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Muhammad Halley Yudhistira
Visiting Fellow, The Australian National University, mhyudhistira@ui.ac.id

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How Congested Jakarta is? Perception of Jakarta's Citizen on Traffic Congestion

Muhammad H. Yudhistira[a,*], Decky Priambodo K.[b], Sonny H.B. Harmadi[c], Andhika Putra Pratama[d]

[a] *Visiting Fellow, The Australian National University*
[b] *Department of Public Work, DKI Jakarta*
[c] *Department of Economics, Faculty of Economics and Business, Universitas Indonesia*
[d] *Lembaga Penyelidikan Ekonomi dan Masyarakat, Fakultas Ekonomi dan Bisnis, Universitas Indonesia*

Abstract

This paper aims to reveal the behavior and perception of Jakarta's citizens on traffic congestion in Jakarta. Although this approach is somewhat well-developed in behavioral science, its utilization in urban economics study, is still limited. Detecting the traffic congestion and its cause mainly relies on physical (engineering) methods, i.e V/C ratio. Here, we define the traffic congestion through two variables; ordinal traffic congestion perception and proportion of expected travel time to perceived travel time. Using a non-probabilistic sampling survey held in one of densest business district in Jakarta called Sudirman-Thamrin Golden Triangle Area; the estimation results show that travel behavior plays a major role in affecting travel time perceptions.
Keywords: Traffic Congestion; Travel Time; Travel Behavior; Perception

Abstrak

Studi ini bertujuan untuk melihat tingkah laku masyarakat Jakarta terhadap kemacetan di Jakarta. Pendekatan yang digunakan dalam studi ini telah banyak dikembangkan dalam studi behavioral science, namun penggunaanya dalam studi ekonomi perkotaan masih terbatas. Mendeteksi tingkat kemacetan serta penyebabnya umumnya mengandalkan metode fisik seperti V/C ratio. Studi ini mendefinisikan tingkat kemacetan ke dalam dua variabel, persepsi tingkat kemacetan ordinasl serta proporsi dari ekspektasi waktu perjalanan terhadap waktu perjalanan actual. Dengan menggunakan survey non-probabilitic sampling di Sudirman-Tharim Golden Triangle Area, hasil estimasi menunjukkan bahwa perilaku perjalanan (travel behavior) berperan utama dalam mempengaruhi persepsi waktu perjalanan.
Kata kunci: *Tingkat Kemacetan; Waktu Perjalanan; Perilaku Perjalanan; Persepsi*

JEL classifications: R40; R41

1. Introduction

As the largest and densest urbanized areas in Indonesia, Jakarta experienced severe traffic congestion for a quite long time. Along with flooding, massive urbanization, and urban slum, traffic congestion is categorized as biggest challenges in Jakarta. The congestion level in Jakarta has increased twofold during 1985–2000 causing potential loss as much as 65 trillion rupiahs in 2020 (Harmadi 2006). This calculation is based on two parameters, loss due to vehicle operational costs (28.1 trillion rupiahs) and the cost of longer travel time (36.9 trillion rupiahs). The calculation does not account cost of environmental deterioration (i.e. air and noise pollution), cancelled transaction, lower productivity and competitive advantage relative to other major big cities (McFadden 2007; Boarnet, Kim, & Parkany 1998). Hence, potentially, the number of potential losses due to traffic congestion in Jakarta is higher than predicted.

Transportation Planning of DKI Jakarta (2007) suggests that there are four main problems as the

*Corresponding Address: Indonesia Project – The Arndt-Corden Department of Economics – Crawford School of Public Policy – The Australian National University, Canberra ACT 0200, Australia. *E-mail*: mhyudhistira@ui.ac.id / mhyudhistira@lpem-feui.org.

source of traffic congestion. It consists of road interconnection problem, roadway misuse due to of user's discipline, lack of additional road infrastructure, and high growth of private transportation modes. In order to provide a better traffic in Jakarta, it is believed that the government should manage those challenges as well as providing a better service in transport infrastructure.

Among those barriers, lack of additional road infrastructure and high growth of private transportation modes believed as the main causes of traffic congestion. The number of private vehicles users in Jakarta has grown faster than roadway and railway growth. During 1999–2003, private vehicles users has grown 6.3% annually, reaching its peak with average growth almost 10% in 2003. On the same period, motorcycle had experienced its highest growth, as high as 7.9% annually on average, and reached its peak around 14.3% in 2003. In the other hand, during 2000–2003, Jakarta roadway has only grown 2.09% or less than one percent annually. Bearing those condition in mind, another transport data also shows that, by the year of 2002, most of transportation mode used by people in Jakarta is private vehicles (54%), where 40.3% of them is using private car and the rest using motorcycle. (Jakarta Metropolitan Area Police Office, Traffic Division Unit 2004).

A persistent unbalanced growth of transportation supply and demand leads to longer travel time in almost all roadways in Jakarta, especially in the rush hours (morning and evening). Continuous growing in suburban area of Jakarta, namely Bodetabek, generates unbalanced urban structure which creates excessive commuting inflow in the morning and outflow in the evening toward central of Jakarta. Some studies attempt to measure the level of the traffic congestion by various metrics, i.e. lower speed at rush hours (Mochtar & Hino 2006) and V/C ratio (Anindia, Verhaeghe, & Zondag 2007). So far, those metrics are mainly dominated by engineering approaches which examine the congestion problem in macro context. They measure the level of congestion by using a certain unit of area or road as unit analysis. On contrary, behavioral approaches using individual or household as unit analysis are still underutilized.

This paper attempts to investigate the relation between trip behavior and perception of Jakarta's and its suburban areas' citizen toward traffic congestion. Using a trip survey held in the central of Jakarta, we measured the congestion level by asking the respondents to evaluate how severe the congestion level as well as the perceived ideal travel time compared to the actual travel time. We show that Jakarta's congestion level is perceived at severe level using both measurements and the perception is associated with the frequency of being caught in congestion, trip purpose, and transport cost. We also find socio-economic variables also affect the perception.

This paper is structured as follows. The first section contains the introduction and literature work, including previous study in measuring congestion in Jakarta and the neighboring areas, the second part explains the methodology and survey, and the last section is analysis and concluding remarks, then followed by recommendations.

2. Literature Review

Urban traffic congestion has been a major problem in big cities in the world, particularly for those which have vast emerging suburban areas. Congestion can be defined as a situation in which demand for road space exceeds supply, making the impedance vehicles impose on each other, due to the speed-flow relationship, in conditions where the use of a transport system approaches capacity (Transport Research Centre 2004). Severe traffic congestion generates many externalities, taking form of increasing travel time, pollution (air, noise, etc.), excess fuel consumption, and traffic accidents.

One of the most criticizing externality produced by congestion is the increasing travel time. It creates lower speed of goods, services, peoples, information, and in turn, hampers regional economic growth. Because of this externality, basic transportation economics theory believes that urban congestion level tends to below its optimum level. The nature of roadway is not pure public goods which still characterizes as rivalry goods in some level. Additional road user will directly cost other road users by increasing their travel time or opportunity cost (O'Sullivan 2006). This process exists as long as the users do not necessarily incur the cost they cause and will end until the roadway nearly reaches its capacity.

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Considering huge impact of urban traffic congestion, there are abundant studies about the nature of congestion in transportation engineering. They have produced many measurements to understand the level of traffic congestion of a certain area. Some common basic measurements include: (1) traffic density, (2) average travel speed, (3) maximum service flow rate, (4) a ratio of traffic volume to road capacity (V/C), (5) average daily traffic volume, and (6) daily vehicle miles of travel (Laetz 1990). Several studies developed much more complicated congestion indexes, which are locally acceptable, i.e. Texas Transportation Index's Roadway Congestion Index (Schrank & Lomax 1997), ACCESS index (Boarnet, Kim, & Parkany 1998), hydrodynamic models of fluid and turbulent flow (McFadden 2007), and urban Mobility Index (Wilbur Smith Associates 2008). Transportation engineering approach in measuring urban congestion as part of consumer behavior can be seen as a "macro" approach; it calculates the level of congestion using roadway or area as the unit analysis. This 'macro' model somewhat neglects the human existence as subject and object of congestion and its policy. It cannot catch the rationality behind the behavior of the people who travel in a particular roadway or area which the transportation economics model does. However, as emphasized by (McFadden 2007) level of modeling of behavior depends on the nature of the problem. He suggests physical analogies for aggregate, long-term forecasting, economic optimizing models while economic models of behavior in transportation. Study by Li (2003) introduced travel environments and individuals' expectancy as a part of determinants in understanding travel behavior. Later in this study, we use those variables to understanding travel behavior in Jakarta.

Several studies trying to investigates travel behavior has been conducted to capture individuals' preference on travel behavior. Study by Venezia (2009), focus on finding the right determinants of demand for public transport, by understanding individuals' preferences toward using bus. This study helps in finding area to improve in order to move people's preference from using private cars, to bus transit.

Prior studies predicting individuals travel behavior using perceived time travel has been introduced by Saw, Katti, & Joshi (2016) in Surat, India. It is found that most of socio-economic variables used in study, such as age, gender and education, did not have significant result in understanding individuals travel behavior. Meanwhile, only intensity of environmental disturbance along the route who is significantly correlated with travel time behavior. On another study, Poon & Stopher (2011), also points out that habitual travellers who makes the same journey multiple times, are likely to have successful prediction towards travel-related condition.

3. Method

3.1. Questionnaire Design

This study heavily relies on primary data mining and use questionnaires to collect the data. This study takes several steps to finalize the questionnaire. Early step defines all important variables and conduct a pre-test survey to validate the questionnaire and to gather inputs from respondents. Along with the pretest survey, interview with urban and transportation experts are undertaken to ask their opinion about the draft of questionnaire. The pretest survey result and the interview input are incorporated to finalize the survey.

3.2. Model Estimation

This study observes the relationship between time inefficiency, as a proxy of preference towards congestion and the transportation behavior using two approaches. Firstly, we use the explicit evaluation using an ordinal scale answer, where "1" is considered as normal congestion and "5" as a very severe congestion. Congestion function for the first approach is written as,

$$\begin{aligned}\text{Congestion} &= \alpha + \beta_1\text{Cost} + \beta_2\text{Freq} + \beta_3\text{Income}\\ &+ \beta_4\text{Sex} + \beta_5\text{Educ} + \beta_6\text{Purpose}\\ &+ \beta_6\text{Distance} + \beta_7\text{Modes} + \beta_8\text{Age} + \mu\end{aligned} \quad (1)$$

The second approach is measuring the efficiency level of commuting time by using the proportion of expected travel time divided by actual perceived time. The function for second approach can be written as,

$$\begin{aligned}\text{CongestionRatio} = &\ \alpha + \beta_1\text{Cost} + \beta_2\text{Freq} \\ &+ \beta_3\text{Income} + \beta_4\text{Sex} + \beta_5\text{Educ} \\ &+ \beta_6\text{Purpose} + \beta_6\text{Distance} \\ &+ \beta_7\text{Modes} + \beta_8\text{Age} + \mu\end{aligned} \quad (2)$$

We use similar explanatory variables for both approaches in understanding individual behavior toward congestion. In general, our explanatory variables consist of two types of variables. The first one is transport-related variables, including *Cost*, *Freq*, *Purposes*, *Distance* and *Modes*, and socio-economic variables such as *Income*, *Sex*, *Educ*, and *Age*.

Cost is defined as the rupiahs we spent during our travel from origin to the destination. *Cost* denotes in ten thousand rupiahs per kilometer, and consists of several components, including fuel and toll fees for private transport, and fees for public transport users. Private transport user may avoid some traffic congestions through toll way while public transport user can benefit from better but more expensive than other public transports. In that way, travel cost for private transport is higher and, in our hypothesis, will lead to negative relationship with perceived congestion.

Freq captures how frequent the individual experiences the congestion on daily trip. It measures not only the occurrence of congestion in one-way trip, but also how many days in a week, respondents experience with the congestion. For that purpose, respondents were asked to evaluate their experience with the congestion when performe their main trip. We provide the responses in questionnaires using an ordinal approach, from "1" to "5", where "1" is considered as never experienced congestion, and "5" as always experienced congestions. *Purpose* is defined as individual reason to travel during the time survey was conducted. We divide the answer between working purposes and other purposes.

We define *Travel distance* as distance traveled by respondents from their starting point (origin) to their destination and measured in kilometers. Travel distance is assumed to increase the perceived congestion burden. Longer distance enables the respondent to face more traffic jams. Explanatory variables *Age* is used as additional socio-economic variables to enrich our estimation in understanding individuals travel behavior. However, there is no strong theory about how one gender would perceived a better or worse travel time as another.

Transportation mode variables reflects medium of transportation that the respondents choose to travel. We choose several modes of transportation such as, private cars, motorcycle, bus, and train. All those modes have their own advantages regarding to the characteristics of origin-destination of the respondent. For example, regarding to poor connection of Jakarta's public transport, private transports are more likely. However, those are not reliable enough to deal with the congestion. On contrary, other transportation modes offer a better travel time, such as train, who are less likely to deal with congestion.

On socio-economic variables, we define *Income* as a respondent average monthly disposable income in general, including their basic salary and allowances. We expect that people with high income reveals higher perceived congestion rather than lower income people, since they face higher opportunity cost. They tend to expect shorter travel time to go to their destination. We also include dummy variable Sex to distinguish perceived congestion between male and female. We assign 1 for male and 0 otherwise. We also use explanatory variables *Educ* to reflect the level of education that the respondent has achieved. The level of education is expected to have positive relationship, since educated people is believed to be patient and have better understanding about the cause of congestion.

3.3. Data and Source of Data

The survey was conducted to collect information from people in Golden Triangle Area, both who commute using private cars or public transportation. During the period of study, the transportation infrastructure around to Golden Triangle Area consists of train, bus, mini-bus, and taxi. This survey is conducted in 2008, consists of three blocks of questions. The first block aims to collect general information on respondents' travel behavior. The second block aims to gain people perception on travel behavior when several conditions applied. The third block is aims to collect general profile of the respondents, including their background and financial capacity.

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In order to generate an accurate estimation and strong generalization in this study, probabilistic sampling applied in constructing the survey. It prerequisites that all sample must be taken randomly from the population list that gives equal probability of each population members to be chosen as sample (Sugiyono 2002). We include the respondents both people who lives in Jakarta and people who lives in sub-urban who make trip to Jakarta on regular basis.

The fundamental problem occurs when the list of population is not available since there is no related census database dealing with Jakarta's transportation behavior. It causes the probabilistic sampling does not work. At last, purposive sampling which is categorized as non-probabilistic sampling is applied.

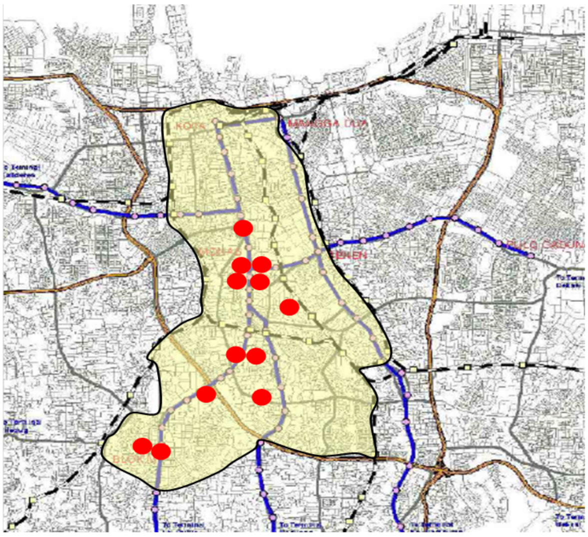

Figure 1: Planned Road Pricing Implementing Area (Yellow Area) and Survey Location (Red Dots)

The next step is to decide which area the survey should be undertaken. After examining all the possible area in Jakarta, it is decided that the area of survey is as can be seen in Figure 1 which is proposed by SITRAMP as ERP area. This area is so-called extended "3 in 1" implementation area which characterized as the center of business and office in Jakarta, most crowded and dense area. It covers Monumen Nasional (Monas), Sudirman–Thamrin Corridor, H.R. Rasuna Said Corridor, Jalan Gatot Subroto Corridor, and Prof. Dr. Satrio Roadway. Red dots show the locations in which the survey was undertaken.

4. Result and Analysis

4.1. General Descriptive Analysis of Transportation Behavior of Respondents

5-day survey generated 411 samples with 100% validity. But, due to some missing values, it is 376 samples only that can be used in empirical estimation. All of the 35 missing values is caused by respondents who declined to answer the question. Of all samples, 58.8% of respondents is male and the rest is female. Age varies from 17 to 70 years with the minimum education is elementary school and the maximum is doctoral degree.

Main transportation of the respondent is private car which accounts for 28.8%, following by motorcycle (23%) (Figure 2). In the other hand, public bus is the most unreliable transportation mode since 14.9% respondents choose it as an alternative transportation mode not be used in daily trip. It indicates a high dependency upon private transports while public transport tends to be neglected as a reliable transport. As emphasized in SITRAMP[1] study, if the quality of Jakarta's public transport does not improve, the dependency on private transport will increase. The people of Jakarta and the suburban area tends to change their transportation mode from public transport to private transport.

In this study, time travel is the main reason in choosing main transportation mode. 53.4% respondents reveal it, followed by safety (19%) and travel cost (17%) (Figure 3). However, even travel time is the main consideration, average time travel is still considered as high. Respondents need 70.9 minutes on average to go to their destination while 37.7 minutes is the ideal time or 56.3% of current time travel (Table 1). This proportion varies, especially toward transportation mode.

Interesting issue arises when the attributes of main transportation mode is compared to alternative

[1] The Study on Integrated Urban Transportation Master Plan. Conducted by Japan International Cooperation Agency (JICA) and Indonesian National Planning Development (Bappenas).

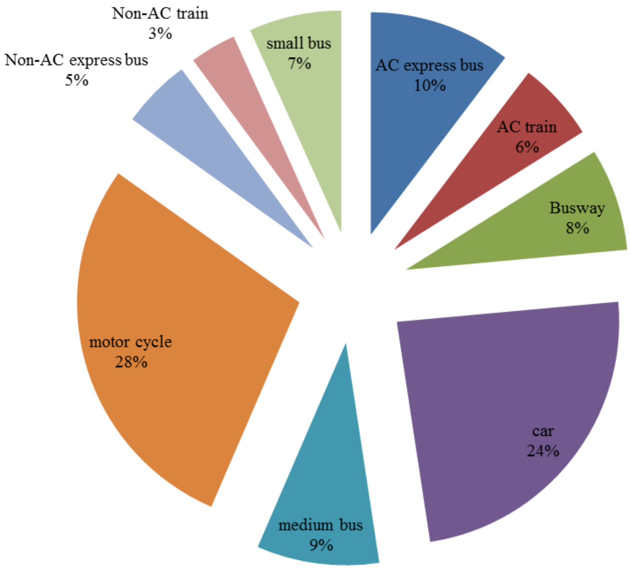

Figure 2: Main Transportation Mode
Source: Survey result

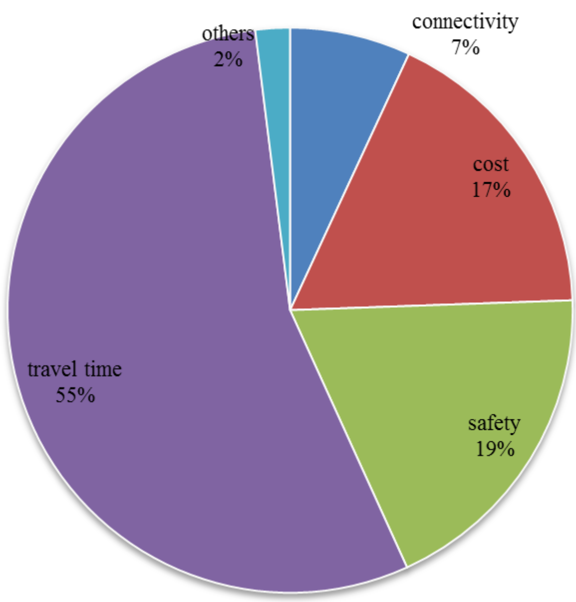

Figure 3: Main Reason in Choosing Transportation Mode
Source: Survey result

Table 1: Proportion of Ideal Travel Time Divided by Preceived Time

Characteristics	Average	Sample
Purpose		
Working	0.567	378
Not working	0.509	33
Origin		
Jakarta	0.574	227
Bodetabek	0.548	184
Transportation Mode		
Car	0.508	100
Motor cycle	0.614	116
Bus	0.538	157
Train	0.651	38
Total Respondent	0.563	411

Source: Survey result

mode (Figure 4). In this survey, there are 4 main attributes defined, which are connectivity, travel cost, safety, and time travel. We define connectivity as how many times respondents need to change their transport modes during its travel from their origin to their destination. Time travel is defined as the time spent by respondents from their origin to the destination. We also measure safety as how safe people feel during its travel from their origin to their destination. Lastly, we define travel cost as the rupiah being spent by respondents to reach their destination on one way trip from their respective origin.

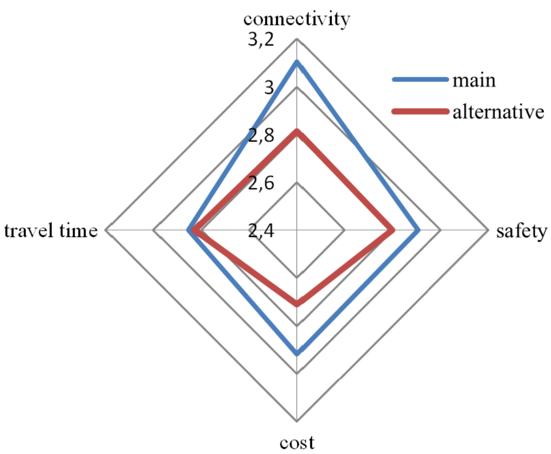

Figure 4: Comparison Among Attributes Between Main Mode and Alternative Mode
Source: Survey result

Respondents are asked to evaluate both, main transportation and alternative modes in respect to those attributes in cardinal scale. 1 refers to bad and 4 for excellent. Apparently, even time travel is the main reason in choosing mode, there is no significant difference in time travel between those two. Instead, connectivity and travel cost shows a significant difference. It does not rule out the fact that time travel is the most important. A severe congestion in Jakarta drives all type of transportations move slower and, in turn drive the time travel is quite similar among transport modes even some respondents perceive quite significant difference. But now, people cannot rather than relies on time travel only, they start to extensively incorporate other attributes, especially connectivity and travel cost. For example, private transport offers higher connectivity than mass transport does, since people did not need to change their mode of transportation when using private transport.

Another interesting figure is when transportation mode is cross-tabulated with travel distance. According to the basic transportation theory, further travel distance leads people to change their transportation choice into longer haul characterized transportation. In this case, public transport, especially railway and bus is more reliable than any private transport in serving longer distance. Survey result shows a similar pattern (Table 2).

4.2. Empirical Results

Empirical result for Equation (1) is presented in Table 3 and 4, respectively. The Table 3 presents the estimation result for perception toward congestion, while the Table 4 shows the result for Proportion of ideal travel time divided by actual perceived time. For both results, low R^2 value indicates weak explanatory level of estimated model. However, F-statistics for overall model and t-statistics for many variables are significant. It provides enough reason to employ the result for further analysis.

In the Table 3, among explanatory variables only frequency in experiencing congestion and income are significant. Other variables have no clear relationship in affecting the perception since all of them do not statistically differ from zero.

The coefficient of the *frequency* in experiencing congestion is positive and significant at 10% level. It can be explained as more frequent people experience congestion when traveling generates worse perception of congestion. As noted earlier, the higher frequency not only refers to more congestion

Table 2: Proportion of Transportation Mode Based on Travel Distance

		Transportation Mode					Total
		car	motor cycle	train	bus	others	
Travel Distance (km)	< 1	0.2	1.5	0.0	1.9	0.0	3.6
	1–3	1.0	2.2	0.0	2.4	0.0	5.6
	3–5	0.5	2.9	0.0	1.9	1.0	6.3
	5–10	2.2	4.4	0.2	5.6	0.0	12.4
	10–15	5.8	3.4	0.2	5.8	1.0	16.3
	15–25	8.5	7.8	1.7	9.2	0.7	28.0
	> 25	5.1	5.6	6.8	8.3	1.9	27.7
Total		23.4	27.7	9.0	35.3	4.6	100.0

Source: Survey result

Table 3: Perception Toward Congestion: Logit Estimates

Independent Variables	Perception toward congestion 0=normal, 1=worse, 2=worst			
	I	II	III	IV
Transport cost per km	-0.104	-	-0.0354	-0.0446
	(0.0932)	-	(0.168)	(0.162)
Frequency	0.741*	0.756*	0.714*	0.756*
	(0.137)	(0.135)	(0.138)	(0.142)
Income	0.423**	0.352**	0.375**	0.493**
	(0.180)	(0.143)	(0.178)	(0.195)
Sex	-0.0329	-0.0555	-0.0482	0.0541
	(0.212)	(0.208)	(0.220)	(0.233)
Year of education	-0.00424	-	-	-0.0140
	(0.0512)	-	-	(0.0532)
Purpose	-	-0.0674	-	-0.0542
	-	(0.150)	-	(0.170)
Distance	-	-	0.102	0.131
	-	-	(0.180)	(0.184)
Age	-	-	-	-0,0289*
	-	-	-	(0.0111)
Mode				
Motorcycle	-	-	0.00428	-0.147
	-	-	(0.338)	(0.354)
Bus	-	-	-0.109	-0.270
	-	-	(0.287)	(0.302)
Cut-off 1	2.756*	2.338*	2.656*	1.695
Constant	(0.897)	(0.505)	(0.633)	-1.085
Cut-off 2	3.737*	3.343*	3.642*	2.702**
Constant	(0.898)	(0.510)	(0.636)	-1.085
Pseudo R^2	0.0513	0.0506	0.0520	0.0654
Loglikelihood	-370.5	-380.9	-373.5	-359.6
Observations	370	379	373	364

Note: (1) Values in parentheses indicate t-statistics. *, **, *** indicate level of 1%, 5%, and 10% significance respectively.
(2) transport cost, income, distance in natural logarithm ($\ln$).

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spot met in single trip, but implicitly reflects more days in a week the individual experiences congestion in daily trip as well.

The estimation result also reports that the coefficient of income is positive and significant at 5% level. This result confirms our previous hypothesis, that people with higher income experienced more severe congestion. Understandably, they are burdened with higher opportunity cost and demand much better traffic congestion than lower income people. It brings a consequence that for a same level of congestion, higher income people leads to vote worst congestion.

Table 4 employs the proportion of ideal travel time divided by actual perceived time as dependent variable provides richer result since there are more significant variables in the estimation result. This study uses ordinary least squares (OLS) as method of estimation. Our previous hypothesis expects the coefficient for travel cost is positive if we use the proportion of ideal time as dependent variable. It means that higher travel cost should indicates better transportation modes, and generates better travel time. However, the estimation is showing different result. It shows a negative and significant correlation between travel time and ratio of ideal time to perceived time. A possible explanation of this results is that the congestion in Jakarta has reached the worst condition, where changing transportation mode from the first best mode into the second best does not provide a significant improvement in travel time. This explanation confirms the fact presented in Figure 3. Respondents asked to evaluate the attributes of their main transportation mode and alternative mode. The result is that there is not much difference between both modes. Another possible explanation is that higher travel cost for better transportation mode generates higher expectation for better travel time. Since the traffic did not change much, the expectation of better travel time did not meet the perceived time.

The *frequency* variable coefficient has significant negative sign. The result is similar with our hypothesis and the estimation using ordered logit. An increase in frequency experiencing congestion would increase the perception. In this case, it will reduce the perceived proportion of travel time. As emphasized earlier in first model, higher frequency in experiencing congestion would directly lower their travel speed. Hence, the gap between current travel time and expected ideal travel time gets wider.

The coefficient of the trip *purpose* dummy variable has negative significant sign suggesting that respondents who travel for working perceive better traveling time rather than those whose purpose is other than working. The possible explanation of this condition is that people who daily commute with working purposes are possibly more realistic toward current condition of Jakarta transportation system. This leads to lower expectation on their expected travel time.

In terms of distance, it suggests that the further people travels, the worse their travel time expectation. One of the possible explanation for this results is that the longer people travels, the higher possibility of traffic jam occurred (for those who used road-based transportation), or the higher possibility of train-related disturbance, such as signal interference, station queuing (for those who used rail-based transportation). The quadratic results for distance interpreted as even though people could expect a higher possibility of traffic jam when they travel at a longer distance, at one point, the traffic will lessen as the distance shortened.

The choice of main transportation modes also plays a significant role in perceiving the congestion. This study use private car as basis. The estimation results for both motorcycle and public transportation could not explain whether using motorcycle or public transportation is resulting better perception on travel time.

Among socio-economic variables, education plays a significant role in forming expectation toward congestion. The coefficient for years of education is negative and significant at 5% level. This result is contrast with our previous hypothesis. It seems that educated people are more optimistic about their expected travel time. They believe that their travel time can be much improved if the congestion is well managed.

5. Conclusion

This paper tries to investigate the behavior of perception toward traffic congestion in Jakarta. In order to do so, we analyze a simple non-probabilistic individual-level survey undertaken in Jakarta's Golden Triangle Area at 2008. To measure

Table 4: Proportion of Ideal Travel Time Divided by Actual Perceived Time

Independent Variables	Ratio			
	(1)	(2)	(3)	(4)
Travel cost	-0.319**	-0.0443*	-0.032**	-0.0424**
	(0.0128)	(0.0136)	(0.0158)	(0.0179)
Frequency	-0.0889*	-0.0809*	-0.0887*	-0.0821*
	(0.0153)	(0.0167)	(0.0152)	(0.0172)
Income	0.0157	-0.00538	-0.00290	0.0103
	(0.0163)	(0.0131)	(0.0143)	(0.0160)
Sex	-0.00873	-0.0113	-0.0135	-0.0138
	(0.0203)	(0.0196)	(0.0209)	(0.0208)
Year of Education	-0.0108**	-	-	-0.0102**
	(0.00464)	-	-	(0.00458)
Distance	-0.0387***	-0.168*	-0.0393	-0.160**
	(0.0219)	(0.0603)	(0.0249)	(0.0706)
Distance Sq.	-	0.0333*	-	0.0320**
	-	(0.0124)	-	(0.0137)
Purpose	-	-0.0248**	-	-0.0263**
	-	(0.0113)	-	(0.0114)
Age	-	-	-	0.000531
	-	-	-	(0.000984)
Mode				
Motorcycle	-	-	0.0273	-0.00700
	-	-	(0.0293)	(0.0325)
Public Transportation	-	-	0.00994	-0.00996
	-	-	(0.0236)	(0.0264)
Constant	0.987*	0.885*	0.833*	1.020*
	(0.0788)	(0.0585)	(0.0564)	(0.0929)
R^2	0.180	0.222	0.165	0.228
F-stat	17.78	16.65	13.99	11.97
Observations	366	369	369	360

Note: (1) Values in parentheses indicate t-statistics. *, **, *** indicate level of 1%, 5%, and 10% significance respectively.
(2) transport cost, income, distance in natural logarithm ($\ln$).

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the perception, we employ two variables; (1) the explicit evaluation measured by ordinal scale, and (2) efficiency level of travel time measured as proportion of expected travel time divided by perceived actual time.

We found several interesting transport behavior variables that play a significant role in forming the perception. Many congestion spots in Jakarta which generates higher frequency in experiencing traffic congestion in daily trip go hand on hand with higher perception. The result also points out that the efficiency level is getting worst as the travel distance increases due to inadequate transport infrastructure.

Taking all the results into consideration, this study points out that there is a growing urge to improve the transport infrastructure in Jakarta to reduce traffic congestion in Jakarta metropolitan areas. By improving the transport infrastructure, we believe that the individuals perception towards congestion would be better as well as its expected travel time. We also believe that the traffic congestion can also be reduced by providing better option at public transport infrastructure.

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