The Dilemma of the Choice Between: Public Transportation or Private Transportation Case Study: Sarbagita Metropolitan Area

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Abstract. Indonesia has entered a third trend of three mega-demographics trends, namely the transition of migration to non-permanent mobility such as commuter and circular movement. Most of the population does movement due to work factors. The higher rate of worker mobility, and the infrastructure of transportation are urgently needed. Commuting is a type of non-permanent movement where a person works in a different place from his residence. They leave the house, home, and apartment in the morning and return in the afternoon or evening every day or back to house, home, and apartment no longer than 24 hours. Many problems will arise when the rate of mobility is high. There are several problems regarding transportation facilities and infrastructure, for example, a severe traffic jam and no exception in the bali province. Another problem in Bali is declining support of trans sarbagita operational funds and the reduction in the number of fleets. This study aims to identify the probability of public transportation use by workers in the sarbagita region. This study uses sakernas 2018 data, using the binary logistic regression model. The results of this study are the use of public transportation depends on individual characteristics such as distance, sex, education, age, and marital status.

Keywords: *commuter, binary logistic, Sarbagita, transportation mode.*

1 Introduction

The increases in the percentage of population in urban areas was caused by several factors, namely the natural birth of the area, migration of people from rural areas or other cities, annexation, and reclassification of rural areas into urban areas [1]. Arifin and Ananta (2013) in their journal explained "three Mega-Demographic trends in Indonesia," the first is the large population, the second trend is the aging of the people, the third trend is the change in the pattern of population mobility which was permanent to non-permanent. In Indonesia, has entered a third trend that is a shift in the form of movement that was long-term migration to non-permanent or short-term migration due to the development of transportation facilities and infrastructure [2].

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Table 1. Distribution of Stayers, Commuters and Circular Workers of Metropolitan areas in Indonesia, 2017

Metropolitan Areas	Stayers	Non-permanent Mobility		Total
		Commuters	Circulars	
Bandung Raya	85.8%	10.9%	3.3%	100.0%
Banjar Bakula	89.2%	8.9%	1.9%	100.0%
Gerbangkertosusila	90.4%	8.5%	1.1%	100.0%
Jabodetabek	76.4%	22.0%	1.6%	100.0%
Kedungsepur	87.7%	8.5%	3.8%	100.0%
Mamminasata	82.3%	14.5%	3.2%	100.0%
Mebidang	84.2%	14.3%	1.5%	100.0%
Palapa	95.5%	3.4%	1.1%	100.0%
Patungraya Agung	95.3%	3.0%	1.7%	100.0%
Sarbagita	83.9%	15.9%	0.2%	100.0%
Total	83.0%	15.1%	1.9%	100.0%

Source: Sakernas, 2017. Susiyanto dan Chotib 2018[3].

Table 1. shows the distribution of stayers, commuters, and circular workers in the metropolitan area in Indonesia. Most Indonesians live and work in one area or can be called a stayer. Then the number of distribution of commuter workers, the highest commuter level in Jabodetabek, is 22 percent, then followed by the Sarbagita area in Bali Province, which is 15.9 percent, and the third is the Mamminasata area which is 14.5 percent. For circular mobility, workers in the Kedungsepur area do a lot of circular movement of 3.8 percent.

The cause of population mobility is to increase income, get opportunities for better education, as well as adequate means of communication and transportation [2]. To do the commuting, the residents need communication and transportation facilities. Cervero, et al. (2017) states that transportation is welfare for workers because transport is used to connect workers in the suburbs to get to the city besides transport is also used to shorten the travel time of workers from the area of origin to the place of work. The commuter have a problem with the choice of using the most efficient mode of transportation to be used both in terms of cost, time, and comfort. There are several types of alternative modes of transportation, such cars, motorbikes, bicycles, public vehicles, online-based transportation, buses, and other public transportation[4].

Setyodhono (2017) states that transportation problems not only because of the availability of transportation facilities and infrastructure but are also influenced by the behavior and characteristics of users in choosing modes of transportation which will have an impact on the severity of congestion [5].

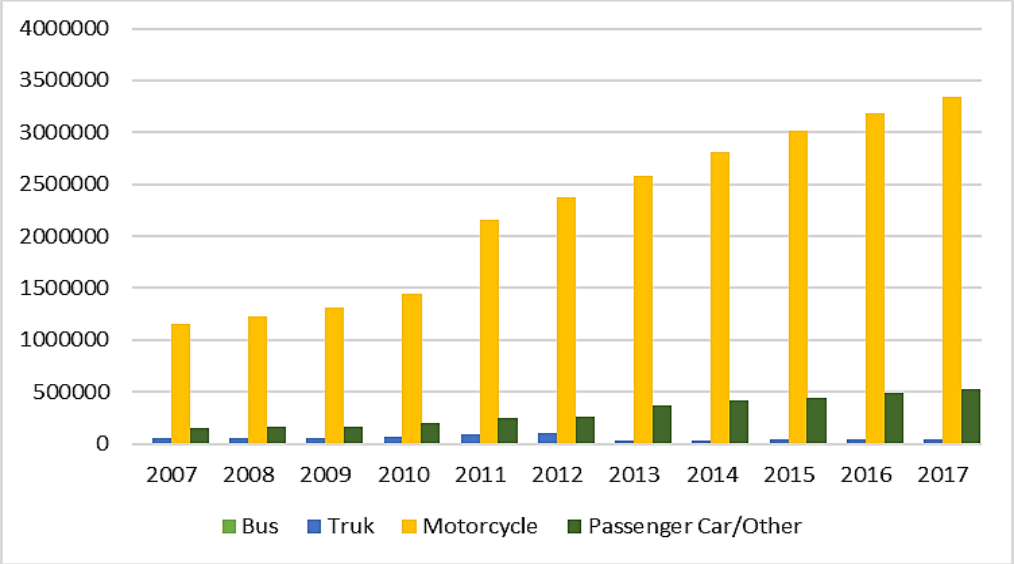

Fig. 1. Number of Vehicles by Vehicle Type in Bali, 2007-2017
Source: BPS (2019), processed.

Figure 1 shows the number of vehicles by vehicle type in Bali in 2007-2017. The trend shows that every year, the volume of vehicles in the Province of Bali has increased. The highest increase occurred in the types of motorcycle transportation modes, than passenger cars/other cars, trucks, and buses. If the volume of vehicles continues to increase over time and is not balanced with adequate road sections, there will be very severe congestion.

One of the metropolitan areas that has problems regarding transportation facilities and infrastructure is Bali Province, specifically the Sarbagita area, namely Denpasar, Badung, Gianyar, and Tabanan. The observation of Siringo (2014) regarding road access in one of the Badung areas, Kuta Beach, is said that the access road is narrow and very crowded with transportation [6].

In contrast to Jabodetabek, workers can use various modes of public transportation, for example, train (KLR), MRT, busway, bajaj, metro mini, and so on [7]. Sarbagita which only has Trans Sarbagita and other small public transport cars in terms of public transportation. Widhyastuti (2015) states that the primary purpose of providing Trans Sarbagita transportation is to reduce the number of private transportation, which is the main problem of traffic congestion in several places [8].

Haustein (2007) argues that labor market demand increases with the flexibility and mobility of workers, rising participation of women workers, and decreasing traditional household structures [9]. The problem has an impact on the increasing need for mobility all the time. Also, mobility needs will also increase the use of private transportation because public transportation is considered unable to meet the requirements, flexibility, and spontaneity.

The primary purpose of this study is to see how commuter workers choose the mode of transportation to go to work based on distance from the area of origin. Also, this research was conducted due to the decrease in operational support for Trans Sarbagita funds and the reduction

in the number of fleets. Then there are local regulations regarding restrictions on the maximum age of open vehicles. Besides that, there is also a discourse to close online taxi operations in the province of Bali. It will have an impact on workers who depend on public transportation, whether using public transit, Trans Sarbagita, or online taxis. Most commuter workers with long-distance workplaces tend to use public transit. It is a big problem for workers who rely on public transit as the main transportation.

2 Literature Review

2.1. Mobility

Hugo (1997) divides migration into two categories, namely circular migration where population movements that cross administrative boundaries at the regency/city level and routinely go to their destination and return to their place of residence in a weekly or monthly period. Then non-permanent migration Commuter mobility is the movement of the population routinely going to their destination and returning to their home in less than 24 hours [10].

Skeldon (1990) suggests that there are six mobility transitions, the first being a pre-transition society characterized by the tendency of non-permanent mobility patterns. The second transition is an early transition society characterized by large cities, which are the main destinations of small and medium-sized city residents. The third transition is an intermediate transitional community characterized by stagnant migration to large cities. The fourth transition is the final transitional community marked by migration flows that occur from rural areas that go directly to big cities and the emergence of megacity. The fifth stage is that people are starting to advance marked by sub-urbanization, and urbanization rates have passed 50 percent, and non-permanent mobility has increased. The sixth stage is advanced society, that is, the urban population, which spreads to small towns. The seventh stage is the advanced super society, marked by the influx of foreign workers, increasingly sophisticated technology, reduced permanent mobility, and replaced by non-permanent movement, increased use of sophisticated transportation [11].

2.2. Transportation Mode Selection Theory

Warpani (1990) states that the selection of transportation modes in urban areas is not through a random process. The thing that determines the choice of transportation mode is the factor of distance, mode speed, comfort, availability, cost, constraints, age, area, social, and social-economic status of a person [12].

Overgaard (1966) in Warpani (1990) states that there is a positive relationship between distance and the practicality of a mode. If the range is near or under 3 km, a person tends to walk or bike. Conversely, if the length is longer, then someone decides to use public transportation [12].

Law (1999) in Cresswell (2016) On the scale of travel, traveling to work considers several factors including content, travel length, complexity, and distance in the mobility of men and women involved in daily movement [13]. In the social production and reproduction requires special attention in the factors of destination, distance, mode of transportation used, travel time, and other structural elements that distinguish the mobility of both men and women.

Research on the choice of transportation modes in Jabodetabek, Setyodhono (2017) using multinomial logistic regression models. The results obtained are age, gender, education level, employment status, average worker's income, distance of residence to work, length, and cost of travel have a significant effect on the choice of transportation mode used. Except, self-employed worker, they prefer to use the busway transportation mode [5].

Djakfar, et al (2010), amounted to 77 percent of students who owned and used their motorbikes to go to campus. Based on the variable cost of the trip, 31 percent of students spent Rp. 3,000 - Rp. 4,500 to commute campus trips and homes using public transportation. Other variables are trustworthy and orderly. 2.41 percent of students consider the stopping distance and walking distance to their destination. Or in other words, public transportation in Malang City cannot be trusted and is not organized as the primary choice of transportation mode [14].

3 Analysis Method

This study used data from SAKERNAS (Survei Angkatan Kerja Nasional or National Labor Force Survey) 2018. Sakernas is a survey conducted by the Badan Pusat Statistik or Central Statistics Agency specifically designed to collect data that can describe the general state of employment between periods of enumeration [15].

The location of this research in the Sarbagita metropolitan area. The choice of location is because Sarbagita is one of the urban region in Indonesia, which also has problems with congestion as a result of urbanization. The choice of transportation modes to meet the access needs of the population in meeting the requirements for work is vital to be explored as a follow up to the sustainability of urban infrastructure. Also, the lack of support from the Provincial Government of Bali for the sustainability of trans-Sarbagita public transportation and the issue of reducing the number of fleets has an impact on the fate of trans Sarbagita users.

The analytical method used in this study is a binary logistic regression model. The model used binary logistic regression because the dependent variable (Y) grouped into two categories, 0 = if the respondent uses private transportation, one = if the respondent uses public transportation. The use of the binary logistic regression model because public transportation in Bali Province did not vary, there were only buses, public transportation, taxis, and online taxis. Therefore, it is divided into two categories namely, public transportation and private transportation. The general form for the binary logistic regression model:

$$ln\left(\frac{p_i}{1-p_1}\right) = \beta_{20} + \beta_{21}Distance + \beta_{22}Sex + \beta_{23}Educ + \beta_{24}Age + \beta_{25}\,Mar\_stat + \mu_i \quad (1)$$

Information:

Distance	= 0, if the distance <10 km; 1, if the distance ≥10 km.
Sex	= 0, male; 1, female
Educ	= 0, if the education >Senior High School; 1, if the education ≤Senior High School.
Age	= Age of worker; Numeric.
Mar stat	= 1, if the marital status is not married; 2 if the marital status is married; 3 if the marital status is divorced alive/divorced dead.

4 Results and Discussion

4.1. Descriptive Result

Table 2. Choice of Transportation Mode and Distance

Distance	Private	Public	Observations (100%)
<10 km	98.70	1.30	2544
>10 km	96.50	3.50	715
Total	98.22	1.78	3259

Source: Sakernas, raw data, processed in 2018.

Table 2. shows the percentage of modes choice of public transportation modes and the private transportation mode based on distance from the origin area to the workplace less than 10 km and more than 10 km. Based on the table, if the range is less than 10 km, the percentage of workers who use public transportation is 1.30 percent. Then when the travel distance is more than 10 km, the use of public transportation increased by 3.50 percent. That is means the further distance traveled, the percentage of workers who use public transportation will increase. Observations show that workers in Bali mostly work at intervals less than 10 km.

Table 3. Choice of Transportation Mode and Sex

Sex	Private	Public	Observations (100%)
Male	98.76	1.24	1859
Female	97.50	2.50	1400
Total	98.22	1.78	3259

Source: Sakernas, raw data, processed in 2018

Table 3. shows the choice of transportation modes of public and private transportation based on the sex of the worker. Observations show that male workers commute more than women. Women prefer to use public transit if compared to males. The percentage shown in Table 3, for women using public transport is 2.50 percent, and for male is 1.24 percent.

Table 4. Choice of Transportation Mode and Education

Education	Private	Public	Observations (100%)
>SHS	99.03	0.97	2068
≤SHS	96.81	3.19	1191
Total	98.22	1.78	3259

Source: Sakernas, raw data, processed in 2018.

Table 4. show the choice of transportation modes among private and public based on worker education. In general, higher education will choose private transportation, and vice versa. The same thing happened in Bali, that the percentage of workers with education above senior high school who decided to use public transportation was only 0.97 percent. Then those educated below senior high school use public transit is 3.19 percent. Observations show that commuter workers are mostly senior high school and more than senior high school.

Table 5. Choice of Transportation Mode and Age

Age	Private	Public	Observations (100%)
15-19	98.92	1.08	93
20-24	98.43	1.57	318
25-29	99.43	0.57	353
30-34	99.65	0.35	287
35-39	97.42	2.58	349
40-44	98.23	1.77	453
45-49	98.33	1.67	479
50-54	97.93	2.07	338
55-59	96.97	3.03	231
60-64	96.89	3.11	161
65-69	97.12	2.88	104
70-74	95.92	4.08	49
75+	100.00	0	44
Total			3259

Source: Sakernas, raw data, processed in 2018.

Table 5 choice of transportation modes among private and public based on age. Research conducted by Chotib 2019, regarding the selection of transportation modes among private and public shows the results that there is a negative relation between increasing age of workers with the option of transportation modes. Different things happen in Bali Province. Workers aged 35-74 years tend to use public transportation. The use of public transit is highest among workers aged 70-74 years, which is 4.08 percent. For observation, the distribution workers are more in the productive age population.

Figure 2. show the choice of public transportation based on age group. Figure 2 makes it easy to see more clearly the highest increase in the older age group. The younger age group prefer to use private transportation, while the older age group tend to favor public transport to go to work. This study shows different results from previous studies.

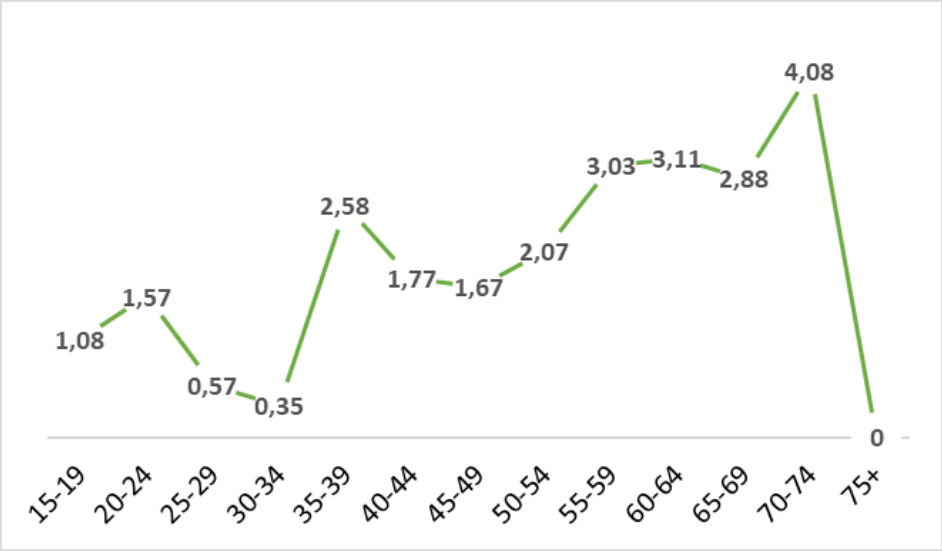

Fig. 2. Choice of Public Transportation based on Age Group
Source: Sakernas, raw data, processed in 2018.

Table 6. Choice of Transportation Mode and Marital Status

Marital Status	Private	Public	Observations (100%)
Not Married	98.77	1.23	650
Married	98.29	1.71	2450
Divorced/Widowed	94.97	5.05	159
Total	98.22	1.78	3259

Source: Sakernas, raw data, processed in 2018.

Table 6. show the choice of transportation modes among private and public based on marital status with three categories namely, not married, married, and divorced/widowed workers. Based on the use of public transportation, workers who are not married tend not to use public transit. Then for divorced workers prefer to use public transit. In general, unmarried workers tend to use public transit compared to married/ever-married workers. But different things happen in the Bali Province.

4.2 Inferential Result

Inferential analysis is intended to estimate the population through sample characteristics through a binary logistic model using STATA. Because the dependent variable consists of two choices, namely public transportation and private transportation, the regression analysis used is Binary Logistic Regression. In this regression, code 0 = the use of private transportation and

code 1 = use of public transportation. The variables used in this study are distance, gender, education, age, and marital status affect the choice of using public or private transport. In the inferential analysis also stated the hypothesis that supports this research. The assumption used based on theory and previous research.

The significance level used is α = 5%, based on this, researchers can determine the critical area of rejection of H0 or accepted H1. Rejecting H0 means that parameter B is not equal to zero, which means that there is a significant influence of an independent variable on the dependent variable. In addition to the parameter B, also displayed OR (Odd Ratio), which shows how many times the risk of a free variable category is likely to be pi compared to the reference variable category. In binary logistic regression OR is used to interpret the relationship between independent and dependent variables.

Table 7. Binary logistic Regression In The Public Transportation Modes

Moda_trns	Coef.	Odds Ratio	Sig.
Distance	0.0313375	5.371382	0.000*
Sex	0.0168857	2.779958	0.000*
Educ	0.0214709	3.94468	0.000*
Age	0.0004164	1.041267	0.501
Mar_stat	0.0058051	1.440772	0.260
_cons	-0.0229269	0.00087	0.000

Source: Sakernas, raw data, processed by author 2018.
**significant with α=5%*

Table 6. shows the results of the binary logistic regression of the choosing of public transportation. Two insignificant variables are age and marital status. Distance, of more than 10 km tends to be 5.4 times more likely to use public transit. The gender variable shows that women tend to be 2.8 times more likely to use public transportation. Workers who are below senior high school are 3.9 times more likely to use public transportation. The age variable, for old workers, the tendency to use public transit is 1.04 times. Workers who are married and divorced/widowed are 1.4 times more likely to use public transit.

5 Conclusion

In contrast to previous studies conducted by (Setyodhono, 2017) and (Chotib, 2019) regarding the age variable, it does not apply in the Province of Bali. And marital status variables, detailed results obtained that workers who are not married tend not to use public transportation.

All variables affect the choice of transportation mode. Of the five variables used, there are two variables influential but not significant, namely the age and marital status variables.

The policy of the Government in Bali Province regarding the reduction in the number of fleets, age restrictions on vehicles, and the lack of financial support for the continuation of public transportation in the Bali Province significantly affects the commuter workers who depend on public transport.

Also, one of the solutions to traffic congestion in Bali is to improve public transportation facilities and infrastructure, increase stopping points, and be more on time so that commuter workers can switch from private transportation to public transportation.

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