Online Shared Taxi as Substitute for Personal Transport in Indonesian Cities: The cases of Semarang and Bogor

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Abstract: In many cities, ride-hailing or shared taxi systems have transformed service delivery, spurred new businesses, and changed lifestyles. There is nonetheless limited systematic analysis of the impact of these shared taxi systems on transport decisions and travel patterns. The article aims to fill that void by drawing on new survey data to analyze factors that influenced the adoption of shared taxis in Semarang and Bogor, Indonesia. The article employs an ordered logit model to assess the effect of individual attributes, socio-economic conditions, vehicle ownership, online system evaluations, and public transport preferences on the adoption and use of shared taxis. The results of the data analysis demonstrate that use of the shared taxis differed across cities and modes; ride-hailing correlates with the perceived merits of the shared taxi system as well as the level of service of public transport in the city; and female users tended to avoid shared motorcycle taxis.

Keywords: online taxi, ordered logit, substitute mode, Semarang City, Bogor City

1. INTRODUCTION

Over the past two decades, the rapid growth of cities have coupled with rising rural-to-urban migration to spur the emergence of booming megacities in many developing countries, especially in Asia. Yet formal public transport systems has not always kept pace with this expansion and fast-rising transport demands, leading to the collapse of these systems in several developing countries. The unfortunate result is that many cities have witnessed the growth of alternative modes such as paratransit or informal transport to fill widening mobility and accessibility gaps.

In recent years, ride-hailing or shared taxi systems have begun to play an increasingly important role in filling these accessibility and mobility gaps. Starting with Uber in the United States in 2009 (Clewlow and Mishra, 2017), ride-hailing has become a fixture of the transport system in a wide range of countries. In Indonesia, the company GOJEK integrated ride-sharing into the informal transit motorcycle taxi system in 2015 (Suzuki, 2019). This integration has led to the growth of a new model of "shared mobility" that is powered by the informal transit system. That new model of mobility now employs more than two millions motorcycle taxi drivers as partners (Suzuki, 2019). While some have raised concerns that this has led to growth of illegal and unregulated taxis (Clewlow and Mishra, 2017), an expanding body of evidence suggests the positives outweigh the negatives. Different reviews have maintained that new ride-hailing systems have improved operational efficiency (cutting idling and down time), enhanced service coverage, increased wages, extended the reach of businesses, and become more gender-responsive and inclusive (by matching women drivers and riders) (Jin, et al, 2018; Edelman and Geradin, 2016; Nugroho, 2012; Rogers, 2015; Ge at al, 2016).

Like in many parts of the world, then, ride-hailing or shared taxi systems have become a transformative force in Indonesia. There is nonetheless limited systematic analysis of the impact of shared taxi systems on transport decisions and travel patterns. The article aims to fill that void by drawing on new survey data to analyze factors that influenced the adoption of shared taxis in Semarang and Bogor, Indonesia. The article employs an ordered logit model to assess the effect of individual attributes, socio-economic conditions, vehicle ownership, online system evaluations, and public transport preferences on the adoption and use of shared taxis. The results of that analysis demonstrate that use of the shared taxis differed across cities and modes; ride-hailing correlates with the perceived merits of the shared taxi system as well as the level of service of public transport in the city; and female users tended to avoid shared motorcycle taxis.

The remainder of the article is divide into four sections. The next section illustrates where the case shared economy sits in the literature on urban transport in developing countries. A third section describes the context in Semarang and Bogor. A fourth section presents results. A final section concludes with a discussion of areas for future research.

2. LITERATURE REVIEW AND METHODS

Urban city services and urban lifestyles are changing quickly. People are more digitally connected and the sharing economy is making it more convenient and efficient to move from place to place. At the same time, information and communication technologies that facilitate access to location data and smartphones applications (apps) provide unique opportunities for the introduction and widespread deployment of new technology-enabled mobility options and services. The most rapidly growing – and sometimes controversial – forms of shared-mobility in the transport sector is a demand-driven taxi also known as ride hailing or ride sourcing (Weideli, 2013).

Ride-hailing services are a form of shared mobility that is so-named because it enables a passenger to request a driver and “share” their vehicle through a smartphone app (Shaheen and Chan, 2016). The app allows the driver to access the user’s location through a global positioning system (GPS). The estimated waiting time, cost and travel time is provided to the user based on the support from GPS technology, digital maps and routing algorithms.

Ride-hailing services have many benefits. They provide higher efficiency than regular taxis by better matching demand and supply (Jin et al, 2018). The system also rely on surge pricing to efficiently meet fluctuations in demand (a dynamic pricing mechanism in parallel to the demand that increase fares during high demand periods). To reduce transaction costs, the algorithms of the system in the app works to minimizing cost of searching a ride (Roger, 2015).

Shared taxi could play both to be a complement and competitor to public transit system. It might serve as feeders for public transits system alleviating the first-mile/last-mile problem (Jin, et al, 2018). It was confirmed the Uber pickup surged when new train station open and shuttle the passenger from station to their final destinations. On the other hand, ride-hailing also competes with public transit especially in high-density areas. The users will shift to public transport system if shared taxi system unavailable (Jin, et al, 2018). However, other study found the different impacts depend on the type of public transport system. Shared taxi pulled people away from public bus and light rail while complemented to heavy rail (Clewlaw and Mishra, 2017). The system also encourage modal shift from private vehicle use (Hampshire, et al., 2017). The service reflect a shift away from vehicles as products to vehicle

as a mobility services (Clewlaw and Mishra, 2017) and prosumer situation that most people consumed what they produced themselves (Toffler, 1981).

Behavioral research related new life style associate with shared economy especially online shared taxi is still limited and most of literature written in English focused exclusively on the U.S (Jin, et al., 2018). The rate of adoption of the system is high for adult people while it is not popular for elderly society (Clewlaw and Mishra, 2017). The study also found that higher adoption rate and utilization in metropolitan areas and urban neighborhoods of cities. The difficulties to find parking space for their vehicle is the top reason to use shared taxi system while avoiding driving when drinking is another favorite reason. It is acknowledge the profile users of shared taxi are younger, better-educated and more affluent individuals (Clewlow & Mishra, 2017; Rayle et al., 2016). The system also highly associated with access to information and communication technology (ICT) and smartphone. The variation of service level may influenced by low-income neighborhoods and spatial employment density (Jin, et al, 2018). The discrete-choice approach is famous and commonly used in the various studies of travel demand such as adoption and utilization of shared taxi system. The degree of possibility to choose and use shared taxi system could be divided into several level from impossible to very possible. In this case, the ordered logit model that used to observe changes of people decision on the upgrading of vehicle ownership level (Dargay and Hanly, 2007) is suitable to capture the adoption and utilization of shared taxi. The possibility to use shared taxi as a substitute mode for daily trip may follow these ordered: (a) not possible; (b) possible; (c) very possible.

The ordered logit model was applied to capture the transition possibility to choose the online taxi as an alternative mode as follows:

$$y^* = \beta' x + \varepsilon, \qquad (1)$$

$$Y = \begin{cases} 0 & \text{if } y^* \le \mu_1, \\ 1 & \text{if } \mu_1 < y^* \le \mu_2, \\ . & \\ N & \text{if } \mu_N < y^* \end{cases} \qquad (2)$$

where y^* represents the observed responses of the possibility to use shared taxi as a substitute mode which was explained in above paragraph respectively. The **β** is vectors of parameters, **x** is vectors of independent variables associated with the household and μ is threshold value that divides a continuous joint distribution of error terms ε into intervals associated with different levels of possibility to use shared taxi (y=0 represent impossible; y=1 to represent possible answer and y=2 is very possible). The ordered logit model was developed by considering: (a) individual attributes: age, gender and job/occupation as full time worker; (b) socio-economic attribute: Income, vehicle ownership or access to use private vehicle; (c) barrier to use public transport; and (d) perceive evaluation on the merits of online taxi system.

3. LOCATION OF STUDY

Semarang is the capital city of Central Java Province and the fifth largest city in Indonesia located around 450 km in the eastern part from the capital city of Jakarta. It is located in between two main cities in Java Island, Jakarta and Surabaya city. Total population of city is 1,595,267 persons and 471,327 households (as of 2015) and total area of a little more than 370 square kilometres. The gross regional domestic product (GRDP) per capita at 6,461.5 USD (1USD=13,000 IDR) and the largest contributor to GRDP is secondary sector such as manufacturing food, beverage and tobacco, chemical and pharmaceuticals, and other industry

such as textile and transport equipment (IGES,2017). The build-up of Semarang and surrounding areas has led to urban sprawl that placed strain on transport services and infrastructure. The city also face various physical challenges due to its coastal geography, such as tidal flooding, erosion, land subsidence and rising sea levels. These issues present serious challengers for Semarang, making it increasingly important to become more resilient. Then, Semarang became member of the Rockefeller 100 Resilient Cities (100 RC) program and developed a Resilience Strategy (Semarang City Government, 2016) with components on mobility that aim to encourage residents to shift from private vehicles to public transport (BRT system).

Bogor is located 60 km from the capital city of Jakarta. It is known not only as the residential areas of many people who work in Jakarta, but also as short tourism destination (botanical garden, summer palace and others) and also educational hub that is home to the country's largest agricultural university. Bogor has been growing as one of supporting cities to Greater Jakarta, or so-called JABODETABEK covering cities of Jakarta, Bogor, Depok, Tangerang and Bekasi. This situation provides strategic potential for the economic and social development and growth. Total population more than one million people, growing at a relatively steady rate of approximately 1.8 percent based on recent data (Statistic Bureau of Bogor City, 2014). The population increase more three times within two decades from 1990 to 2010 (Kawaguchi, 2012). The total population is about 272,251 in 1990 and surpass 1 million inhabitants since 2012. On the same period, number of household increase about 5 times. However, average family size decreased from 5.42 people to 4.11 per household or around 20% since 1990 to 2013. Over a third of that population is under 20 years indicates further growth in the future. The gross regional domestic product (GRDP) per capacity is 11.57 million rupiah (Kawaguchi, 2010). Bogor city and Bogor Regency also play an important role as residential zone of the greater Jakarta metropolitan area and about 6% of employee residing in Bogor commute to Jakarta by railway and highway.

3.1 Urban Transport Situations and Daily Commuting Patterns

3.1.1 Semarang

The inner city transport relies heavily on road transport and the majority of people use private vehicles (80%) and 20% use public transport. The share of public transport consists of Angkot (minibus) (50%); quasi-BRT Trans Semarang (40%) and regular bus (10%). The angkot and regular bus cover 88 routes which serve by 1766 unit of angkot and 83 regular buses. While the quasi-BRT Trans Semarang which adopt all BRT standard without dedicated lane and still use mix traffic and share the road with other modes, cover 9 routes and serve by 153 buses (as of January 2019). Trans Semarang is expanding and it is expected to complete all 12 corridors in 2020 or 2021. The highest passenger volume of Trans Semarang is around 2677 passengers per hour per direction in corridor no 1 which is almost same with passenger volume in Beijing or Islamabad (ITDP, 2018).

Most of commuters use private vehicles (80%) and among them, 56.1% of respondents use motorcycle for their daily commuting trip while remaining 43.9% use private car. The intensive use of motorcycle also observed on the vehicle kilometer travelled of motorcycle is around 12,446 km/year, while car used slightly less at 11,680 km/year. The average travel cost of BRT Trans Semarang user's is 9,492 rupiah per trip and average total travel time include access and egress around 60.85 minutes. While for Angkot users, average travel time for commuting around 35 minutes and travel cost around 8052 rupiah per trip.

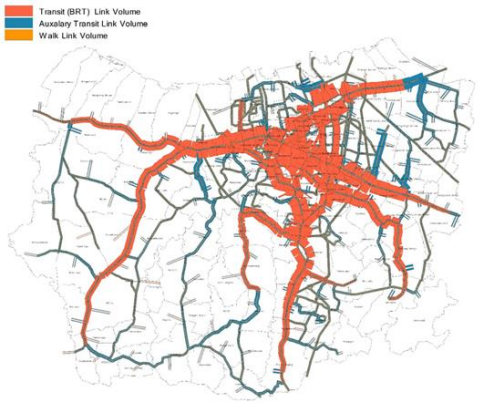


Figure 1. Passenger Volume of Trans Semarang & other public transport modes

3.1.2 Bogor

The inner city transport also relies heavily on road transport. The railway pass through the city serves for mainly inter-city trip to Jakarta in the north and Sukabumi in the south. Public transport within the city serve by mini transit (minibus) type "Angkot" and a simplified bus rapid transit (BRT) system namely Trans Pakuan commenced in 2007. The modal share of angkot is 50% of motorized commuting trip in Bogor in 2002 (Kawaguchi, 2010). The share of Trans Pakuan is roughly about 0.2% of inner city trip (Kawaguchi, 2012). However, due to rapid motorization of private vehicle (either car or motorcycle), share of public transport mode (angkot) decreases to 18% in 2010 (Kawaguchi, 2012), while on the same period, private vehicle increase dramatically. The registered motorcycle increase five times only in 8 years from 2002 to 2010. The number of motorcycle registered in the city more than 207,000 units (as of 2010) and the population of private car is 50,000 units in 2010 which is almost double compare to the population of private car in 2002.

For their daily inner trip, most of respondents in Bogor also use private vehicle (74.9%) and public transport (Angkot and Bus) only around 8.1% and the other use shared taxi or walking. As for the home base trip, average departure time for commuting: 07:45 AM; average travel distance: 7.28 km and average travel time: 25 minutes. The average travel cost: 6,650 rupiah per trip. The vehicle kilometre travelled of car is 11,713 km/year & Motorcycle around 6,286 km/year.

3.2. Travel Survey

3.2.1 Semarang

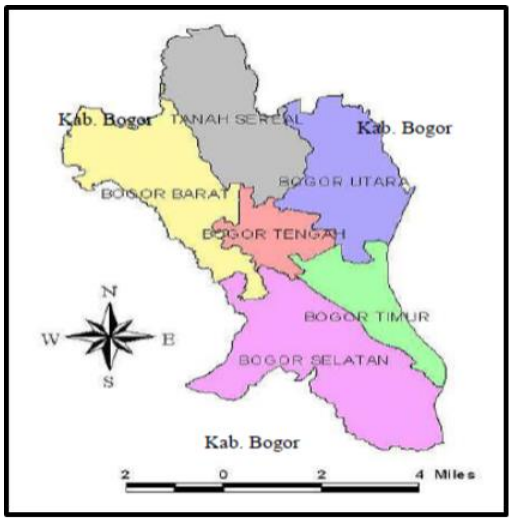
The first survey was parking lot survey administered in October – December 2016 for about 671 private vehicle users at several parking areas of shopping malls or other commercial centers. This survey focused to explore travel activities by private vehicles (car and motorcycle) users within the city. The second onsite interview survey administered in July – September 2017 for 600 respondents of two targeted groups of (a) user of quasi-BRT Trans Semarang and (b) non-users of quasi-BRT. The users of BRT defined as frequent user at least twice in a week while non-users was mainly less frequent users of BRT (once a week or less), angkot (minibus) users, and user of other modes. The onsite interview survey for user was done in all 6 corridors and 300 respondents was gathered from 50 respondents randomly selected at each corridor. While the other remaining 300 non-BRT users was randomly

selected at 5 regions in Semarang: north, east, west and central Semarang. The inner city trips around 93.1% and inter-city trip from surrounding cities to city center about 6.9% in which almost half came from western part of the city. The survey for Trans Semarang also shows the highest passenger movement at the east and west direction to be concentrated in the city center area.

Figure 2 Survey in Semarang (2016 & 2017)

3.2.2 Bogor

Household interview survey administered in January – March 2018 for 600 respondents in Bogor City. The respondents of home interview survey was selected randomly based on the area/village level at 6 sub-district in Bogor. The number of respondents in each village was proportionally determined based on total population and population density at each village and district (Figure 3).



Sub-districts	*Respondents*
Bogor Barat	136
Bogor Tengah	74
Bogor Timur	45
Bogor Selatan	119
Bogor Utara	109
Tanah Sereal	125
Total	**608**

Figure 3 Household Interview Survey in Bogor (2018)

The questionnaire includes several information related to (a) individual attributes (age, gender, education, income, working status, etc); (b) household energy consumption include transport sector; (c) awareness on energy saving/participation in social activities; (d) vehicle ownership; (e) daily trip survey and (f) access to essential services.

3.2 Demographics of Respondents

3.3.1 Semarang

Looking at the demographic of respondents, male drivers of private vehicles (either car or motorbike) are dominant (69.7%) while in contrast, public transport dominated by female user (57% of BRT users and 63 % of Angkot/Minibus users). The largest users of private vehicles are adult respondents of 21-30 years old, while most users or public transport (BRT and Angkot (minibus) or regular bus) are below 20 years (Table 1). Students and university students are major users of public transport (Trans Semarang and Angkot). While full time workers are major users of private vehicles (car and motorcycle) (Table 2). By comparing three different modes, we found retired person use BRT rather than private vehicles nor angkot. Since most users of Angkot and Trans Semarang are students and university students, their income is less than 2 million rupiah or equal to 143 USD/month (1 USD=14,000 rupiah) (Table 3). Most of public transport users (88.6% of BRT users and 94.4% of Angkot users) had income less than 4 million rupiah per month, while 12.5% of private vehicle users had income more than 5 million rupiah per month.

Table 1 Age Distribution in Semarang City

Age	Private Vehicle Users (N=671)	BRT Users (N=300)	Angkot users (N=300)
< 20	26.2%	28. 7%	41.3%
21-30	30.3%	24.3%	26.0%
31-40	18.0%	12.7%	11.7%
41-50	15.5%	14.3%	9.3%
51-60	9.0%	14.0%	7.0%
>60	1.0%	6.0%	4.7%

Source: Author Survey

Table 2 Occupation of respondents in Semarang City

Occupation	Private Vehicle Users (N=671)	BRT Users (N=300)	Angkot users (N=300)
1. Full time workers	41.7%	-	-
a. Government officers	-	6.7%	3.0%
b. Private company	-	32.2%	21.7%
2. Owner/Part time workers	12.7%	6.0%	5.3%
3. Student and University student	39.8%	35.7%	51.4%
4. Retired Person	1.2%	3.0%	2.3%
5. Un-employee	-	1.7%	0.3%
6. Housewife	-	8.0%	8.3%
7. Others	4.6%	6.7%	7.7%

Source: Author Survey

Table 3 Income Level of respondents in Semarang City

Income	Private Vehicle Users (N=671)	Income	BRT Users (N=300)	Angkot users (N=300)
< 1 Mil	30.1%	< 2 million	61.3%	73.7%
1-2.5 M	30.6%	2.0-3.9 Millions	27.3%	20.8%
2.6-5	26.8%	4.0-5.9 Millions	6.7%	3.3%
5.1-10	11.4%	6.0-8.0 Millions	2.7%	2.0%
>10 Mil	1.1%	> 8 millions	2.0%	0.0%

Source: Author Survey

3.3.2 Bogor

The home survey in Bogor captured the average age of respondent is 46.6 years old, full time workers (34.8%) and hold a college degree (53.6%). We found a large proportion (30.2%) of housewife in Bogor due to home interview survey which was done in both weekdays and weekend days. It was slightly different to the onsite survey in Semarang. The largest group (31%) had monthly income around 7.6-10 million rupiah and most of them (71.5%) had income lower than 10 million rupiah. Most of respondents in Bogor owned at least one motorcycle, while very few did not own a private vehicle (3.6%) (Table 4). In case of Bogor city, the largest group of respondents had combination of motorcycle and car (41.6%).

Table 4 General Information about respondents in Bogor

Category		Frequency(N=602)
Gender	Male	50.8%
	Female	49.2%
Age	Below 20	0.0%
	21-30	8.8%
	31-40	19.8%
	41-50	37.5%
	51-60	23.4%
	>60	10.5%
Occupation	Full time workers	34.8%
	Part time workers	11.0%
	Students (and university students)	0.2%
	Retired Person	8.8%
	Housewife	30.2%
	Others	15.0%
Education Level	Postgraduate	6.3%
	Graduate from university or college	53.6%
	High school or lower than undergraduate student	40.1%
Household Income	Less than 1 million rupiah	3.3%
	1-3 million rupiah	
	3-5 million rupiah	18 %
	Greater than 5 million rupiah	78.6%
Vehicle ownership	Motorcycle owner	40.8%
	Private Car Owner	13.8%
	Combination of Motorcycle and Car	41.8%
	Non-owner	3.6%
	Verbal information	16.4%
	Paper based information	20.1%

Source: Author's survey

3.3 Barrier to Use Public Transport

To capture the reason behind low modal share of public transit in both city, we use questionnaire survey to capture and explore the barriers to use public transport system in both cities. The limited coverage areas is the top barrier to use public transport among private vehicle users (N=671) in Semarang city. Without dedicated lane for the quasi-BRT Trans Semarang, there was no such benefit on travel time and it was observed as the second top

reason on the barrier to use Trans Semarang. While for Angkot, the barriers are security issues, comfortability and travel time (Figure 4). Travel time and comfortability also key issues on the barrier of citizen to use public transport in Bogor city (Figure 5).

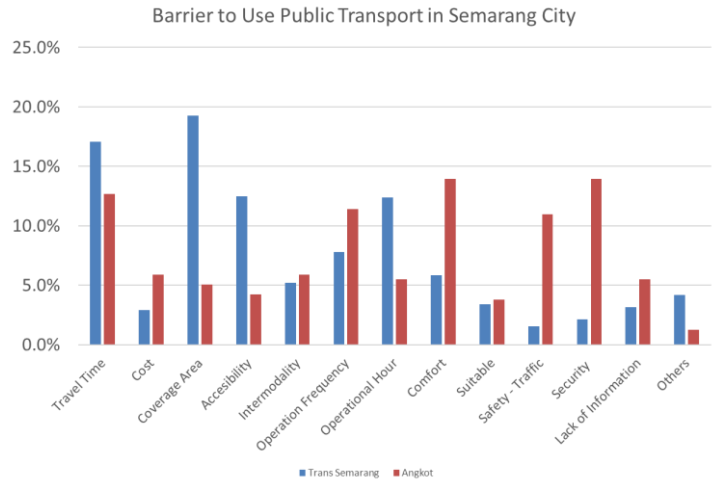


Figure 4. Barrier to use public transport in Semarang City

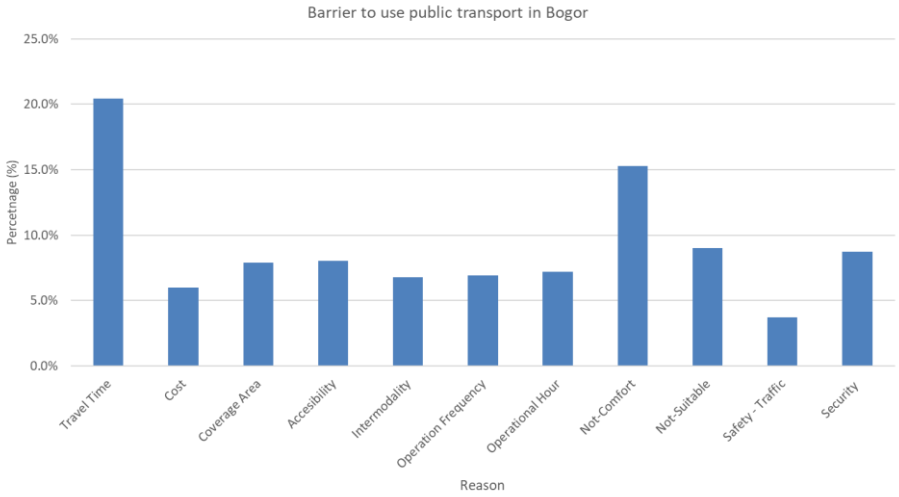


Figure 5. Main barrier to use public transport in Bogor

4. ADOPTION; UTILIZATION AND PREFERENCE TO USE SHARED TAXI

The existing data shows the high share of private vehicle use in Semarang and Bogor and main barrier to use public transport are services areas, travel time and comfortability of public transport. The shared taxi system (motorcycle taxi and regular shared taxi) play a key role to fulfill these gap as a substitute mode (Rayle et al., 2016). While other researcher found the shared taxi also pulled people away from public bus (Clewlow and Mishra, 2017). It is important to explore the situations in both cities to have better understanding on the local phenomena in Indonesian cities.

4.1 Adoption and Utilization of Shared Taxi as Substitute Mode

To evaluate the role of shared taxi as substitute mode of the current or existing mode, we ask respondents to answer the possibility to choose shared taxis (car taxi and motorcycle taxi) for the daily activities and provided three options to represent the possibilities which are: (a) very

possible; (b) possible and (c) impossible. The respondents was also need to explain the reason behind their decision to use shared taxi as the alternative modes for these following reasons: (a) to reduce travel time; (b) affordable cost; (c) efficient (not necessary to change mode); (d) not necessary to walk; (e) discount of travel cost and (f) security and comfortability (only applied for regular taxi). The respondents need to compare those above considerations and give appropriate score from most important (score 1) to less important (score 5 for motorcycle taxi and score 6 for regular taxi) for all variables.

In general, we found utilization of shared taxi is higher in Bogor city compare to Semarang city. Looking at the comparison among mode, the utilization of motorcycle taxi is higher than regular car taxi in both cities (Table 5). The home interview survey in Bogor confirm the high share of private vehicle use (75%) while only 10% of respondents use Bus and minibus (Angkot) for their daily activities. In contrast, most of respondents are public transport users in Semarang city. In term of coverage areas of public bus system, Trans Semarang covers 9 corridors while Trans Pakuan Bogor only serve about 4 corridors. The coverage areas in term of total routes serve by Angkot in Semarang also wider than Bogor. To reduce travel time is top reason to select shared motorcycle taxi. While security and comfortability is the major reason to select shared taxi (regular car). Both reasons are consistent across cities (Table 6). The discount or promo on travel cost of motorcycle taxi and regular car taxi is least attractive for respondents in Semarang.

Table 5 Possibility to use shared taxi system

No	Modes	Semarang (N=600)			Bogor (N=608)		
		Very Possible	Possible	Impossible	Very Possible	Possible	Impossible
1	Motorcycle taxi	7.3%	28.5%	64.2%	41.0%	43.8%	15.2%
2	Regular taxi	1.8%	15.3%	82.9%	29.0%	51.2%	19.8%

Table 6 Rank on the important of several reasons to choose shared taxi

No	Descriptions	Semarang		Bogor	
		Motorcycle taxi	Regular Taxi	Motorcycle taxi	Regular Taxi
1	Reduce Travel Time	2.15	3.14	1.67	2.64
2	Affordable Cost	3.35	4.13	1.94	2.74
3	Efficient (not necessary to change the mode)	2.43	2.53	2.32	3.1
4	Not necessary to walk	2.65	2.70	2.23	2.97
5	Discount/Promotion on travel cost	3.63	4.04	2.20	2.99
6	Security and Comfortability	n/a	1.94	n/a	1.86

4.2 Impacts of Shared Taxi on the Modal Shifts

The existing literature suggests that shared taxi can compete with regular taxi but it plays double roles as complements and competes with public transit system (Jin et al, 2018). Looking at the modal shift patter involving shared motorcycle taxi (ojek), the passenger users of formal transit system BRT Trans Semarang coming from Angkot's (mini/micro transit) user (28.7%); motorcycle (26.3%) and regular bus (22%). While angkot users originally use pick-up and drop off by other person and motorcycle. However, we also found reverse direction from public transport users became motorcycle users based on our interview with 600 private vehicle users in 2016. The survey found reverse phenomena of modal shift from public transport to private vehicle (motorcycle, 37.4%) due to mainly two reasons: (a) travel

time and (b) flexibility. They shifted from public transit to motorcycle usually at 21.04 years old in parallel with initial start to formal work to get their own income that led to affordability to buy motorcycle by themselves. Public transit (BRT) users will use these following modes as substitute mode such as: (a) minibus (angkot); (b) motorcycle; (c) regular bus and (d) ojek (motorcycle taxi) (figure 6).

In Bogor, due to limited data of bus users and lower services of public buses and public transport mainly served by minibus or Angkot, we also found similar transition process from angkot user to motorcycle user then gradually shift to car. However, the role of shared motorcycle taxi (Ojek) as substitute mode observed clearly in Bogor. Motorcycle users tend to use Ojek rather than return to use angkot as substitute mode (figure 7). Further analysis is necessary to understand the decision making process by considering individual attributes, socio-economic aspects and perceived evaluation on the system itself.

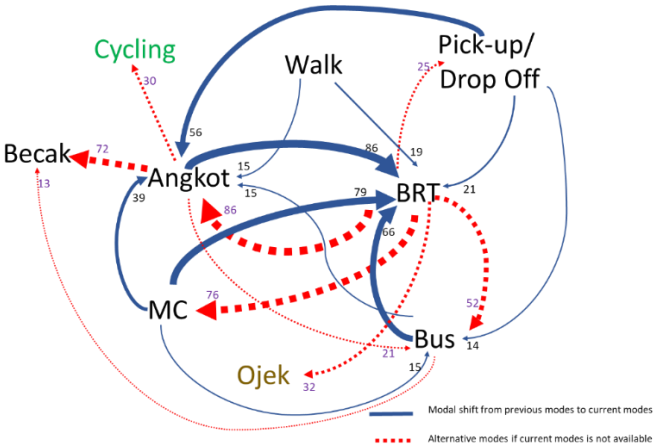


Figure 6 Modal Shift pattern in Semarang City

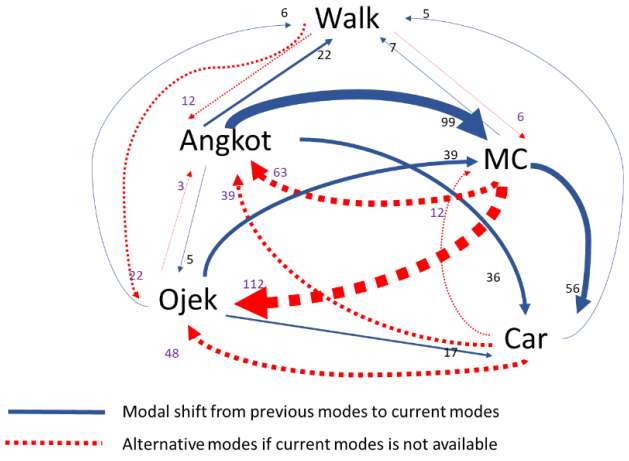


Figure 7 Modal Shift pattern in Bogor City

4.3 Estimation Results of the Preference Use of Shared Taxi system

We apply ordered logit model to identify influential factors on possibility to use shared sharing taxi as substitute or alternative mode. The dependent variable is level of possibility which were expressed into 3 levels (Y=0; 1; 2). Estimation result shown in Table 7 was calculated by using software LIMDEP (NLOGIT) (Greene, 2002).

First, we understood the possibility to use shared taxi are different across mode and

across city. The estimation results confirm that the possibility of motorcycle taxi is positive while in contrast, regular taxi had negative constant in Bogor city. It shows that motorcycle taxi is more preferable for Bogor's citizen rather than shared car taxi. Second, by comparing the constant coefficient for motorcycle taxi in Bogor compare to Semarang city, we found negative sign indicates shared motorcycle taxi system is not a substitute mode for public transit users (BRT users and minibus users) in Semarang city. Looking at model performance, the highest coefficient of Mc Fadden rho-squared was observed in Semarang city. The model had highest fit to represent existing data gathered from the survey. The threshold value (μ) that divides a continuous joint distribution of error terms ε into intervals associated with different levels of possibility is substantively and statistically significant in the estimation results. The constant term $\mu_{(1)}$; represent the threshold parameter between possible and very possible level. The estimate threshold parameter between impossible and possible is also clear and significant.

Looking at the individual attributes, female respondents give positive and significant influence on the possibility to choose regular online taxi in Bogor. While in contrast, female respondents less possible to choose shared motorcycle taxi in Semarang. It is follow the logical reason that regular taxi may suitable and less gender-sensitive aspect compare to shared motorcycle taxi for women users. The ownership or access to use private vehicle also had significant correlation with the selection of online taxi system. We found positive and significant correlation for respondent who don't have access to use car. The utilization of shared motorcycle taxi as substitute mode may increase in Semarang city. The ownership of multiple vehicles (combination of car and motorcycle) may also increase possibility to choose motorcycle taxi as an alternative mode in Bogor city. The reason to avoid driving and difficulty to find parking place may encourage private vehicle owner to use shared taxi. The result confirm and support the initial findings from previous research that the effects of shared taxi on vehicle ownership is still unclear and ambiguous (Clewlow and Mishra, 2017). The attribute age of respondent also construct the logical decision on the possibility to use shared taxi system as also mentioned in the previous study (Clewloe and Mishra, 2017; Rayle et al., 2016), however, the result is insignificant probably due to limited sample size in this study.

Key elements on the decision to use shared taxi as substitute mode may highly associated with perceived evaluation on the merits of the system itself. All variables show positive and significant influence on the possibility to choose shared taxi as substitute mode if the existing mode is unavailable. The specific variable embedded to the shared car taxi, security and comfortability, also gives positive and significant impacts on the decision to use shared taxi as an alternative or substitute mode. The model also helpful to evaluate the role of shared taxi system with existing public transport services at each city. Passenger users of public transport such as BRT Trans Semarang tend to avoid the shared motorcycle taxi as substitute mode and a similar situation found for shared car taxi in Bogor. It may represent the complementary role of shared motorcycle taxi for public transit system in Semarang city. While, due to respondent's top reason on travel time as the barrier to prevent them using public transit system, shared regular taxi could not compete with public transport system in Bogor city. This result indicate dual role of shared taxi which different depending on the transit service level and quality in each city. The improvement on public transport system may effective to control or manage the shared taxi system.

Table 7 Estimation results of ordered logit model

Variable	**Bogor**		**Semarang**
	Y_1(Shared Ojek)	Y_1(Shared Taxi)	Y1(Shared Ojek)
	Beta (t-score)	Beta (t-score)	Beta (t-score)
Constant	0.799 (1.981)**	-0.915(-2.189)**	-1.024(-2.518)**

Household Attributes			
Age of respondent	-0.093(-1.595)	0.073(1.139)	-0.001(-0.988)
Female	0.200(1.438)	0.302(1.979)**	-0.001(-3.012)**
Fulltime workers	-0.169(-1.180)	-0.224(-1.495)	0.056(0.927)
Income	-0.025(-0.656)	-0.002(-0.047)	0.244(1.332)
Vehicle Ownership			
Ownership of multiple vehicle (Car& Motorcycle)	0.320(2.328)**	0.156(1.072)	n/a
Don't have access to Motorcycle	n/a	n/a	0.032(0.154)
Don't have access to Car	n/a	n/a	0.807(3.991)***
Evaluation/Rank about Shared Taxi			
Reduce Travel Time	0.236(4.988)***	0.195(4.906)***	0.258(4.172)***
No need to walk	0.128(2.715)***	0.140(2.927)***	0.208(3.070)***
Discount Price/Travel Cost	0.112(2.625)***	0.230(5.921)***	0.224(4.011)***
Security & Comfort (only for Taxi)	n/a	0.154(4.379)***	n/a
Barrier to use public Transport			
Barrier relate to travel time	-0.003(-0.414)	-0.156(-4.392)***	n/a
No barrier (already use BRT for commuting)	n/a	n/a	-0.960 (-4.701)***
Threshold parameter for index (μ)			
$\mu_{(1)}$:	2.28 (15.154)***	2.698(16.818)***	2.567(13.440)***
Model's Attributes			
Degree of Freedom	9	10	11
AIC	1.561	1.349	1.456
BIC	1.677	1.481	1.650
Mc Fadden Pseudo R-squared	0.079	0.185	0.242

5. CONCLUSION

This article aims to explore and analyze influential factors on possibility to choose shared taxi system as a substitute or alternative in Indonesian cities. The analysis was done by using travel survey data and apply an ordered logit model that consider household attributes, socio-economic condition and urban transport services. Travel survey was performed through face-to-face interview in June to August 2017 of 600 respondents in Semarang city and in January to March in 2018 of 600 household in Bogor city Indonesia. The explanatory variable selected in the model give meaningful information on behavior model, threshold parameter also clear and significant which is helpful to identify level of possibility to use the shared taxi system in both city.

The empirical studies confirmed modal shift from private to public transport and vice versa mainly due to (a) service level of public transport and (b) affordability to own private vehicle. Improvement and increasing level of service of public transport may encourage modal shift from private vehicle to public transport and modal shift from another means of public transport. However, ownership and accessibility to private vehicle may also pull back a shifting from public to private vehicle. The role of sharing motorcycle taxi system is fulfilling the gap in between above two situations in Bogor city.

The ordered logit model is helpful to explore influential factors on decision to choose

shared taxi system. The possibility to choose shared taxi system could be an ordered process from impossible to another level of possible, culminating with very possible. There is a clear threshold between these levels. Looking at the decision making process by individual travelers, first, female user tend to choose shared car taxi system rather than motorcycle taxi types due to its comfortability and security. It is gender-sensitive issue related and embedded to shared motorbike taxi. Second, access to use private vehicle may reduce the probability to choose the online sharing system. Finally, perceive evaluation on the merits of the system by individual respondent as a catalyst the selection process. All above factors may increase the demand of shared taxi system in developing cities.

The dual role of shared taxi system and public transport system could be as a competitor or could be a supplement to transit system. Sufficient level of service of public transport encourage people to use transit and put the shared taxi as supplement or feeder to overcome the first and last mile problem of using transit system. The evidence based on comparison analysis of shared motorcycle taxi in Bogor and Semarang city. Sufficient and convenience level of service of BRT Trans Semarang make citizen willing to use it and avoid shared motorcycle taxi system.

Finally, it is important to highlight some limitations to the study. There is a limitation of the result of study due to data availability and variables that used to evaluate the decision making process. Second, the sharing taxi system may associate with accessibility to internet services and smart phone users, an intensive survey should focus to this group of respondents.

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