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GENDER AND HOUSEHOLDS' VEHICLE OWNERSHIP AND USAGE BEHAVIOR IN A DEVELOPING CITY

Widyarini Weningtyas
Lecturer
Department of Civil Engineering
Institut Teknologi Bandung

Sony Sulaksono Wibowo
Lecturer
Department of Civil Engineering
Institut Teknologi Bandung

ABSTRACT

In Indonesia, motorcycle ownership has grown significantly compared to private car ownership. Nowadays, using motorcycles is no longer a special privilege for men. Progressively women have started owning/riding motorcycles because of their involvement in the labor market, causing a certain level of travel needs. Although motorcycle is a promising mobility tool to fulfill their needs for travel, it is also known that women are more likely to face with driving difficulties that potentially cause accidents, while public transport and paratransit may be less safe. Accordingly, there is a possibility that women just use motorcycle because there are no alternatives that meet their needs for safety travel. However, little has been done with respect to women issues in transportation in developing countries.

To fill in this gap, this study attempts to first clarify the influence of gender on households' decisions about vehicle ownership and usage, and then to examine the gender differences in the usage of motorcycle for their daily lives. In this study, a questionnaire survey data collected in JABODETABEK area of Indonesia in January 2010 is used. In the survey, respondents were asked to answer their household vehicle ownership and usage, satisfaction level towards paratransit, household income, residential attributes, and individual attributes.

We first apply an aggregate analysis to explore the gender differences in motorcycle ownership and usage. Then, we develop an ordered probit model to capture the impa cts of satisfaction level towards paratransit on motorcycle usage with taking into account gender differences as well as trip purpose differences. We hypothesize that women who don't satisfy with the safety of paratransit tend to use motorcycle. The empirical results partly support our hypothesis: the lower satisfaction for *Ojek* security has a negative impact on their motorcycle usage, when participating in shopping activities. Such information could be useful for supporting women's mobility in developing cities by properly controlling the ever-increasing motorcycle ownership.

Keywords: Household vehicle ownership and usage, Gender, Developing cities, Ordered probit model

1. INTRODUCTION

The historians and social theoreticians believe that men and women have "separate spheres" (Wachs 1996). Woman's sphere was the care of children, the nurturing of the family, the comfort and tranquility of the home, and the moral guardianship of family and religious values, while men sphere are "work place." Evaluating from the workforce statistic data in Jakarta (see Table 1), the woman's sphere is no longer separated with the man's sphere. The data shows that the contributions of women in the labor force are almost equal to men's contributions. On the statistic data, the percentage of male

worker/ workforce population is slightly higher up to 2-5% than female workforce. More than 80% of the workforce population is actively working for both men and women. The increase rate from year 2009 to 2010, for male worker is around 12 % and for female worker is around 9%. The term of workforce mentions here, is the population above 15 years old, below 60 years old and eligible to work. This increase rate for men as well as women would directly affect the increase of travel needs.

Travelers usually used the available modes, either private vehicle or public transportation In order to satisfy travel needs. Jakarta suffers from poor-quality bus transport partly because services are almost entirely road based, forced to compete with other traffic for scarce road space (Susantono, 1997). Although there is a possibility that public transportation can give higher performances, in the real case, because of the driver income depend on the filling on empty seats not based on fixed income, the competition between each unit become unavoidable. This circumstance goes for public transportation like bus (excluding Busway or TransJakarta), minibus (kopaja or metro mini), and paratransit like *angkot* (mikrolet), *ojek* (motorcycle taxi) and other types. Formal public transport services are rarely up to the task of satisfying escalating demands for travel. Most public transport operators exist as protected monopolies, and accordingly lack the incentive to contain costs, operate efficiently, innovate, or respond to shifting market demands (Cervero, 2000). Certain level of mobility that is needed by the traveler cannot be accommodated by the available public transportation or paratransit, and thus shifting from public transportation to paratransit or motorcycle still continues in Jakarta.

In Jabodetabek from 1985 to 2002, car ownership increased approximately three times and motorcycle ownership three and a half times increased. The study by JICA and BAPPENAS shows that, at household level, the average number of car owned per 100 households is 20.7. If adequate public transport is not available, then the rich will use private automobiles while the relatively poor will shift first to bicycles, then to motorcycles (Vietnam and Indonesia), then to taxis (China and Indonesia), and ultimately to inexpensive cars as their incomes increase (World Bank, 2002). Year 1998, in Jakarta city's motorcycle ownership is rated high by international standards, it averaged 180 motorcycles per 1000 residents (Cervero, 2000).

Table 1: Population above 15 Years Old Based on Main Activity (In Thousands)

Main Activity	August 2009			August 2010		
	Male	Female	Total	Male	Female	Total
1. Population above 15 Years old	3417.52	3621.56	7039.08	3922.57	3850.24	7772.81
2. Work Force	2833.06	1854.67	4687.73	3230.2	2042.4	5272.6
a. Work	2512.7	1605.69	4118.39	2928.26	1761.5	4689.76
b. Jobless	320.36	248.98	569.34	301.94	280.91	582.85
3. Population Non Work Force	584.46	1766.9	2351.35	692.37	1807.84	2500.21
4. Participation Level Work Force (%)	89%	87%	88%	91%	86%	89%
5. Jobless Level (%)	11%	13%	12%	9%	14%	11%

Source : jakarta.bps.go.id

There have been many studies about vehicle ownership that mostly concentrated on relationship between socio-economic attributes and vehicle ownership. Senbil et al (2007) conducted a vehicle ownership study for three metropolitan areas that are Jabotabek (Indonesia), Kuala Lumpur (Malaysia) and Manila (Philippines) metropolitan areas. Golob et al. (1996) used structural equation models with latent choice variables to model household mobility decisions as being derived from decisions to participate in activities in various locations. Sanko et al. (2009) underscore that age and

gender differences have become less important in modal choices and car ownership as motorization proceeds. The finding is consistent with the current Indonesian situation as mentioned above.

From the problems that has been mentioned about public transportation and paratransit above, in several studies it is still believe that the existence of paratransit is not supposed to be eliminated but should be preserved. In recent years, studies regarding the preservation of paratransit in developing countries have become popular. Paratransit's feeder potential and performance in urban transportation have gradually been examined (Satiennam et al., 2006, Akkarapol T., et al 2009). Public perception was recognized as an important tool in evaluating paratransit operation and its future (Joewono et al, 2007). These topics provide the several agendas about the importance and useful function of paratransit in the future.

In Joewono et al (2007) mentioned that users whose families own a motorbike are loyal, this can be understood as the limitation of travel using a motorbike, since the number of motorbikes in a family is not sufficient for use by all family members. He also mentions that this is because usually the user of the motorbike is the father, or young family members, but not the mother or child. Also, in his study he mentions that the female users (including the married ones) seem to show more loyalty to paratransit. By this we can say that women are no longer having the option of using motocycle, but only paratransit. In this matter, there is a possibility of inequity in household in terms of usage of motocycle ownership.

As mentioned above, there are wide ranges of discussions on the transportation issues in developing cities, but gender issues are less discussed compared to others. Thus, in this study, women inequity in terms on vehicle ownership and usage is discussed. Concretely speaking, this study first attempts to clarify the influence of gender on vehicle ownership and usage, and then explore gender differences in the usage of motorcycle for their daily lives.

This paper is organized as follows. In the following section, the data used in this study is briefly described, and then conduct an aggregate analysis focusing on the vehicle ownership and usage with taking into account gender differences. In Section 3, we develop an ordered probit model to capture the impacts of satisfaction level for paratransit on motorcycle usage. Section 4 gives the discussions on the estimation results of the ordered probit model. We summarize our findings and future tasks in Section 5.

2. DATA USED IN THIS STUDY

For the empirical analysis of this study, we use the data collected in the metropolitan area, Jabodetabek, including Jakarta and 7 local governments (Bodetabek) in the surrounding areas covering Kota (municipality) Bogor, Kabupaten (regency/district) Bogor, Kota Depok, Kota Bekasi, Kabupaten Bekasi, Kota Tangerang, and Kabupaten Tangerang.

Individual interview survey was conducted in January 2010 in Jabodetabek area. There are more than 700 samples that have been collected. Random sampling method is used in order to choose the respondent. The questionnaires are divided into four parts, which are vehicle ownership and usage, satisfaction level towards angkot and ojek, residential attributes, and individual attributes. The household vehicle ownership is investigated by asking respondents to report the number of vehicles by type (car, motorcycle or others). The information about vehicle usage is included in the

respondents' usage frequency for each mode and for each purpose. The respondents also asked about their satisfaction level towards angkot and ojek as their other alternative mode as comparison. Satisfaction level includes fare, travel time, safety and security indicators. At the same time household income and residential attributes (e.g., detailed location, distance to work place or school) as well as individual attributes (e.g., age, gender, education level, employment status, and license ownership) are also investigated. The data show that the income level distribution is concentrated in category 1-3, which means that the income is lower than 3 million rupiah or around 340 US Dollar per month. In the household income the distribution concentrated in category 2-5. Which mean the level income is from above 1 – 5 million rupiah or around 115-570 US Dollar per month. The characteristics of the data are summarized in Table 2.

Table 2: General characteristics of Respondents

Variable Group	Observed Variable	Classifications	Male	Female
Gender			49.7%	50.3%
Socio demographic attributes	Age	1 - < 16 years old (excluded in the model)	3.3%	2.5%
		2 - 16 - 60 years old	95.7%	97.2%
		3 - >60 years old	1.1%	0.3%
	Education	1 – Senior high school and less	53.3%	41.6%
		2 – College/ University student and higher	46.1%	55.8%
		3 – other	0.6%	2.5%
	Occupation	1 – Worker	67.6%	46.7%
		2 – Student	25.2%	36.8%
		3 – Other	7.2%	16.4%
	Household Income	1 – <1 million	3.4%	3.4%
		2 – 1-2.0 million	21.8%	19.0%
		3 – 2-3.0 million	23.8%	23.8%
		4 – 3-4.0 million	12.9%	13.3%
		5 – 4-5.0 million	12.0%	15.3%
		6 – 5-6.0 million	7.2%	7.1%
		7 – >6 million	18.9%	18.1%
	License Car	1 – own	31.8%	14.4%
	License Motorcycle	1 – own	72.2%	26.3%
Residential information	Distance home to work	In Km (uncategorized)		
	Residential location	1 – North Jakarta	2.3%	2.3%
		2 – South Jakarta	32.7%	27.8%
		3 – West Jakarta	2.0%	2.0%
		4 – East Jakarta	8.9%	10.7%
		5 – Central Jakarta	2.9%	7.3%
		6 – Bogor	10.6%	7.3%
		8 – Tangerang	8.8%	8.4%
		9 – Depok	25.2%	24.6%
		10 – Bekasi	6.6%	9.6%
Motorcycle Usage	Mandatory	1 – do not use	23.1%	39.9%
		2 – less than 1 times a week	2.3%	5.3%
		3 – 1or 2 times a week	8.5%	8.7%
		4 – almost everyday	66.1%	46.1%
	Shopping	1 – do not use	53.3%	57.5%
		2 – less than 1 times a week	22.6%	22.4%
		3 – 1or 2 times a week	16.9%	14.4%
		4 – almost everyday	7.2%	5.7%
	Leisure	1 – do not use	65.6%	76.5%
		2 – less than 1 times a week	20.9%	14.4%
		3 – 1or 2 times a week	8.0%	6.5%
		4 – almost everyday	5.4%	2.5%

The ownership of other vehicle beside car and motorcycle because of a very small number of ownership were not considerate. **Error! Reference source not found.** shows the cross tabulation results between car or motorcycle ownership and usage based on gender. From these aggregate analyses we can see that while in one household having one car, then for female who had the same frequency usage (4 = almost every day) as male is having lower percentage share in car usage. But if

one household has two or more cars then the share becomes equal. By this statistic evidence shows that inequity happens when there is only single ownership of car in one household.

This inequity also occurs in the motorcycle ownership. When one household have only one motorcycle, then male have the first priority in using it. This is show by the percentage of using motorcycle (4 = almost every day) in having single motorcycle is 44.4% for male and almost half 26.9% in female. When there is multiple motorcycle ownership then the share become equal.

Table 3: Crosstabs Household Car and Motorcycle Ownership vs Usage

			Frequency Car Usage*					
			0	1	2	3	4	Total
Male	**Car Ownership (unit)**	0	72.8%	0.0%	0.0%	0.0%	0.0%	72.8%
		1	2.6%	1.7%	7.4%	1.7%	10.0%	23.5%
		2	0.0%	0.0%	1.1%	0.6%	1.7%	3.4%
		3	0.0%	0.0%	0.0%	0.0%	0.3%	.3%
	Total		**75.4%**	**1.7%**	**8.6%**	**2.3%**	**12.0%**	**100.0%**
Female	**Car Ownership (unit)**	0	74.2%	0.0%	0.0%	0.0%	0.0%	74.2%
		1	2.5%	3.4%	6.5%	1.7%	7.4%	21.5%
		2	0.0%	0.3%	0.8%	0.3%	2.8%	4.2%
	Total		**76.8%**	**3.7%**	**7.4%**	**2.0%**	**10.2%**	**100.0%**
			Frequency Motorcycle Usage*					
			0	1	2	3	4	Total
Male	**Motorcycle Ownership (unit)**	0	21.5%	0.0%	0.0%	0.0%	0.0%	21.5%
		1	3.2%	1.7%	3.7%	6.6%	44.4%	59.6%
		2	0.9%	0.6%	0.6%	0.3%	9.7%	12.0%
		3	0.0%	0.3%	0.0%	0.3%	4.6%	5.2%
		4	0.0%	0.3%	0.0%	0.0%	1.4%	1.7%
	Total		**25.5%**	**2.9%**	**4.3%**	**7.2%**	**60.2%**	**100.0%**
Female	**Motorcycle Ownership (unit)**	0	42.2%	0.0%	0.0%	0.0%	0.0%	42.2%
		1	4.2%	1.4%	4.5%	4.8%	26.9%	41.9%
		2	0.3%	0.6%	0.3%	1.1%	9.3%	11.6%
		3	0.6%	0.0%	0.6%	0.0%	2.5%	3.7%
		4	0.0%	0.0%	0.0%	0.0%	0.6%	.6%
	Total		**47.3%**	**2.0%**	**5.4%**	**5.9%**	**39.4%**	**100.0%**

*see at Table 2

3. MODEL AND METHODOLOGY

The ordered probit model was used by Senbil et al. (2006) to investigate the inferences on motorcycle ownership and it use in Jabodetabek. Yamamoto (2009) also used the same method in order to examine the interactions among different types of vehicle ownership. We also develop an ordered probit model to examine the interrelation between vehicle usage and satisfaction level for the alternative mode (angkot and ojek), and how gender affects such interrelation with other factors. This study argues that these interrelations can be integrated in a model using ordered probit model. The ordered probit model is estimated by employing the usage of motorcycle for each trip purpose as dependent variable.

$$y_t^* = \beta X_t + \varepsilon_t, with\ \ \varepsilon_t \sim N(0,1)$$

where

y_t^* = motorcycle usage per person t, coded as 0, 1, 2…., J;

X_t = influential factors of person t;

β = vector of coefficient; and

ε_t = error term of person t

The observed category of y_t^* and can be defined as:

$$y = 0 \ \ if \ \ y^* \le 0$$

$$y = 1 \ \ if \ \ 0 \le y^* \le \gamma_1$$

....

$$y = J \ \ if \ \ \gamma_{J-1} \le y^*$$

where

γ_1 = estimable threshold parameters

The following probabilities result from the normal distribution:

$$\Pr = (y = 0) = \Phi(-\beta' x)$$

$$\Pr = (y = 1) = \Phi(\gamma_1 - \beta' x) - \Phi(-\beta' x)$$

....

$$\Pr = (y = J) = 1 - \Phi(\gamma_{J-1} - \beta' x)$$

Therefore, the probability that y_1 falls into *j* th category is given by

$$\Pr = (y = J) = \Phi(\gamma_J - \beta' x) - \Phi(\gamma_{J+1} - \beta' x) j = 0,1,...J$$

Where γ_1 and γ_1 denote the upper and lower threshold values for category *J*. The log likelihood function is the sum of the individual log probabilities:

$$Log = \sum_{j=1}^{J} \sum_{y_t = j} \log\left[\Phi(\gamma_J - \beta' x_i) - \Phi(\gamma_i - \beta' x_i)\right]$$

The ordered probit model includes two parameters, which are constant and other threshold parameters. These two parameters indicate the range of normal distribution associated with specific values of the explanatory variables.

The estimation was performed separately between male, female and also for each trip purpose. The trip purposes we classified into three groups of activities that are:

1. Mandatory, comprised of the two activities coded as work and school
2. Shopping, comprised of activities coded as meals and shopping, and
3. Leisure, comprised of activities coded as hobbies, amusements, exercise, incidental trips

By this we have 6 separated models to achieve the goal of the study. There are several hypotheses that are going to be tested in this study. Between male and female would have different characteristics in owning or use of motorcycle compare to the satisfaction level of using *angkot* and *ojek*. Tarigan, 2010 mention that 'Waiting for paratransits on the roads (especially in the evening) for quite a long time (and alone) may become to be a crucial issue for women (rather than men) due to safety consideration. From this statement, we hypothyze in the male case safety and security are not the main consideration in using *angkot* or *ojek*. But in the female case, these two indicators possibly are the main influential factor in using *angkot* or *ojek*. If these two indicators are not fulfilled then the

female traveler would shift from *angkot* or *ojek* to motorcycles. There are several other factors that influence the choice to use *angkot* or *ojek* rather than motorcycles.

4. ESTIMATION RESULTS

The ordered probit model (see Table 4) is separated into male and female models for each trip purpose. The result of the model shows the value of Mc Fadden Rho Square and the Adjusted Rho Square are above 4.0 and the highest is more than 7.0 for shopping purpose in male model. From the ordered probit model result shows that, most of men did not prefer using *angkot* or *ojek* no matter what kind of improvement that can be made. Other factors like satisfaction level towards *angkot* or *ojek*, socio demographic attributes, and residential information did not show any significant influences for shopping and leisure in male model. But in the mandatory trip for male, increase of age would reduce the motorcycle usage. The increase in license car and the increase of distance home to work would also reduce the motorcycle usage. Probably in this case, for male they will choose other type of vehicle instead of motorcycle.

This study found an interesting result can be drawn here, that women use paratransit higher than men. From the result also show that men were more dissatisfied with the service performance of paratransit rather than women. The result shows that women implying that safety in paratransit are a critical issue for them. For female, the factor is not about safety that would influence them in using *angkot* or *ojek* again. But *angkot* fare becomes important factor in the mandatory trip.

Interestingly in shopping trip, if the security of ojek increases although would outcome in ojek's fare increase they will still use ojek. Interestingly In the other hand if the angkot travel time reduced they will also chooses angkot for shopping trip rather than motorcycle. When the household income increase, then female will choose to own motorcycle. This is also supported by the aggregate analysis that shows men and women equity in using motorcycle when one household own more than one motorcycle. While increase in the distance home to work, would decrease the usage of angkot and ojek, and substantially increase the usage of motorcycle.
In the leisure trip there are no significant influential factor that could influence men and women to use angkot or ojek.

This study suggests that paratransit operators may anticipate winning the competition with motorization to some degree. To this extent, this study also wants to promote the use of paratransit rather than motorcycle.

5. CONCLUSION

In this study we successfully provide the evidence that is becoming the new user of motorcycle if there are no improvements in paratransit. But in the contrary female are also potential users for paratransit in the future. An individual survey was conducted in order to support the analysis in this study. From this study we can conclude that progressively women are starting to participate in the labor market. It can be seen from the women respondent data that almost 50% of total respondent are worker. Women also contribute in gaining more education level than men, this is shown by the higher respondent data that almost 40% of total respondent are student.

From the aggregate analysis show the evidence that women had the inequity in using both car and motorcycle compare to men. Although for both men and women, the needs in using of motorcycle are

having the same share. In this study, we can say that there are no separate spheres for women and men in doing their activities in their daily life.

From the analysis we can conclude that the government can support women to shift back to *angkot* or *ojek* rather than men. The most influential factor is mostly about the tangible service performance not on the intangible service performances (like safety and security). In the future, the government should promote this tangible performance improvement and later the intangible improvement. By this the government can properly controlled the ever-increasing motorcycle ownership.

For further study, this study will not only focuses on the unique travel behavior of gender for the usage of the motorcycle/car/paratransit but also include the intra household interaction which also influence the departure time and transport mode choice for the morning commute Such combination of the travel behavior of accompanied children and escorting adults (e.g women) will influenced transport mode choice since the simplicity of the motorcycle allows a great degree of versatility in regards to multiple family member transport.

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