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Mode Choice Vs Passenger Frequency on Trans Semarang'S Bus Rapid Transit

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Abstract

This paper aimed to testing whether from-origin and to-destination mean of transportation choice are affected number of passenger frequency on Trans Semarang's Bus. The mean of transportation including walk, hitch, motorbike taxi, para-transit, bus, and private vehicles. Researcher also measured the availability of transportation mean alternative effect for the same dependent variable. Data were collected using Likert based questionnaire. Surveys were conducted on 6 Trans Semarang Route. Data validation based on bar-plot graphical validation and non-parametric test (Kruskal Wallis test and Pearson's Chi-squared test). Validation result confirm that there are no evidence that variability in from-origin and to-destination mode choice affected passenger frequency. Strong statistical evidence accept null-hypothesis.

Keywords: passengers, frequency, mode choice, significance.

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1. Introduction

Load factor of public transport, especially Bus Rapid Transit are below the standard (Munawar 2007; Kresnanto 2014). On the other hand, certain levels of load factor are needed to ensure the operability of public transport (Perhubungan 2002).

Yin et al. (2014) conclude that people buses or cars mainly depends on occupation and income. Their analysis did find that travel time and travel cost have major influence of residents' public transit decisions. Moreover, crowding is an attribute that inhibits people from using public buses (Suman et al. 2016). There were some notice on bus user, most of the user are students or captive (Malkhamah 2001; Munawar 2007; Kresnanto 2014).

Based on those condition, researcher were figuring out factors that can increased public transport frequency demand. This research measured significance of mode choice and passenger frequency. Furthermore, researcher also measured significance of availability of alternative mode and passenger frequency. Likert scale data are used to measure respondents attitudes to a particular statement (Likert 1967). Statistical measurements were utilized to reveal the significance.

2. Method

Researchers were interested in statistically testing if there were a significant difference between the travel frequency tendencies of Passengers among different from-origin, to-destination and the availability of alternative mode choice. Those research question were breaking down below;

1. Do passenger travel frequencies differ by from origin mode choice?
2. Do passenger travel frequencies differ by to destination mode choice?
3. Do passenger travel frequencies differ by the availability of alternative mode?
4. How associated p-values for each coefficient?

The null hypothesis of this research is travel frequency did not affect both by before and after ride a bus, and the availability of alternative mode.

2.1. Data

Our data consists of respondents answer to the question of travel behavior, the passenger travel frequency (very infrequently, infrequently, occasionally, frequently, very frequently), from origin and to destination mode (walk, hitch, private veh, para-transit, motorbike taxi, bus), and availability of alternative mode.

Questionnaire of the survey were compiled based on “Panduan Pengumpulan Data Angkutan Umum Perkotaan” (Direktorat Jenderal Perhubungan Darat 2002). The survey carried out on Route 1 to 6 of BRT Trans Semarang, for 200 respondents. On Likert scale, One must recall that Likert-type data is ordinal data, values are ranked – given a value that simply indicates their relative order. We can only say that one score is higher than another, not the distance between the points (McKillup 2011).

2.2. Significance test

The Likert scale of the questionnaire is very infrequently, infrequently, occasionally, frequently, very frequently. The most frequently used non-parametric test for more than two independent samples is the Kruskal–Wallis test (McKillup 2011). Therefore analysis of variance techniques in this research include; Kruskal Wallis test and Pearson’s Chi-squared test. The chi-square test for goodness of fit compares observed ratios with expected ratios for nominal scale data (McKillup 2011). The Chi-Square test can be used

if we combine the data into nominal categories, this compares the observed numbers in each category with those expected (i.e. equal proportions), we asses if any observed discrepancies (from our theory of equal proportions) can be reasonably put down to chance.

Besides those statistical tools, researcher also used bar-plot graphical validation. We may conclude from the bar-plot if there are seemingly any differences in the travel frequency tendencies of passengers among different origin mode choice. Researcher were used graphical validation since this method gave the big picture of the data more clear (Anscombe 1973; Figueiredo Filho et al. 2013).

This research included the ordinal logistic regression model for regression techniques. Ordinal logistic regression or (ordinal regression) was used to predict an ordinal dependent variable given one or more independent variables. Researcher used MASS library in R to make its prediction.

3. Result

3.1. Do passenger travel frequency differ by from origin mode choice?

The significance test result written in Appendix A. The Kruskal-Wallis test gives us a p-vale of 0.8304, hence we have no evidence to reject our null hypothesis. We are likely therefore to believe that there is no difference in travel frequency tendency between people with different origin mode choice.

Output from each Chi-square test is shown in Appendix A. Initially we test if there is a significant difference in travel frequency tendency between people with different origin mode choice. The Chi-squared test gives us a p-value of > 0.001; hence we have a significant result at the 1% level allowing us to accept the null hypothesis (of equal proportions). We would therefore believe that there are equal proportions of people with different origin mode choice scoring in each of the travel frequency categories.

3.2. Do passenger travel frequency differ by from destination mode choice?

The Kruskal-Wallis test (Appendix B) gives us a p-vale of 0.5778; hence we have no evidence to reject our null hypothesis. We are likely therefore to believe that there is

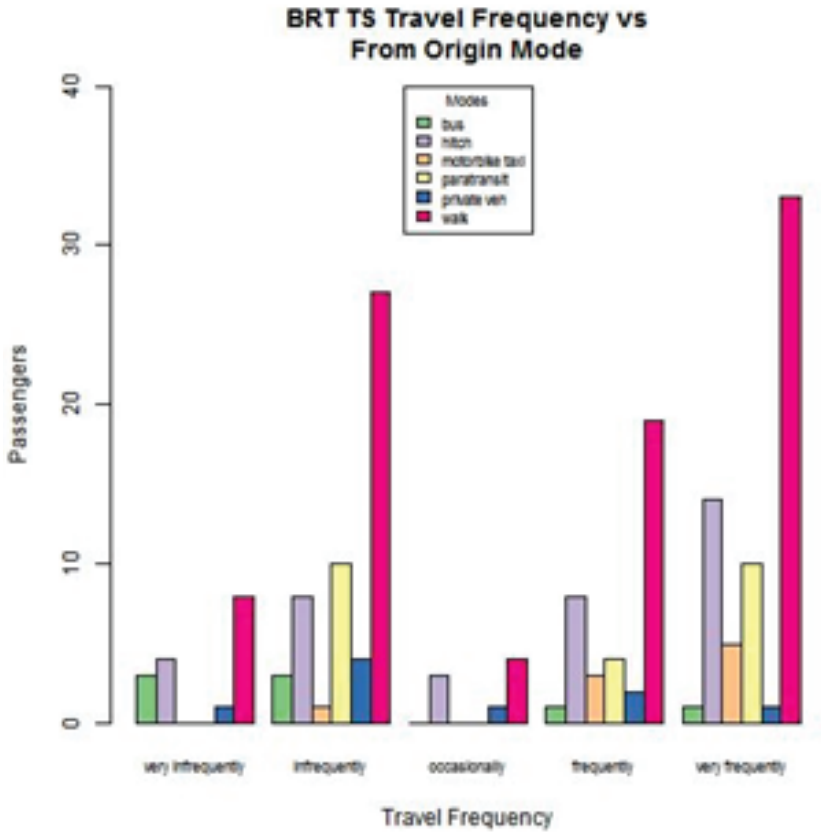

Figure 1

no difference in travel frequency tendency between people with different destination mode choice.

Output from each Chi-square test is shown in Appendix B. Initially we test if there is a significant difference in travel frequency tendency between people with different origin mode choice. The Chi-squared test gives us a p-value of > 0.001; hence we have a significant result at the 1% level allowing us to accept the null hypothesis (of equal proportions). We would therefore believe that there are equal proportions of people with different destination mode choice scoring in each of the travel frequency categories.

3.3. Do passenger travel frequency differ by their availability of alternative mode?

The Kruskal-Wallis test (Appendix C) gives us a p-vale of 0.6044; hence we have no evidence to reject our null hypothesis. We are likely therefore to believe that there is no difference in travel frequency tendency between people with different destination mode choice.

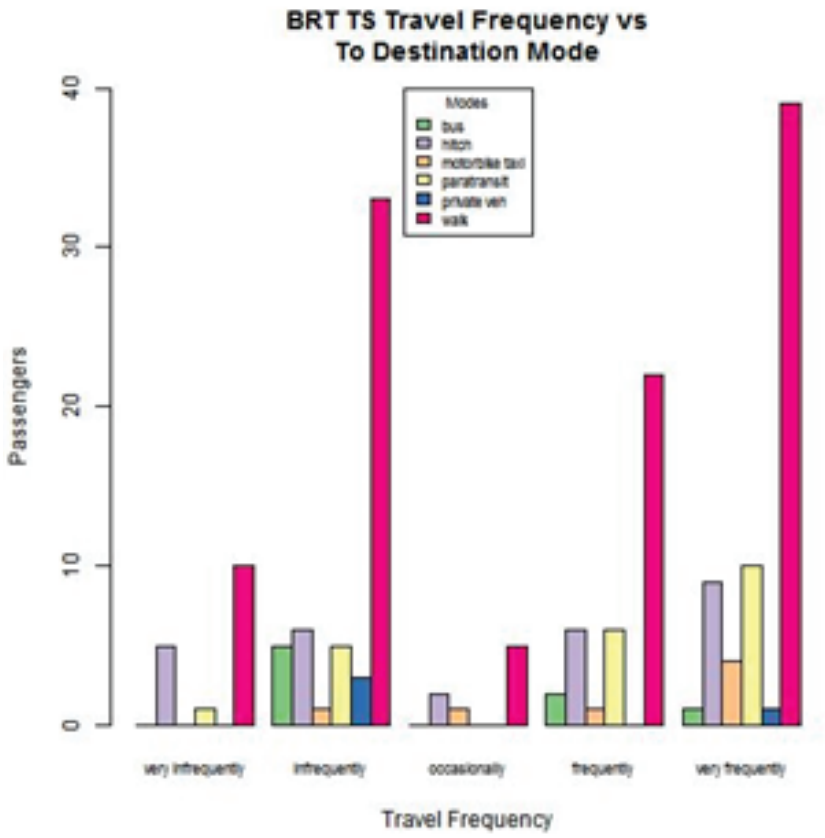

Figure 2

Output from each Chi-square test is shown in Appendix C. Initially we test if there is a significant difference in travel frequency tendency between people with different origin mode choice. The Chi-squared test gives us a p-value of > 0.001, hence we have a significant result at the 1% level allowing us to accept the null hypothesis (of equal proportions). We would therefore believe that there are equal proportions of people with different destination mode choice scoring in each of the travel frequency categories.

3.4. The Ordinal Logistic Regression Model

Appendix D are the test statistics and p-values, respectively for the null hypothesis that an individual predictor's regression coefficient is zero given that the rest of the predictors are in the model. We note that we can accept this null hypothesis for all of the predictors with associated p-values large than 0.05 respectively. Interpretation for these p-values is similar to any other regression analysis. There are equal proportions of people with different origin or destination mode choice or availability of alternative mode, scoring in each of the travel frequency categories.

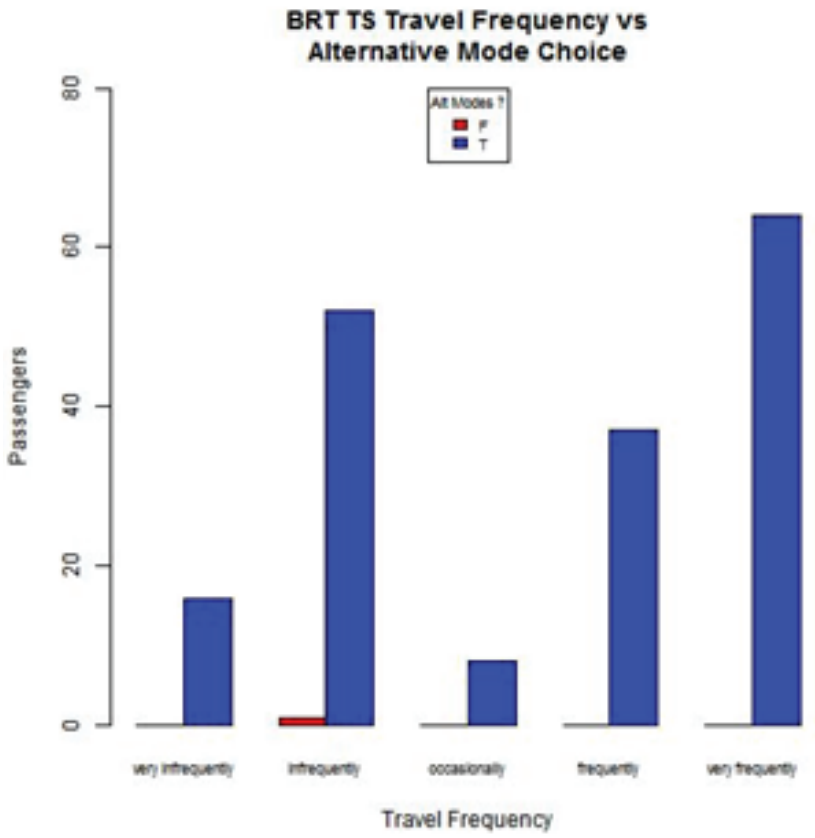

Figure 3

4. Discussion

This research was limited to the availability of the data. The results were not find factors that make more frequent passenger. Therefore another research need to conduct to find those factors.

Acknowledgment

We would like to express our acknowledgment to Yudith Moudia for data collection and Universitas Negeri Semarang (Unnes) Research Institute (LP2M) for the funding this research.

Appendix A

```
================================================================================
Test for a difference in Travel Frequency tendencies
of Passengers with different Origin Mode
================================================================================

        Kruskal-Wallis rank sum test

data:  datax$travfeq by datax$orimode
Kruskal-Wallis chi-squared = 2.1332, df = 5, p-value = 0.8304
================================================================================

        Pearson's Chi-squared test

data:  table(datax$travfeq, datax$orimode)
X-squared = 23.164, df = 20, p-value = 0.2808
================================================================================
```

Figure 4

Appendix B

```
================================================================================
Test for a difference in Travel Frequency tendancies
of Passengers with different Destination Mode
================================================================================

        Kruskal-Wallis rank sum test

data:  datax$travfeq by datax$desmode
Kruskal-Wallis chi-squared = 3.8049, df = 5, p-value = 0.5778
================================================================================

        Pearson's Chi-squared test

data:  table(datax$travfeq, datax$desmode)
X-squared = 19.736, df = 20, p-value = 0.4746
================================================================================
```

Figure 5

Appendix C

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================================================================================
Test for a difference in Travel Frequency tendancies
of Passengers with different Alternative Mode Choice
================================================================================

       Kruskal-Wallis rank sum test

data:  datax$travfeq by datax$tramoption
Kruskal-Wallis chi-squared = 0.26847, df = 1,p-value = 0.6044
================================================================================

       Pearson's Chi-squared test

data:  table(datax$travfeq, datax$tramoption)
X-squared = 2.3718, df = 4, p-value = 0.6677
================================================================================
```

Figure 6

Appendix D

```
================================================================================
Summary of The Ordinal Logisic Regression Model
================================================================================
associated p-values for each coefficient
================================================================================
                                      Value Std. Error
orimodehitch                     -0.5567990  0.7877850
orimodemotorbike taxi            -1.0652889  0.9966089
orimodeparatransit               -0.8980183  0.8108001
orimodeprivate veh               -1.2754043  0.9292898
orimodewalk                      -0.6970770  0.7551907
desmodehitch                      1.2539400  0.7029013
desmodemotorbike taxi             1.3739505  0.9174329
desmodeparatransit                0.8176787  0.7168286
desmodeprivate veh                0.5697938  0.9927293
desmodewalk                       0.9276153  0.6233307
tramoptionT                       0.7085470  1.5175846
frequently|infrequently          -0.4658323  1.8038929
infrequently|occasionally         0.9266790  1.8085064
occasionally|very frequently      1.1132480  1.8104183
very frequently|very infrequently 3.2761003  1.8239487
                                    t value p value
orimodehitch                     -0.7067905   0.480
orimodemotorbike taxi            -1.0689137   0.285
orimodeparatransit               -1.1075705   0.268
orimodeprivate veh               -1.3724505   0.170
orimodewalk                      -0.9230476   0.356
desmodehitch                      1.7839490   0.074
desmodemotorbike taxi             1.4976034   0.134
desmodeparatransit                1.1406893   0.254
desmodeprivate veh                0.5739669   0.566
desmodewalk                       1.4881593   0.137
tramoptionT                       0.4668913   0.641
frequently|infrequently          -0.2582373   0.796
infrequently|occasionally         0.5124002   0.608
occasionally|very frequently      0.6149120   0.539
very frequently|very infrequently 1.7961581   0.072
================================================================================
```

Figure 7

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