takes place when there is no difference between data derived from observation and data derived from prediction. The test results show the significance value of *Hosmer and Lemeshow's goodness of fit test* is 0.704. The value is higher than the statistic *fit test* (0.05), which means that the zero hypothesis is accepted, thus the model is able to predict its observation value or we may state that the model is acceptable since it conforms to the observation data.

#### 3.2. Overall Model Fit Test Results

Omnibus tests of model coefficients shows that the Chi-square value is 70.113. The highest Chi-square of 70.113 is the difference of  $-2 \log \text{likelihood}$  before independent variables are included into the model (137.628) subtracted with  $-2 \log \text{likelihood}$  after independent variables are included into the model (67.515). The Chi-square of 70.113 is higher than the Chi-square of table on df 5 with significance level 0.05, which is 11.070. Since Chi-square count value > table Chi-square value, addition of independent variables will provide real impact on the model or, in other words, the model is fit. This also means that the decision to use BRT Trans Semarang may be predicted according to the income, vehicle ownership, distance, accessibility, and tariff variables.

#### 3.3. Coefficient of Determination Test Results (*Nagelkerke's R Square*)

Cox and snell's R square is a measurement which tries to imitate the  $R^2$  measurement on multiple regression which is based on likelihood estimation technique with maximum value <1 (one). Nagelkerke's R square is a modification of cox and snell's coefficient to ensure that the values vary from 0 (zero) to 1 (one). *Nagelkerke's R square* value is 0.674 (67.4%). This shows that the independent variables in this research are only able to explain the dependent variable of 67.4%, while the remaining 32.6% is explained by other variables beyond this research.

#### 3.4. Partial Test Results (Wald Test)

This test is employed to examine whether or not the independent variables included into the model influence the dependent variables. This test may also be stated as a hypothesis test. The results of wald test may be viewed in Table 1:

The data processing results in Table 2 may be explained using the following logistic regression equation:

**Table 1: Variables in the equation**

Variable	B	Wald	Sig.	Exp (B)
Step 1a X1	-0.975	2.144	0.143	0.377
X2	0.949	1.723	0.189	2.584
X3	0.440	0.467	0.494	1.553
X4	3.665	18.583	0.000	39.041
X5	2.384	12.784	0.000	10.851
Constant	-4.225	18.758	0.000	0.015

Source: Processed primary data, 2018

$$\text{Ln} \left( \frac{pi}{1-pi} \right) = -4.225 - 0.975 \text{ Income} + 0.949 \text{ Vehicle Ownership} \\ + 0.440 \text{ Distance} + 3.665 \text{ Accessibility} + 2.384 \text{ tariff} + \mu$$

The parameter used for partial test in this research is to compare significance value with significance level 5%. According to the processing results as listed in Table 2 above, we may conclude that the income variable has coefficient value of  $-0.975$  and in *binary logistic regression* estimation has significance level of 0.143. This shows that significance value (0.143) > significance level ( $\alpha = 0.05$ ), which means that income variable is insignificant and unreliable to predict worker's decision to determine whether or not they will public transportation BRT Trans Semarang. In other words, this shows that there is no difference in the opportunity between decision to be willing to or decision not to be willing to use public transportation BRT Trans Semarang based on worker's income rate. This negative and insignificant relationship shows that higher income will insignificantly decrease the probability of worker's decision to use public transportation BRT Trans Semarang and, lower income will insignificantly increase the probability of worker's decision to use public transportation BRT Trans Semarang.

This negative relationship between income and decision to use public transportation conforms to the research conducted by (P. Susongko, 2018) which reveals that the use of transportation to go to work is influenced by socio-economic factors (education, position, income). Income variable is insignificant and unreliable to predict worker's decision to determine whether or not they will public transportation BRT Trans Semarang, which may be explained with the existing phenomena in the research. Although an individual has low income but with relatively low needs, he will be able to buy more than one private vehicle, which will thus influence his decision to use public transportation BRT Trans Semarang and would prefer to use private vehicle. Similarly, an individual with higher income but with higher necessity will only be able to buy one vehicle, thus the need for vehicle for each family member will not be satisfied. This will influence his decision to use public transportation BRT Trans Semarang.

The vehicle ownership variable has coefficient value of 0.949 and in *binary logistic regression* estimation has significance level of 0.189. This shows that significance value (0.189) > significance level ( $\alpha = 0.05$ ), which means that vehicle ownership variable is insignificant and unreliable to predict worker's decision to determine whether or not they will public transportation BRT Trans Semarang. This positive and insignificant relationship shows that higher vehicle ownership will insignificantly increase the



**Table 2: Results of simulation of opportunity of willingness and unwillingness to public transportation**

Simulation	Opportunity (%)		Change (%)		Description
	Willing	Unwilling			
First	27.78	72.22	–	–	–
Second	38.52	61.48	7.5	10.74	There is an increase of opportunity of willingness to use public transportation in case of increasing accessibility. Change in opportunity is higher than change in accessibility
Third	14.15	85.85	28.57	24.37	There is a decrease of opportunity of willingness to use public transportation in case of increasing tariff. Change in opportunity is lower than change in tariff

probability of worker's decision to use public transportation BRT Trans Semarang and, lower vehicle ownership will insignificantly decrease the probability of worker's decision to use public transportation BRT Trans Semarang.

The results of this research do not conform to the research conducted by (Warman et al., 2014) which finds that vehicle ownership negatively influences decision to use public transportation. However, they conform to the research conducted by (Chuen et al., 2014) which shows that vehicle ownership has positive and significant relationship with decision to use public transportation online. The non-conformance between the research results and the theories and previous researches may be explained with the phenomena in the research showing that vehicle ownership is not a reason for a worker to use public transportation BRT Trans Semarang. Higher or lower number of worker's vehicle ownership does not influence the probability of his decision whether or not to be willing use public transportation BRT Trans Semarang. For example, when an individual has more than one private vehicle in the family, he will keep using public transportation BRT Trans Semarang since the number of private vehicles in possession does not meet the need of his family members and also since he is unable to drive private vehicle, either motorcycle or car.

The distance variable has coefficient value of 0.440 and in *binary logistic regression* estimation has significance level of 0.494. This shows that significance value (0.494) > significance level ( $\alpha = 0.05$ ), which means that distance variable is insignificant and unreliable to predict worker's decision to determine whether or not they will public transportation BRT Trans Semarang. This positive and insignificant relationship shows that a longer distance a worker take to get to work will insignificantly increase the probability of his decision to use public transportation BRT Trans Semarang. The insignificant relationship conforms to the theory of (Tamin, 2000) stating that one factor to influence choice of mode of transportation based on movement characteristic is travel distance.

The result of distance variable analysis is insignificant and unreliable to predict worker's decision to determine whether or not they will use public transportation BRT Trans Semarang. This may be explained with the phenomena in the research which shows that when the distance to travel to get to work increases, it is uncertain that the probability of worker's decision to use public transportation BRT Trans Semarang will also increase. When the distance to travel to get to work decreases, it is also uncertain that the probability of worker's decision to use public transportation BRT Trans Semarang will also decrease, since the decision to use public transportation BRT Trans Semarang for the workers in this

research is not caused by whether or not the distance to take is long, but which transportation is deemed effective to get to work.

The accessibility variable has coefficient value of 3.665 and in *binary logistic regression* estimation has significance level of 0.000. This shows that significance value (0.000) < significance level ( $\alpha = 0.05$ ), which means that significance accessibility is significant and reliable to predict worker's decision to determine whether or not they will public transportation BRT Trans Semarang. The positive coefficient mark (+) shows that there is positive or parallel relationship between accessibility and probability of worker's decision to use public transportation BRT Trans Semarang. The higher the accessibility to bus stop, the probability of worker's decision to use public transportation BRT Trans Semarang will be higher, when the accessibility to bus stop is lower, the probability of worker's decision to use public transportation BRT Trans Semarang will be lower.

The accessibility of bus stop becomes worker's consideration to use public transportation BRT Trans Semarang, that if it is too long to get to the bus stop, he will find it difficult and his travel to get to work will be ineffective. This positive relationship between accessibility and the probability of worker's decision to use public transportation conforms to the research conducted by (Azali, 2018), which reveals that accessibility positively and significantly influences choice of mode of BRT. Better perception of the accessibility of BRT will increase the probability of choice of BRT. As stated by Yu et al. (2018), easiness in accessing public transportation will be the ground for the public to choose public transportation instead of private transportation.

The tariff variable has coefficient value of 2.384 and in *binary logistic regression* estimation has significance level of 0.000. This shows that significance value (0.000) < significance level ( $\alpha = 0.05$ ), which means that tariff variable is significant and reliable to predict worker's decision to determine whether or not they will public transportation BRT Trans Semarang. Meanwhile, the positive coefficient mark (+) shows that there is positive or parallel relationship between tariff and the probability of worker's decision to use public transportation BRT Trans Semarang. When worker's tariff perception becomes the main consideration to use public transportation, the probability of worker's decision to use public transportation depends on the designated tariff. This result conforms to the research conducted by (Rahmani et al., 2018) which finds that there is positive relationship between tariff and people's preference to use public transportation service, thus people's perception of very affordable tariff or in this case making tariff the main consideration will enhance people's preference to use public transportation service.

An analysis using *binary logistic regression* may also be used to create simulation of worker's each opportunity in determining whether or not they will public transportation BRT Trans Semarang. This may be conducted by inserting existing data into the equation and ignoring insignificant independent variables. Therefore, variables which may be used to create simulation of worker's each opportunity are the accessibility and tariff variables (Table 2). From the analysis results, the following logistic regression model equation is obtained:

$$\text{Ln} \left( \frac{pi}{1-pi} \right) = -4.225 + 3.665 \text{ Accessibility} + 2.384 \text{ Tariff}$$

First simulation, the accessibility to bus stop averagely takes 160 meters or 40% (percentage of 160 meters divided by the longest distance, 400 meters) and tariff of IDR 3,500.00 which becomes the main consideration of 37% (percentage of tariff perception IDR 3,500.00 as the main consideration).

Based on the calculation results of each opportunity of classification of decision to use BRT Trans Semarang is 0.2778 or 27.78% and the opportunity of unwillingness to use BRT Trans Semarang is 0.7222 or 72.22%. The policy simulation may be modified in order to obtain which of the opportunities is the highest to enable implementation towards green transportation. Second simulation, in case of increase of accessibility, in which the distance to get to bus stop gets closer and the tariff is fixed.

If the accessibility gets closer, initial distance 160 meters to 130 meters or 32.50% (percentage of distance 130 meters divided by the longest distance to get to bus stop, which is 400 meters), while the tariff is fixed IDR 3,500.00. This change will cause difference in the opportunity to use public transportation. Based on the calculation results of each opportunity of classification of decision to use BRT Trans Semarang in the second simulation, we may view that the opportunity of willingness to use BRT Trans Semarang is 0.3852 or 38.52% and the opportunity of unwillingness to use BRT Trans Semarang is 0.6148 or 61.48%. This shows that if the access to bus stop is closer, worker's opportunity to use public transportation will be higher of 38.52%, which means that there is an increase of opportunity of 10.74% (38.52–27.78%) derived from increasing the accessibility, thus the distance to get to bus stop is closer of 7.5% (40–32.5%).

Further, in case of change of tariff variable from IDR 3,500.00 to IDR 4,000.00 or increasing of IDR 500.00 while the accessibility is fixed, worker's opportunity to use public transportation changes. This change may be viewed in the detailed calculation. A tariff increase of IDR 500.00 or 65.57% (percentage of tariff increase nominal divided by designated tariff) while the accessibility is fixed of 130 meters or 32.50%, the opportunity of decision to use public transportation BRT Trans Semarang will decrease to 0.1415 or 14.15%, while the opportunity not to use public transportation BRT Trans Semarang will increase to 0.8585 or 85.85%.

The third simulation shows that if there is only an increase of tariff variable while the other variables are fixed, the opportunity of decision to use public transportation BRT Trans Semarang will decrease to 0.1415 or 14.15%, while the opportunity of decision

not to use public transportation BRT Trans Semarang will increase to 0.8585 or 85.85%. Based on Table 2, we may examine that worker's opportunity to decide to use public transportation BRT Trans Semarang will increase in line with increasing accessibility and will decrease in line with increasing tariff. Therefore, the opportunity of willingness to use public transportation BRT Trans Semarang will be higher when the accessibility variable increases, instead of increasing the tariff variable. Similarly, other various conditions may be calculated with the results of logistic regression equation estimation above. Some scenarios above may be useful as the ground for decision or policy making for public transportation issues, especially BRT Trans Semarang.

## 4. CONCLUSION

Based on the research results and discussion, the individual's awareness to switch from private transportation to public transportation to the green transportation is a learning process that is not easy. It is seen that only accessibility and tariffs influence individual decisions in using transportation. While income, vehicle ownership and distance are not significant. Based in the policy simulation, the opportunity of using public transportation will be higher the access is easier. It will be getting lower if the tariff is raised when the other variables are constant. Therefore, to influence private decisions using the public transportation, the government must be oriented towards reachable distance and tariffs.

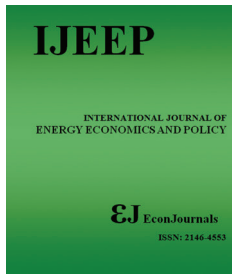
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Author Query???

AQ1: Kindly provide JEL classification



# A Simulated Policy towards Green Public Transportation in a Metropolitan in Indonesia

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## ABSTRACT

The need for mode of transportation is proportional with urban population growth. The dependence of people using private transportation causes many problems. In addition to congestion, it can create environmental problems such as air quality deterioration and pollution in the cities. Learning to be in this research is the process of individual learning to move from private transportation to public transportation. The purpose of this study is to predict and opportunities for private decision using the public transportation toward green transportation in Semarang city. This research is designed using a quantitative approach. Respondents in this study were workers. Data collection methods with questionnaires. The samples are collected using proportional sampling technique. Data are analyzed with binary logistic regression. The results showed that the accessibility and tariff variables are significantly influence to predict private decision for using public transportation as an effort toward green transportation. Based on the policy simulation, the opportunity of using public transportation will be higher if the distance is closer and reachable. It will be getting lower if the tariff is raised when the other variables are constant. Therefore, to influence private decisions using the public transportation, the government must be oriented towards reachable distance and tariff.

**Keywords:** Green Transportation, Sustainability, Opportunity, Environmental, Policy

**JEL Classifications:** O18, R48, Q56

## 1. INTRODUCTION

Population growth influences the growth of an area, either rural or urban. Growing population on one hand increases the human resources as capital for development. On the other hand, however, it requires more necessary facilities and infrastructures including the need for in-urban travel. The bigger the population, the need for transportation will also get higher. Transportation is an effort to move goods and people from a place of origin to a destination (Nasution, 2004). Transportation service is a facility which cannot be separated from and the need of the society to support their activities. However, urban transportation currently has various problems as the result of the society's increasing dependency on private vehicles, both car and motorcycle. The society's high dependency on private vehicles will cause traffic congestion and pollution, which will lead to environmental damage. According to

(Naganathan dan Chong, 2017), transportation has an important role for goods and services delivery flow, to create employment and drive economic growth rate. However, we cannot deny that transportation also has adverse impact on the environment, in the form of environmental pollution. Yu et al. (2018) state that high number of populations in urban area resulted from migration will have adverse impact on the quality of the urban environment.

Jiang et al. (2018) states that generally the need for traffic in urban area always increases faster than available traffic capacity, thus it will create various transportation problems. The high number of private vehicle users will cause various problems like traffic congestion. Traffic congestion is an imbalance condition between road capacity and the number of vehicles passing the road. In addition, increasing number of vehicles will also have impact on the traffic, in which there are many traffic accidents,

endangering road users (Zhou et al. 2018). Besides impacts on traffic congestion and accident, the numerous numbers of private vehicle users will lead to environmental pollution and air pollution and noise pollution (Park et al., 2018). (Gusnita 2010) states that these vehicles' Fuel Oil (BBM) contains lead which contributes a great amount of pollution to air and health quality. As stated by (Labib et al., 2018), the decreasing air quality in urban area is caused by the increasing usages of motor vehicles, disincentive to fuel oil-free transportation, and decreasing urban green area.

The responsibility of maintaining and caring for the environment is not only the responsibility of the government. Individuals as members of society also have the same obligations. This is in accordance with the opinion of (La Trobe dan Acott, 2000) and (Reif, 2015) that environmental problems cannot only be solved technically, but the more important matter is how to change the mindset, awareness and responsible behavior to actively participate in managing the environment. Public awareness in supporting environmental development such as the use of green transportation requires education based on learning. (Liem dan Martin, 2015) also showed the important roles of social and personal norms to foster pro-environment behavior.

Learning becomes one of the pillars in education that can improve the process of individualization in society, while at the same time increasing social interaction that is very supportive of development. The intended learning is the process of awakening individuals as a member of society to move from private transportation to public transportation. Public transportation is a process towards green transportation. This was confirmed by (Delors, 2013) and (Amini, 2015) that stated if we want to solve all the risks faced, education is the only solution: education as a way to gain knowledge but also assessment, as an apprenticeship in independence before we assume responsibility, and as a school tolerance that teaches us how to coexist with other people, wherever they come from. (Ozden, 2008) also stated many people believe that environmental education is the most important factor to prevent environmental problems.

Central Java is a province with the highest percentage of migration number increase in Java Island. The increase of incoming migration number into Central Java is 71.89% (BPS, 2017). This increasing population will certainly have impacts on environmental issues. The high total population of Central Java Province is caused by the growth of population of each regency and city, which increases annually. Semarang City is the capital city of Central Java Province with 1,729.42 thousand population. This number makes Semarang City a city with the highest population among the other cities in Central Java. Semarang City's high population is also followed with high flow of incoming migration of 472,777 (BPSb, 2017). Semarang City is chosen to be a migration destination because of it has an attraction as a city of trades, services, industries, and education. This incoming migration to the city will increase its population annually.

The population growth rate increases 0.70% from 2012 to 2016. An area's population growth and economic growth cause increasing movement of people, goods and services in the area

and its surroundings. As the capital city of Central Java Province, Semarang City must be able to fulfill the needs and demand for goods and services, both of the city itself and its surrounding areas. This, therefore, requires transportation to support the activities. Generally, there are two types of mode of passenger transportation: private vehicle and public vehicle. Private vehicle is one for non-public use and owned by individual, while public vehicle or transport is one to be utilized by the public. The number of private vehicles and public vehicles in Semarang City in the last five years always increases. Despite continuously increasing, the number of private vehicles is higher than that of public vehicles annually. In 2017, the number of private vehicles in Semarang City is 1,981,208 or 99.59% and the number of public transportations is 8,207 or 0.41% (Badan Pengelola Pendapatan Daerah, 2018).

Transportation in big cities like Semarang City is one of the sources of pollution, in which 70% of urban air pollution is caused by motor vehicle activities (Kusminingrum dan Gunawan, 2008). With various existing problems caused by transportation, a solution is required to overcome it in order to create a sustainable and environmentally-friendly transportation. A sustainable transportation is, according to Organization for Economic Cooperation and Development, in (Gusnita, 2010), transportation which does not harm ecosystem and public health and fulfills the need for mobility. This sustainable transportation is often called green transportation, which is an effort to fulfill current generation's need for mobility and transportation without prejudice to future generation's ability to fulfill their need for mobility. However, it is not easy to realize a sustainable transportation. The research conducted by (Shankar, 2018) states that the constraints often faced in realizing a sustainable transportation are the financial resource, awareness and behavior of every person in using an environmentally-friendly transportation. In addition, that there is no binding rule of law on sustainable transportation implementation in urban area also inhibit such sustainable transportation implementation (Kurapati et al., 2018).

Theoretically, a sustainable transportation must fulfill 3 aspects: environmental, economic, and social aspects. In environmental aspect, a sustainable transportation does not cause air, water, and soil pollution and does not use resources excessively. In economic aspect, a sustainable transportation is affordable for the public and may fulfill the need for operating costs of urban productive transportation. In social aspect, a sustainable transportation may support realization of healthy social environment, minimize noise and traffic congestion, and may improve social justice and well-being. Meanwhile, (Brotodewo, 2010) proposes that an approach often used to create green transportation is to use public transport instead of using private vehicle. Meanwhile, according to RPJMD of Semarang City 2016–2021, sustainable transportation development will be focused on provision of environmentally-friendly public transportation (BRT, monorail/MRT).

Bus-based public transport like Bus rapid transit (BRT) is an appropriate means of public transportation to be applied in Semarang City. BRT or known as Trans Semarang is one public transportation managed by BLU Trans Semarang with a purpose to reduce traffic congestion in Semarang City. Despite still

using Fuel Oil (BBM) which may cause negative impact on the environment, at least, however, using public transportation like BRT will minimize vehicle movement and reduce motor vehicle usage. Since the operation of BRT Trans Semarang in 2010, many people have utilized it to support their daily activities to go to school, to work, to market, etc. The number of BRT Trans Semarang continuously increases. BRT Trans Semarang users are divided into two groups: public and students. The public is dominated by workers, considering that working is the main purpose of movement. In 2017, the percentage of public users' increase is lower. Public users only increase 11.92 percent, while student users increase 37.84%. That the increase of BRT Trans Semarang public users is lower than that of student users is caused by some factors that influence individual's decision whether or not to use BRT Trans Semarang. Public transportation is a process towards green transportation.

If the decision to use BRT Trans Semarang is associated with factors influencing selection of mode of transportation according to (Tamin, 2000), then the factor may be classified based on road user characteristic, movement characteristic, facility characteristic, and city or zone characteristic. Income, vehicle ownership, distance, accessibility, and tariff are factors that may represent each factor based on the respective characteristic. By examining the reliable factors to predict workers' decision to use BRT Trans Semarang, business actors may continuously their service quality to fulfill consumers' desire. It will attract workers, as a member of society to use environmentally-friendly transportation and reduce the private transportation. Making it a habit becomes very important for the success of the learning process (Zaenuri et al., 2017) because awareness should start from ourselves, from now on without having to wait for the right moment to do so (Power, 2004). When it becomes a habit, it shows that someone has changed his mind set and already has the awareness to use public transportation. Although it requires a long time and learning process for individuals in the community, the results are in accordance with the expected goals of green transportation. This opinion related with (Reif, 2015) that it requires a long process and the outcome cannot be seen immediately, the solution of environmental problems through the development of responsible behavior. Previous research on sustainable transportation has been widely conducted, but no one has yet researched the opportunity factors that influence an individual's decision to switch from conventional transportation to sustainable transportation with policy simulations. Therefore, it is important to conduct research predicting the factors that influence and the chances of people's decisions using public transportation towards sustainable transportation in Semarang. Based on the subject matter, the purpose of this research is to predict and opportunities for private decisions using the public transportation toward green transportation.

## 2. METHODS

This descriptive research employs a quantitative approach. This research's samples are collected using proportional sampling technique. 100 respondents are obtained as its samples. The respondents who work in 5 districts in Semarang City including

Mijen, Candisari, Semarang Utara, Semarang Tengah, and Gunungpati. The data used in this research are primary data and secondary data. The primary data are obtained by distributing questionnaires to 100 respondents previously determined from the five districts under certain criteria. The secondary data are obtained from journals, books, electronic media, and data issued by relevant departments such as the Central Statistics, Department of Transportation. Data are analyzed with the logit model (binary logistic regression). The logit model analysis method is employed when the dependent variable (response) is binary variable/dichotomy. The logit model in the research of people's decision to use BRT Trans Semarang is formulated in Equation 1 as follows:

$$Li = \ln \left( \frac{pi}{1-pi} \right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + u_i \quad (1)$$

In which:

- $Li = \ln \left( \frac{pi}{1-pi} \right)$  = decision to use BRT Trans Semarang, 1 = if willing to use BRT Trans Semarang and 0 = if unwilling to use BRT Trans Semarang
- $\beta_0$  = constant
- $\beta_1, \beta_2, \beta_3$  = estimation coefficient
- $X_1$  = income
- $X_2$  = distance
- $X_3$  = accessibility
- $X_4$  = tariff
- $U_i$  = error term

The decision to use public transportation (BRT Trans Semarang) variable is described through respondent's decision whether or not to be willing to use public transportation. This variable is measured using two categories: 0 for respondent's decision to be unwilling to use public transportation and 1 for respondent's decision to be willing to use public transportation. Income is the total money received by a person within a certain period, commonly on a monthly basis. The income meant in this research is one derived from respondent's main job or side job. The income variable is measured using two categories: 1 if the income is up to IDR 2,310,000.00 and 0 if the income is more than IDR 2,310,000.00 pursuant to the city minimum wage. Vehicle ownership is measured based on private motor vehicle ownership, either motorcycle or car. The private vehicle ownership variable is measured with two categories: 0 if respondent has more than 1 private vehicle and 1 if respondent has up to 1 private vehicle. Distance is a relative distance measurement for respondent from his/her residence to work place. The residence distance variable is measured with two categories: 0 if respondent's residence distance is up to 5 km and 1 if respondent's residence distance is more than 5 km. Accessibility is the easiness of access to BRT Trans Semarang stop. The criteria of accessibility level may be viewed according to the distance to BRT Trans Semarang stop, time to get to BRT Trans Semarang stop, and the easiness of how to get to BRT Trans Semarang stop from respondent's house. The accessibility variable in this research is measured using two categories: 0 if respondent finds it difficult to get to BRT Trans Semarang and 1 if respondent finds it easy to get to BRT Trans Semarang. The tariff designated for a type of transportation will influence consumers' willingness to use it. This tariff variable is used to examine whether

or not tariff is the main consideration for the public to decide to use BRT Trans Semarang. The tariff variable is measured with two categories: 0 if tariff is not taken as the main consideration for the public to use BRT Trans Semarang and 1 if tariff is taken as the main consideration for the public to use BRT Trans Semarang. To test the appropriateness of logistic regression model to the data, some statistic tests are employed: Regression Goodness of Fit Test with *Hosmer and Lemeshow test*, Overall Model Fit test with *likelihood ratio and Omnibus Tests of Model Coefficients test*, and Determination uji Coefficient of Determination using *Nagelkerke's R Square*. Wald Test is employed for Partial Test.

### 3. RESULTS AND DISCUSSION

#### 3.1. Goodness of Fit Test Results

A good logistic regression model takes place when there is no difference between data derived from observation and data derived from prediction. The test results show the significance value of *Hosmer and Lemeshow's goodness of fit test* is 0.704. The value is higher than the statistic *fit test* (0.05), which means that the zero hypothesis is accepted, thus the model is able to predict its observation value or we may state that the model is acceptable since it conforms to the observation data.

#### 3.2. Overall Model Fit Test Results

Omnibus tests of model coefficients shows that the Chi-square value is 70.113. The highest Chi-square of 70.113 is the difference of  $-2 \log \text{likelihood}$  before independent variables are included into the model (137.628) subtracted with  $-2 \log \text{likelihood}$  after independent variables are included into the model (67.515). The Chi-square of 70.113 is higher than the Chi-square of table on df 5 with significance level 0.05, which is 11.070. Since Chi-square count value > table Chi-square value, addition of independent variables will provide real impact on the model or, in other words, the model is fit. This also means that the decision to use BRT Trans Semarang may be predicted according to the income, vehicle ownership, distance, accessibility, and tariff variables.

#### 3.3. Coefficient of Determination Test Results (Nagelkerke's R Square)

Cox and snell's R square is a measurement which tries to imitate the R<sup>2</sup> measurement on multiple regression which is based on likelihood estimation technique with maximum value <1 (one). Nagelkerke's R square is a modification of cox and snell's coefficient to ensure that the values vary from 0 (zero) to 1 (one). *Nagelkerke's R square* value is 0.674 (67.4%). This shows that the independent variables in this research are only able to explain the dependent variable of 67.4%, while the remaining 32.6% is explained by other variables beyond this research.

#### 3.4. Partial Test Results (Wald Test)

This test is employed to examine whether or not the independent variables included into the model influence the dependent variables. This test may also be stated as a hypothesis test. The results of wald test may be viewed in Table 1:

The data processing results in Table 2 may be explained using the following logistic regression equation:

**Table 1: Variables in the equation**

Variable	B	Wald	Sig.	Exp (B)
Step 1a X1	-0.975	2.144	0.143	0.377
X2	0.949	1.723	0.189	2.584
X3	0.440	0.467	0.494	1.553
X4	3.665	18.583	0.000	39.041
X5	2.384	12.784	0.000	10.851
Constant	-4.225	18.758	0.000	0.015

Source: Processed primary data, 2018

$$\text{Ln} \left( \frac{pi}{1 - pi} \right) = -4.225 - 0.975 \text{ Income} + 0.949 \text{ Vehicle Ownership} + 0.440 \text{ Distance} + 3.665 \text{ Accessibility} + 2.384 \text{ tariff} + \mu$$

The parameter used for partial test in this research is to compare significance value with significance level 5%. According to the processing results as listed in Table 2 above, we may conclude that the income variable has coefficient value of -0.975 and in *binary logistic regression* estimation has significance level of 0.143. This shows that significance value (0.143) > significance level ( $\alpha = 0.05$ ), which means that income variable is insignificant and unreliable to predict worker's decision to determine whether or not they will public transportation BRT Trans Semarang. In other words, this shows that there is no difference in the opportunity between decision to be willing to or decision not to be willing to use public transportation BRT Trans Semarang based on worker's income rate. This negative and insignificant relationship shows that higher income will insignificantly decrease the probability of worker's decision to use public transportation BRT Trans Semarang and, lower income will insignificantly increase the probability of worker's decision to use public transportation BRT Trans Semarang.

This negative relationship between income and decision to use public transportation conforms to the research conducted by (P. Susongko, 2018) which reveals that the use of transportation to go to work is influenced by socio-economic factors (education, position, income). Income variable is insignificant and unreliable to predict worker's decision to determine whether or not they will public transportation BRT Trans Semarang, which may be explained with the existing phenomena in the research. Although an individual has low income but with relatively low needs, he will be able to buy more than one private vehicle, which will thus influence his decision to use public transportation BRT Trans Semarang and would prefer to use private vehicle. Similarly, an individual with higher income but with higher necessity will only be able to buy one vehicle, thus the need for vehicle for each family member will not be satisfied. This will influence his decision to use public transportation BRT Trans Semarang.

The vehicle ownership variable has coefficient value of 0.949 and in *binary logistic regression* estimation has significance level of 0.189. This shows that significance value (0.189) > significance level ( $\alpha = 0.05$ ), which means that vehicle ownership variable is insignificant and unreliable to predict worker's decision to determine whether or not they will public transportation BRT Trans Semarang. This positive and insignificant relationship shows that higher vehicle ownership will insignificantly increase the

**Table 2: Results of simulation of opportunity of willingness and unwillingness to public transportation**

Simulation	Opportunity (%)		Change (%)		Description
	Willing	Unwilling			
First	27.78	72.22	–	–	–
Second	38.52	61.48	7.5	10.74	There is an increase of opportunity of willingness to use public transportation in case of increasing accessibility. Change in opportunity is higher than change in accessibility
Third	14.15	85.85	28.57	24.37	There is a decrease of opportunity of willingness to use public transportation in case of increasing tariff. Change in opportunity is lower than change in tariff

probability of worker's decision to use public transportation BRT Trans Semarang and, lower vehicle ownership will insignificantly decrease the probability of worker's decision to use public transportation BRT Trans Semarang.

The results of this research do not conform to the research conducted by (Warman et al., 2014) which finds that vehicle ownership negatively influences decision to use public transportation. However, they conform to the research conducted by (Chuen et al., 2014) which shows that vehicle ownership has positive and significant relationship with decision to use public transportation online. The non-conformance between the research results and the theories and previous researches may be explained with the phenomena in the research showing that vehicle ownership is not a reason for a worker to use public transportation BRT Trans Semarang. Higher or lower number of worker's vehicle ownership does not influence the probability of his decision whether or not to be willing use public transportation BRT Trans Semarang. For example, when an individual has more than one private vehicle in the family, he will keep using public transportation BRT Trans Semarang since the number of private vehicles in possession does not meet the need of his family members and also since he is unable to drive private vehicle, either motorcycle or car.

The distance variable has coefficient value of 0.440 and in *binary logistic regression* estimation has significance level of 0.494. This shows that significance value (0.494) > significance level ( $\alpha = 0.05$ ), which means that distance variable is insignificant and unreliable to predict worker's decision to determine whether or not they will public transportation BRT Trans Semarang. This positive and insignificant relationship shows that a longer distance a worker take to get to work will insignificantly increase the probability of his decision to use public transportation BRT Trans Semarang. The insignificant relationship conforms to the theory of (Tamin, 2000) stating that one factor to influence choice of mode of transportation based on movement characteristic is travel distance.

The result of distance variable analysis is insignificant and unreliable to predict worker's decision to determine whether or not they will use public transportation BRT Trans Semarang. This may be explained with the phenomena in the research which shows that when the distance to travel to get to work increases, it is uncertain that the probability of worker's decision to use public transportation BRT Trans Semarang will also increase. When the distance to travel to get to work decreases, it is also uncertain that the probability of worker's decision to use public transportation BRT Trans Semarang will also decrease, since the decision to use public transportation BRT Trans Semarang for the workers in this

research is not caused by whether or not the distance to take is long, but which transportation is deemed effective to get to work.

The accessibility variable has coefficient value of 3.665 and in *binary logistic regression* estimation has significance level of 0.000. This shows that significance value (0.000) < significance level ( $\alpha = 0.05$ ), which means that significance accessibility is significant and reliable to predict worker's decision to determine whether or not they will public transportation BRT Trans Semarang. The positive coefficient mark (+) shows that there is positive or parallel relationship between accessibility and probability of worker's decision to use public transportation BRT Trans Semarang. The higher the accessibility to bus stop, the probability of worker's decision to use public transportation BRT Trans Semarang will be higher, when the accessibility to bus stop is lower, the probability of worker's decision to use public transportation BRT Trans Semarang will be lower.

The accessibility of bus stop becomes worker's consideration to use public transportation BRT Trans Semarang, that if it is too long to get to the bus stop, he will find it difficult and his travel to get to work will be ineffective. This positive relationship between accessibility and the probability of worker's decision to use public transportation conforms to the research conducted by (Azali, 2018), which reveals that accessibility positively and significantly influences choice of mode of BRT. Better perception of the accessibility of BRT will increase the probability of choice of BRT. As stated by Yu et al. (2018), easiness in accessing public transportation will be the ground for the public to choose public transportation instead of private transportation.

The tariff variable has coefficient value of 2.384 and in *binary logistic regression* estimation has significance level of 0.000. This shows that significance value (0.000) < significance level ( $\alpha = 0.05$ ), which means that tariff variable is significant and reliable to predict worker's decision to determine whether or not they will public transportation BRT Trans Semarang. Meanwhile, the positive coefficient mark (+) shows that there is positive or parallel relationship between tariff and the probability of worker's decision to use public transportation BRT Trans Semarang. When worker's tariff perception becomes the main consideration to use public transportation, the probability of worker's decision to use public transportation depends on the designated tariff. This result conforms to the research conducted by (Rahmani et al., 2018) which finds that there is positive relationship between tariff and people's preference to use public transportation service, thus people's perception of very affordable tariff or in this case making tariff the main consideration will enhance people's preference to use public transportation service.



An analysis using *binary logistic regression* may also be used to create simulation of worker's each opportunity in determining whether or not they will public transportation BRT Trans Semarang. This may be conducted by inserting existing data into the equation and ignoring insignificant independent variables. Therefore, variables which may be used to create simulation of worker's each opportunity are the accessibility and tariff variables (Table 2). From the analysis results, the following logistic regression model equation is obtained:

$$\ln\left(\frac{pi}{1-pi}\right) = -4.225 + 3.665 \text{ Accessibility} + 2.384 \text{ Tariff}$$

First simulation, the accessibility to bus stop averagely takes 160 meters or 40% (percentage of 160 meters divided by the longest distance, 400 meters) and tariff of IDR 3,500.00 which becomes the main consideration of 37% (percentage of tariff perception IDR 3,500.00 as the main consideration).

Based on the calculation results of each opportunity of classification of decision to use BRT Trans Semarang is 0.2778 or 27.78% and the opportunity of unwillingness to use BRT Trans Semarang is 0.7222 or 72.22%. The policy simulation may be modified in order to obtain which of the opportunities is the highest to enable implementation towards green transportation. Second simulation, in case of increase of accessibility, in which the distance to get to bus stop gets closer and the tariff is fixed.

If the accessibility gets closer, initial distance 160 meters to 130 meters or 32.50% (percentage of distance 130 meters divided by the longest distance to get to bus stop, which is 400 meters), while the tariff is fixed IDR 3,500.00. This change will cause difference in the opportunity to use public transportation. Based on the calculation results of each opportunity of classification of decision to use BRT Trans Semarang in the second simulation, we may view that the opportunity of willingness to use BRT Trans Semarang is 0.3852 or 38.52% and the opportunity of unwillingness to use BRT Trans Semarang is 0.6148 or 61.48%. This shows that if the access to bus stop is closer, worker's opportunity to use public transportation will be higher of 38.52%, which means that there is an increase of opportunity of 10.74% (38.52–27.78%) derived from increasing the accessibility, thus the distance to get to bus stop is closer of 7.5% (40–32.5%).

Further, in case of change of tariff variable from IDR 3,500.00 to IDR 4,000.00 or increasing of IDR 500.00 while the accessibility is fixed, worker's opportunity to use public transportation changes. This change may be viewed in the detailed calculation. A tariff increase of IDR 500.00 or 65.57% (percentage of tariff increase nominal divided by designated tariff) while the accessibility is fixed of 130 meters or 32.50%, the opportunity of decision to use public transportation BRT Trans Semarang will decrease to 0.1415 or 14.15%, while the opportunity not to use public transportation BRT Trans Semarang will increase to 0.8585 or 85.85%.

The third simulation shows that if there is only an increase of tariff variable while the other variables are fixed, the opportunity of decision to use public transportation BRT Trans Semarang will decrease to 0.1415 or 14.15%, while the opportunity of decision

not to use public transportation BRT Trans Semarang will increase to 0.8585 or 85.85%. Based on Table 2, we may examine that worker's opportunity to decide to use public transportation BRT Trans Semarang will increase in line with increasing accessibility and will decrease in line with increasing tariff. Therefore, the opportunity of willingness to use public transportation BRT Trans Semarang will be higher when the accessibility variable increases, instead of increasing the tariff variable. Similarly, other various conditions may be calculated with the results of logistic regression equation estimation above. Some scenarios above may be useful as the ground for decision or policy making for public transportation issues, especially BRT Trans Semarang.

## 4. CONCLUSION

Based on the research results and discussion, the individual's awareness to switch from private transportation to public transportation to the green transportation is a learning process that is not easy. It is seen that only accessibility and tariffs influence individual decisions in using transportation. While income, vehicle ownership and distance are not significant. Based in the policy simulation, the opportunity of using public transportation will be higher the access is easier. It will be getting lower if the tariff is raised when the other variables are constant. Therefore, to influence private decisions using the public transportation, the government must be oriented towards reachable distance and tariffs.

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