Use of latent variables representing psychological motivation to explore citizens’ intentions with respect to congestion charging reform in Jakarta

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The aim of this paper is to investigate the intentions of Jakarta citizens with respect to the electronic road pricing (ERP) reform proposed by the city government. Utilizing data from a stated preference survey conducted in 2013, we construct six variables representing latent psychological motivations (appropriateness of ERP adoption; recognition that ERP can mitigate congestion and improve the environment; car dependency (CDC); awareness of the problems of cars in society; inhibition of freedom movement caused by ERP; and doubts about the ability of ERP to mitigate congestion and environment problems). A multiple-indicators multiple-causes (MIMIC) model is developed to investigate the effects of respondents’ socio-demographics (causes) on the latent constructs in order to gain better understanding of the relationship between respondents’ intentions and the observed individual’s responses (indicators) obtained from the stated preference survey. The MIMIC model offers a good account of whether and how socio-demographic attributes and individual indicators predict the latent variables of psychological motivation constructs. Then, we further verify the influences of the latent variables, combining them with levy rate patterns and daily mobility attributes to investigate significant determining factors for social acceptance of the ERP proposal. A latent variable representations based on the generalized ordered response model are employed in our investigations to allow more flexibility in parameter estimation across outcomes. The results confirm that there is a strong correlation between latent psychological motivations and daily mobility attributes and the level of social acceptance for the ERP proposal. This empirical investigation demonstrates that the latent variables play a more substantial role in determining scheme’s acceptance. Moreover, elasticity measures show that latent attributes are more sensitive compared to levies and daily mobility attributes. Therefore, in order to gain the acceptance of the majority of road users, a gradual introduction of ERP may be needed to allow users to gain understanding of the scheme, thereby gaining a more acceptable response. The findings from this work should provide insight for the Jakarta government in designing a more effective and acceptable policy aiming at promoting the adoption of ERP in Jakarta.

Keywords: citizens’ intentions; ERP; MIMIC; latent constructs; psychological motivations; GORM; public acceptance; Jakarta

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1. Introduction

Jakarta, the capital of Indonesia, is one of the largest metropolitan areas in the South Asia region. As with many metropolitan areas in the world, it has been urbanizing rapidly and has undergone substantial changes in the recent years. High economic growth has led not only to rapid urbanization, but also to expansion of the metropolitan area as the suburbs absorbed much of the population influx from outside.

Jakarta is the country’s major population and economic center. The region’s share of gross domestic product is estimated to be 19%, amounting to approximately US $118.7 billion (BPS, 2010). The population of Jakarta accounts for 10% of the nation’s total, and it has increased 1.6 times in 20 years from 17 million in 1990 to 28 million in 2010 (JUTPI, 2012). The apparent population of Jakarta is also influenced by the growing number of commuters from surrounding municipalities such as Bogor, Depok, Tangerang, and Bekasi. Commuting trips from peripheral municipalities to Jakarta increased by roughly 1.5 times from 2002 to 2010 (JUTPI, 2012).

The city relies heavily on road transportation, with private vehicles taking a mode share of almost 80% of trips (JUTPI, 2012). The Jakarta police authority reported 7.5 million and 2.1 million registered motorcycles and passenger cars, respectively, in 2010. This represents an increase of 464% (motorcycles) and 201% (cars) compared to the base year (2000). The tremendous number of motor vehicles results in huge economic losses arising from worsening traffic congestion. Estimates for 2002 suggest that US$300 million was lost in wasted vehicle operation costs and US$250 million in travel time (SITRAMP, 2004). In spite of integrated projects such as bus rapid transit (BRT), the Jakarta outer ring road, and the 3-in-1 high-occupancy vehicle (HOV) system implemented by Jakarta’s Government, congestion has increased in recent years as motorization accelerates. Consequently, a number of externalities are manifested by motorized traffic, including excessive travel times, air pollution, excessive energy consumption, and driver frustration. Such problems have affected Jakarta particularly badly in recent decades, as extraordinary growth in motorization has taken place. Accordingly, the government of Jakarta needs to act strategically to deal with motorization-related pressures.

A policy of transportation demand management is the most promising approach to reducing dependence on motorized transport in Jakarta. An electronic road pricing (ERP) scheme is planned to replace the existing 3-in-1 HOV, which has had insufficient effect in alleviating traffic congestion (JUTPI, 2012). Recently, Jakarta’s Government began an ERP trial in Jakarta. This first trial, which started on 15 July 2014, is scheduled to last about three months (Tempo, 2014). There a few preliminary studies have been conducted to explore the prospects of ERP prior to its implementation in Jakarta. Yet, several researchers conducted preliminary studies in preparation for the ERP proposal. Among these, Prayudianto, Tamin, Driejang, and Umami (2013) carried out an assessment of environmental issues considering various road pricing scenarios. Yagi and Mohammadian (2009) and Yagi, Nobel, and Mohammadian (2013) analyzed activity-based travel demand when a road pricing policy is applied. More recently, Sugiarto, Miwa, Sato, and Morikawa (2014a) explored transportation budget frontier in household spending with respect to the ERP proposal, while a preliminary analysis of public acceptance of ERP in consideration of Jakarta citizens’ consciousness was also carried out by Sugiarto, Miwa, Sato, and Morikawa (2014b).

Transport pricing is regarded as the most effective measure to reduce private motorized traffic. Road pricing implementations in Singapore, London, and Stockholm have successfully mitigated traffic jams (see for example Eliasson & Mattsson, 2006;
Loukopulos, Jakobsson, Garling, & Fujii, 2006; Olszewski & Xie, 2006; Phang & Toh, 1997). Therefore, it is argued that road pricing could improve mobility in Jakarta as well by reducing car traffic. However, public acceptability is perhaps the greatest obstacle in advance of adoption of such a policy. This is a crucial issue and it is most important to understand what might improve the public’s support for such a scheme. We need to know how citizens or users will evaluate an ERP proposal and then respond to it by investigating their unobserved preferences. This is affected by whether they will receive benefits from the scheme or, rather, find their private mobility affected. The aim of this study is therefore to investigate the determinants of public support for an ERP scheme in the context of a developing Asian country. In contrast to developed countries, there is only a small body of literature regarding citizens’ acceptability of transport pricing in the context of Asian communities.

This investigation looks at Jakarta citizens’ intentions with respect to the ERP proposal introduced by their city government. Utilizing data from a stated preference survey conducted in 2013, we construct six variables representing latent psychological motivations (appropriateness of ERP adoption, recognition that ERP can mitigate congestion, and improve the environment, CDC, awareness of the problems of cars in society, inhibition of freedom movement caused by ERP, and doubts about the ability of ERP to mitigate congestion and environment problems). A multiple-indicators multiple-causes (MIMIC) model is developed to investigate the effects of respondents’ socio-demographics (causes) on the latent variables in order to gain better understanding of the relationship between respondents’ intentions and observed individuals’ responses (indicators) extracted from the stated preference survey. The MIMIC model offers a good account of whether and how attributed socio-demographics and individuals’ indicators predict the latent structures of psychological motivation constructs. Then, we further verify the influences of the latent variables of psychological motivations by combining them with levy rate patterns and daily mobility attributes to investigate significant determining factors on the social acceptance of the ERP proposal. We employed latent variables representation based on the generalized ordered response model (GORM) to allow more flexibility of parameter estimation across outcomes. Lastly, elasticity analysis is conducted in order to provide several insights into implication of the estimation results.

The remainder of this paper is organized into several sections that describe the survey and data profiles, develop the model, set up the empirical data-set, carry out the model estimation, and conduct elasticity and willingness to pay analysis. The conclusions and recommendations of the study are presented at the end of the paper.

2. Literature review

Since most transport reforms are associated with externalities, there has been a great deal of policy development aimed at internalizing these issues. A widely accepted economic theory of road pricing was developed by Pigou in 1920 and Knight in 1924 based on the concept of external effect. Growing personal mobility leads to unsustain-able externalities, leading to particular interest in how transport planning policies might moderate the pressures (Cools et al., 2011). A general agreement is that these issues need to be solved by encouraging changes in travel behavior. In this context, congestion charging methods such as road pricing schemes appear to be the most effective instruments (Schade & Schlag, 2003; Steg & Schuitema, 2007, Chapter 9). The ultimate goals of such schemes include achieving efficient infrastructure use, efficient infrastructure
provision, and improved financial viability (Link & Stewart-Ladewig, 2005). Moreover, Litman (2002) and VTPI (2014) stated that road pricing has two general objectives: revenue generation and congestion management. Examples of road pricing implementations in Singapore, London, and Stockholm that have effectively mitigated traffic congestion have been reported by Eliasson and Mattsson (2006), Loukopulos et al. (2006), Olszewski and Xie (2006), and Phang and Toh (1997). In respecting a case of Singapore, fascinating success was shown because of reflecting more a culture of obedience toward officialdom. Whereas in the UK was seen as the most prominent that has been successfully practiced charging policy in larger city.

A congestion pricing implementation could be addressed several beneficial impacts for societies. For instance, Transport for London (2004) reported that traffic reductions of 15–20% were achieved after implementation of congestion charge. Most impacts, arising from reduced traffic, will be beneficial. There could be an essential reduction in traffic accidents due to reducing in autos traffic. Moreover, Green, Heywood, and Navarro (2014) showed that the policy generated a substantial reduction in both accidents and fatalities in the charged area. They further demonstrate that the congestion charge reduced accidents and fatalities in adjacent areas, times, and for uncharged vehicles. These results further depict that congestion charge to more broadly promote change driving habits, lead to safety improvements. Further impacts of reduction in autos traffic, the congestion charge sought to reallocate road space from private cars to public transport. Furthermore, Transport for London (2004) estimates that roughly half the increase is due to the improved bus service and half to the congestion charge. Further exploration by Leape (2006) reported that the rise in the number of individuals entering central London by bus exceeded predictions by almost 50% from autumn 2002 to autumn 2003, bus passengers entering the charging zone in the morning peak period by bus rose by 29,000, an increase of 38%.

Despite well established a rationale that congestion pricing strategy able to combat badly auto traffic including several beneficial impacts such as improving safety and enhancing public transport ridership. Yet, in the same time, it is difficult to implement. Public is skeptical in general about accepting a pricing policy, significant opposition arises particularly among car users. Several road pricing proposals have been dropped for lack of public support, such as a proposal in Edinburgh (see Gaunt, Rye, & Allen, 2007) and one in New York City (see Schaller, 2010). For examples, in Edinburg and Manchester, the public glare of referenda was rejected charging proposals by majorities 70–80%. Furthermore, the extension of congestion pricing in London has also been abolished due to local opposition including genuine concern about effects on businesses in more suburban areas (Wilson, 2013). These exhibits that there are serious barriers to the pursuit of transport charging, and that the governments need clear guidance to make better use of this powerful transport pricing policy.

The major challenge in implementing road pricing is to design a road pricing scheme that is both acceptable to the public and effective in achieving the objective of more sustainable mobility (Francke & Kaniok, 2013). Transport pricing has always been a controversial and debatable concept since it involves the issue of equity. A number of authors (Goh, 2002; Ison, 2000) have pointed out that willingness to adopt road pricing depends on political will, public acceptance, budgetary constraints, and the availability of alternatives. There are several perspectives that need to be balanced in order to achieve and effective and fair policy, namely those of the user, traffic authority, and society (see for example Cracknell, 2000; Litman, 2002; VTPI, 2014). Public
acceptability and social concerns remain a major barrier to implementation (Chain, 2005; Rentziou, Milioti, Gkritza, & Karlaftis, 2011).

A rich body of literature can be found on the topic of congestion charging acceptability. Schuitema, Steg, and Forward (2010) examined factors that affect acceptability judgments of pricing policy. They concluded that the acceptability of a scheme is well explained by determinants such as personal outcome expectations and expected effects of the policy implementation. This result is in line with Schade and Schlag (2003), who found that the degree of acceptability correlates positively with personal outcome expectations and perceived effectiveness of the policy. Furthermore, extensive (psychological) studies have been carried out to identify individual factors that affect public support, indicating that the acceptability of transport pricing appears to be explained by a wide range of determinant factors. However, previous surveys (such as Eriksson, Garvill, & Nordlund, 2006, 2008; Jakobsson, Fujii, & Garling, 2000; Kim, Schmocker, Fujii, & Noland, 2013; Steg & Schuitema, 2007, Chapter 19) noted that psychological motivations are significant contributors to the rate of gain public support. Empirical evidence has shown that collective awareness of problems, policy fairness, and perceived effectiveness have direct and indirect effects on charging acceptability.

Further exploration by Gehlert, Nielsen, Rich, and Schlag (2008) demonstrated that behavioral adaptation to road pricing, manifested in ways such as preference for a particular revenue allocation, appears to have an influence. Moreover, public support really depends on individual constraints such as a person’s character, attitudes, opinions, means of transport, and alternative transport modes. Citizen approval strongly corresponds to individual perceptions of the policy, such as the environmental benefits, improved freedom of movement, understanding of the charging system, and allocation of a scheme’s revenue (see Falzarano, 2009; Jaensirisak, Wardman, & May, 2005; Odioso & Smith, 2009; Sugiarto et al., 2014b). Specifically related to revenue allocation, general agreement is that investment in public transport is one of the more preferred options for the allocation of revenues. For example, Farrell and Saleh (2005) investigated revenue allocation in the city of Edinburg. Respondents were asked to indicate their level of agreement for a number of revenue allocation spending options. The result has shown that overall agreement on spending the revenues on improving public transport services. This in a similar vein to the results by Thorpe, Hills, and Jaensirisak (2000), based on survey in UK, the most popular allocation was on public transport improvements. They further found that there was a little support for spending on other issues such as for reducing general taxation or funding new roads. In case of Trondheim charging policy, it was to raise revenue to improve the transport system include spending revenue consisting of 82% on road building, and 18% on public transport, safety, and environmental improvements (Langmyhr & Sager, 1997).

In sum, several studies have shown that road pricing can improve mobility by cutting dependency on private automobile traffic. However, in many cases, the implementation of road pricing faces significant barriers. Lack of political and public support is perhaps the greatest obstacles prior to the implementation of a scheme. Therefore, it is crucially important to understand what determines these factors in order to enhance public support and gain acceptance for ERP adoption as an effective measures against gridlocked traffic in the city center of Jakarta.
3. Data

3.1. Survey

The study focused on one part of the city center of Jakarta. The target zone is the central business district (CBD), which is a dense mix of business and commercial areas (see Figure 1). The CBD attracts many visitors and is served by urban arterial roads that experience serious congestion. There is only one pleasant means of public transit serving the corridors into the city center, the trans-Jakarta BRT, so most visitors rely on private automobiles. Although Jakarta’s Government has being considered ERP since 2004 and scheduled to be implemented by the end of year 2014 (JUTPI, 2012; SITRAMP, 2004). However, insufficient of public transit serving within proposed charging corridors is the vital issue. With highly commuting trips to the city center, improving public transport services in terms of capacity and reliability scheduling is must be done prior to the implementation. Indeed, the Governor of Jakarta Mr Basuki Tjahaja Purnama mentioned that the first corridor of ERP (along the Sudirman–MH Thamrin corridor) will be tendered in mid of year 2015 Kompas (2015). Consequently, the Department of Transport (DoT) of Jakarta will provide approximately 51 new buses for the Jakarta’s BRT to serve first corridor along with free regular busses. The government argues that it urgently to apply ERP for first corridor as congestion is badly occurred along this corridor (the busiest corridor along city center). Then, complete ERP for whole corridors could be done after mass rapid transit (Jakarta’s mass rapid transit [MRT]) has been operated. Government has been targeted to operate first corridor of Jakarta’s MRT in the end of year 2017. Therefore, auto usages could be able to shift their mode from private to the public transit conveniently, such as Jakarta’s BRT and Jakarta’s MRT.

In this work, we applied a stated preference survey or opinion survey method (Li & Hensher, 2012; Louviere, Hensher, & Swait, 2000) to arrange questionnaire sheets. The stated preference (SP) questionnaire was designed to capture respondent’s related information such as visitor mobility characteristics, respondent’s acceptance to the ERP proposal, expectation of mobility responses after introducing the scheme and...

![Figure 1. (a) Jakarta region; (b) ERP charging zone (SITRAMP, 2004).](image-url)
socio-demographic attributes. Three patterns of charging proposals were designed and introduced to the respondents. As for charge, the Government of Jakarta has decided charge patterns refer to the (SITRAMP, 2004) document which is recommended by Japan International Cooperation Agency. The SP experiment that includes time of survey, target location, distribution methods, number of samples, charge, and refund patterns are summarized in Table 1. The description of the questionnaire is summarized in Table 2. Furthermore, the respondents were asked to answer a set of questions regarding ERP proposal which are related to their intentions on such scheme. The set of questions are related to individual’s psychological motivation corresponding to several measures including the appropriateness of ERP, recognition of ERP able to mitigate congestion and improve environment, CDC and its problem, inhabitation of freedom movement, and doubt about the merits of ERP as listed in Table 5 for more detail information.

Data were collected by direct interviewing and manually noted on questionnaire sheet by enumerators. The survey was conducted on 17 November–3 December 2013 in city center of Jakarta. Target respondents were visitors to the CBD, including commuters, shoppers, commercial visitors, and business establishment users. A total of 2100 questionnaires were distributed by randomly selected visitors, 1640 (80%) obtained by interviewing respondents and 420 (20%) distributed to several offices and collected in the following couple of days. A total of 1998 samples were collected/returned.

3.2. Demographics

Table 3 shows the socio-demographics characteristics of the respondents. It is noteworthy that young people (≤30 years) dominate the sample set, accounting for more than 60% of respondents. The gender distribution is slightly skewed toward males. As regards employment status, the data-set indicates that 69% who are employed, with less than 6% of the sample being housewives and unemployed. Commuters dominate the respondent population, with nearly 95% of respondents making mandatory trips to the CBD as workers or students. Notably, approximately half of the sample has a low-to-medium annual income (AI); that is, about 51.6% of the respondents have an AI up to 24 million IDR. According to BPS (2010), AI below 22 million IDR and ranges from 22 to 49 million IDR are corresponding to low- and medium-income classifications, respectively.

Table 1. Summary of SC experiment.

| Descriptions                           | 17 November–3 December 2013                  |
|----------------------------------------|----------------------------------------------|
| Time of survey                         | Central Jakarta and part of south Jakarta    |
| Target location                        | Direct interviews and collected by enumerator|
| Distribution methods                   | 2100 questionnaires                          |
| Number of questionnaires distributed   | 1998 (95.1%) questionnaires                  |
| Number of questionnaires returned      |                                              |
| Questionnaire patterns                 |                                              |
| Pattern 1 charge                       | 10,000 IDR                                   |
| Pattern 2 charge                       | 21,000 IDR                                   |
| Pattern 3 charge                       | 35,000 IDR                                   |
| Days of week collected sample’s share  |                                              |
| Weekdays (weekends)                    | 71% (29%)                                    |
Table 2. Summary of question categories in questionnaire survey.

| No. | Category                                           | Description                                                                 |
|-----|----------------------------------------------------|-----------------------------------------------------------------------------|
| 1   | Visitor mobility characteristics                   | Purpose of trip, number of accompanying persons, and mode choices          |
| 2   | General opinion of ERP, traffic congestion and the| Recognition, acceptability, and fairness of ERP                            |
|     | environment. Respondents were asked to choose among four responses to road pricing: | Inhibition of freedom of movement by ERP                                   |
|     | 1. well accepted                                   | Consequences of ERP implementation                                         |
|     | 2. accepted                                        | Opinion on present level of urban transport services                       |
|     | 3. not accepted                                    | Opinion on city center transport and environment                           |
|     | 4. not accepted at all                             | Extent of recognition of environmental issues                              |
|     |                                                    | Opinion on government policies                                            |
|     |                                                    | Opinion on use of income from ERP                                         |
| 3   | Respondent’s mobility responses to introduction of | Awareness of possible different visit behavior on day of survey under different charge schemes |
|     | road pricing charge scenarios                      |                                                                             |
| 4   | Individual socio-demographic characteristics       | Gender, age, driver’s license, employment status, annual income           |
| 5   | Daily mobility attitudes and responses to ERP     | Trip purpose, mode choices, frequency of using private modes, frequency of using transit, and frequency of visits to the CBD (in a week) |

Table 3. Summary of respondents’ demographics.

| Item                          | Category       | Frequency | Percentage (%) |
|-------------------------------|----------------|-----------|----------------|
| Age                           | Under 20       | 183       | 11.1           |
|                               | 20 to 29       | 819       | 49.9           |
|                               | 30 to 39       | 421       | 25.6           |
|                               | 40 to 49       | 168       | 10.2           |
|                               | 50 and older   | 51        | 3.1            |
| Gender                        | Male           | 852       | 51.9           |
|                               | Female         | 789       | 48.1           |
| Employment status             | Working        | 1132      | 69.0           |
|                               | Student        | 418       | 25.4           |
|                               | Housewife      | 67        | 4.1            |
|                               | Not working    | 24        | 1.4            |
| Annual household income       | Below 3.6 million IDR | 308 | 18.7          |
|                               | 3.6–6 million IDR | 360 | 22.0          |
|                               | 6–9 million IDR | 358       | 21.8           |
|                               | 9–12 million IDR | 174 | 10.6          |
|                               | 12–18 million IDR | 225 | 13.7          |
|                               | 18–24 million IDR | 91  | 5.5           |
|                               | 24–30 million IDR | 73  | 4.4           |
|                               | 30–36 million IDR | 21  | 1.3           |
|                               | 36 million IDR or more | 32 | 2.0          |

Table 4 describes respondents’ daily mobility attributes. The data reveal that close to 70% of trip makers are licensed drivers. However, this does not mean that 70% of trip makers used private modes to enter the CBD. It can be seen that the travel mode distribution is slightly skewed toward private modes. That is, 50.43% of respondents used
private modes to visit the target area of the pricing scheme (the CBD). These results depict similar results of mode’s share in Jakarta which reported by JUTPI (2012) that mode’s share is close to 50, 20, and 30% for private, public transport and non-motorized, respectively.

Turning to the purpose of the CBD visit, work, study, and going to school are predominant, accounting for about 60% of the respondents. Similarly, 60% of respondents visit the CBD quite often (3–5 days/week), with a possible reason for this being that nearly 60% of trip makers are commuters (for work or education). As expected, the data reveal that approximately 55.8% of respondents frequently use private modes (3–5 days/week). In contrast to private mode usage, almost 65% of respondents quite infrequently use public transit (1–2 days/month). The likely reason for this infrequent use of public modes is that there is only one pleasant means of public transit serving the corridors into the CBD, the trans-Jakarta BRT. Visitors naturally rely on private automobiles as the most convenient alternative mode.

4. Latent constructs of psychological motivations

4.1. Empirical data-set

Apart from the questions regarding the ERP proposal and socio-demographic characteristics, the respondents were asked to answer a set of 16 questions relating to six latent variables representing psychological motivations. The set of 16 psychological-related questions had ordinal responses, with respondents choosing a response from a four-point Likert scale. Each individual’s socio-demographic characteristics were specified in dummy variables. Variable notation, definition, and empirical setting of latent variables, indicators, and causes are summarized in Table 5.
The ordinal psychological-related questions included in the stated preference survey transform into latent variables representing constructs of psychological motivation. The first four variables are related to awareness of the proposed scheme, representing an individual’s perceptions with respect to the appropriateness of ERP adoption, recognition that ERP can mitigate congestion and improve the environment, CDC, and awareness of the problems of cars in society. Two remaining latent variables correspond to the attitudes toward the future prospects of the scheme if implemented, which indicate respondent’s expectations with regard to inhibition of freedom movement caused by ERP and doubts about the ability of ERP to mitigate congestion and environment problems.

4.2. Application of the model

The MIMIC model (Joreskog & Goldberger, 1975) involves using latent variables that are predicted by observed variables. The model explains interrelations between observed

Table 5. Description and empirical setting of latent variables, indicators, and causes.

| Var.    | Description, variable setting                                                                                                                                                                                                 |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ARP     | Appropriateness of ERP adoption                                                                                                                                                                                                 |
| REP     | Recognition that ERP can mitigate congestion and improve the environment                                                                                                                                                   |
| CDC     | Car dependency                                                                                                                                                                                                          |
| APC     | Awareness of the problems of cars in society                                                                                                                                                                             |
| AFM     | Inhibition of freedom movement caused by ERP                                                                                                                                                                             |
| DEP     | Doubts about the ability of ERP to mitigate congestion and environment problems                                                                                                                                           |

Table 5. Description and empirical setting of latent variables, indicators, and causes.

| Var.    | Description, variable setting                                                                                                                                                                                                 |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CRP     | ERP is correct policy, 1 = quite right, 4 = totally wrong                                                                                                                                                                    |
| ACP     | ERP will be accepted by the public, 1 = well accepted, 4 = not accepted at all                                                                                                                                              |
| FRP     | ERP is a fair policy, 1 = quite fair, 4 = quite unfair                                                                                                                                                                      |
| ICG     | ERP should be implemented to improve congestion, 1 = quite agree, 4 = totally disagree                                                                                                                                     |
| IGW     | ERP should be implemented to mitigate global warming (GM), 1 = quite agree, 4 = totally disagree                                                                                                                             |
| MCG     | ERP can mitigate congestion, 1 = much result, 4 = no result at all                                                                                                                                                           |
| MEP     | ERP can mitigate environmental problems, 1 = much result, 4 = no result at all                                                                                                                                              |
| CNL     | A car is absolutely necessary in daily life, 1 = quite necessary, 4 = quite unnecessary                                                                                                                                   |
| PNL     | Public transit (PT) is absolutely necessary in daily life, 1 = quite necessary, 4 = quite unnecessary                                                                                                                     |
| PAV     | PT is easy and convenient to use, 1 = quite easy, 4 = quite hard                                                                                                                                                            |
| TCG     | Traffic is congested in the CBD, 1 = quite congested, 4 = no congested at all                                                                                                                                              |
| PED     | The pedestrian environment is dangerous, 1 = quite dangerous, 4 = quite safe                                                                                                                                               |
| CGW     | Cars are the major cause of global warming, 1 = quite agree, 4 = totally disagree                                                                                                                                           |
| IFD     | ERP can impede the freedom to drive, 1 = no impediment at all, 4 = much impediment                                                                                                                                       |
| IFM     | ERP can impede the freedom of movement, 1 = no impediment at all, 4 = much impediment                                                                                                                                     |
| CNV     | ERP will affect the number visitors to the CBD, 1 = much more, 4 = much less                                                                                                                                               |
| DCU     | ERP will decrease car use, 1 = not decrease at all, 4 = much decrease                                                                                                                                                       |
| IPU     | ERP will increase PT use, 1 = not increase at all, 4 = much increase                                                                                                                                                       |
| DFV     | ERP would decrease or increase your visits to the CBD, 1 = not decrease at all, 4 = much increase                                                                                                                          |

Socio-demographics (causes)

| GD      | Gender, dummy variable with 1 if male, 0 otherwise                                                                                                           |
| AG      | Age, dummy variable with 1 ≥ 40 years, 0 otherwise                                                                                                          |
| AI      | Annual income, numerical ≤3.6 million IDR to ≥36 million IDR                                                                                               |
| ES      | Employment status, dummy variable with 1 if employed, 0 otherwise                                                                                           |
variables and latent variables by minimizing the distance between the sample covariance matrix and a covariance matrix predicted by the model (Buehn & Schneider, 2008). Systematically, the MIMIC model consists of two system equations, the structural equation model and the measurement model. The structural equation model is given by:

\[ \eta_t = B \eta_t + \Gamma x_t + \zeta_t \]  

(1)

The measurement model represents the link between the latent variable and its indicators. The latent unobservable variable is expressed in terms of observable variables, and it can be specified by the following system equation:

\[ y_t = \Lambda \eta_t + \epsilon_t \]  

(2)

where \( y_t \) is a vector of the 16 observable indicator variables, \( x_t \) is a vector of the six exogenous observable variables that cause \( \eta_t \), and \( B, \Gamma \) and \( \Lambda \) are matrices of unknown parameters to be estimated. The terms \( \zeta_t \) and \( \epsilon_t \) are measurement errors. The estimation of parameters in this study was performed using the econometric software LISREL 9.1.

Figure 2 gives, in statistical form, the estimation results of the latent psychological motivation constructs (yellow) using the MIMIC model. The causes for individuals’ latent preferences (gray) are the social-demographics of the respondents, and the indicators for individuals’ latent preferences (blue) are the observed psychological-related responses obtained from the interviewed respondents in the stated preference questionnaire. As for social-demographics, MIMIC estimation was performed by stepwise procedures. Initially, we included all subjected demographic variables that we obtained from SP questionnaire. However, the final model only includes variables that considerably contribute to the model with accepted significant level. Descriptions and empirical settings of the MIMIC specifications are summarized in Table 5. A number of indices were computed to explain the fit of the model in the model fitting process. The goodness-of-fit index (GFI = .86), adjusted goodness-of-fit index (AGFI = .81), and comparative fit index (CFI = .92) are all close to 1.0, which points to a well-fitting model (Hu & Bentler, 1999). The root mean square error of approximation (RMSEA = .09) and the standardized root mean square residual (SRMR = .07) likewise have values that confirm the good fit of the model to the data (Hooper, Coughlan, & Mullen, 2008). Figure 2 depicts the impact of the observed variables on the latent variables of psychological motivation constructs, and the impact of one latent variable on the other latent variables.

Focusing on the gender variable, it appears that males have a positive marker for the latent variables of CDC and inhibition of freedom of movement (AFM). It seems that male respondents are more dependent on private car use. Consequently, they will perceive ERP implementation as inhibiting their freedom of movement. On the other hand, males have a greater awareness of the problems of cars in society (APC) compared to female respondents. We would recommend, therefore, that these characteristics of male respondents should be taken into consideration by policy-makers wanting to achieve a high acceptance of ERP. Interestingly, we found that respondents over 40 years are more concerned with the appropriateness of ERP adoption and have more positive awareness of the problems of cars in society (APC). One possible reason for this is that these older respondents have relatively greater awareness of the congestion and environmental damage caused by badly managed motorization in Jakarta over recent decades. This gives them greater expectations for the effect of road pricing in mitigating congestion and environmental problems.

Looking at the variable of AI, we find that it has a positive correlation with recognition of the effects of ERP in mitigating congestion and environmental problems (REP),
CDC, and awareness of the problems of cars in society (APC). This means that respondents with higher income are more concerned with the problems manifested by motorization while, on the contrary, path coefficient between AI and CDC displays 2.70. It discloses that they are automobile dependent. This might mean that respondents with higher income live in surrounding municipalities where public transit services are inadequate. It is unlikely that these people will change to a public transit mode even if they approve the scheme because of adequate public transport does not exist yet. However, if adequate public transit available, it presumably that people who are aware

Figure 2. MIMIC model estimation result with ellipses represent latent variables, arrows represent paths significant at the 5% level.
to the environmental problem would to shift their private mode to the public transport usage. Finally, as expected, this reveals that employed respondents are unlikely to endorse the appropriateness of ERP adoption in Jakarta. This may be partially because of they need to enter city center more frequently as compared to non-commuter trip makers. Thus, they imagine that implementing road pricing will increase their transportation budget burden. Overall, the MIMIC model offers a good account of whether and how an individual’s demographics (i.e. gender, age) and a respondent’s household characteristics (i.e. AI, employment status) affect the predicted latent variables of psychological motivations. It is confirmed that a certain latent variable can partially explain another latent variable; for instance, the REP factor can partly explain some of the variability in inhibition of freedom of movement (AFM), as can be seen in Figure 2.

5. A social acceptability measures

5.1. Empirical data-set

The observed individual contribution to ERP approval is treated as an apparent endogenous variable, with the variables categorized as shown in Table 6. A total of 1641 samples are used in the study, as noted previously. Latent structures estimated using the MIMIC model are then treated as exogenous variables. Together with the latent variables, levy rate scenarios and individuals’ daily mobility attributes are incorporated into the analysis. The empirical settings of the explanatory variables are summarized in Table 7.

5.2. Specification of the models

Public acceptance in relation to the ERP scheme is explored by employing latent variable representations based on the GORM framework. The model is used to describe the data-generating process for a random outcome that is one of a set of discrete, ordered outcomes (Greene & Hensher, 2010). The thrust of the model is that an underlying intensity variable produces an observable counterpart that is strictly ordered by nature, such as a survey statement of the strength of one’s preference.

Let \( i \) \((i = 1, 2, \ldots, I)\) be an index representing the observation unit and let \( j \) \((j = 1, 2, \ldots, J)\) be an index representing the ordinal value \( j \) of an ordered response variable. The system equation for the standard-ordered response model (SORM) framework is determined by the system equation as follows:

\[
y_i^* = \beta x_i' + \varepsilon_i, y_i = j \quad \text{if} \quad \mu_{j-1} < y_i^* \leq \mu_j
\]

where \( x_i \) is a vector of the exogenous variables, \( \beta \) is a vector of the unknown parameters, representing the individual observations, and \( j \) represents ordinal preferences. The random error term is assumed independent and identically distributed across individual

| Category                | Freq. | Percent | Cumulative |
|-------------------------|-------|---------|------------|
| 1. Well accepted        | 153   | 9.33    | 9.33       |
| 2. Accepted             | 879   | 53.6    | 62.93      |
| 3. Not accepted         | 545   | 33.23   | 96.16      |
| 4. Not accepted at all  | 63    | 3.84    | 100.00     |
observations with a standard normal distribution. Then, the individual contribution to
the likelihood function can be drawn as:

\[ P_r(y=j) = \Phi(\mu_j - \beta x_i^j) - \Phi(\mu_{j-1} - \beta x_i^j) \]  \hspace{1cm} (4)

where \( \Phi(.) \) represents a standard normal cumulative density function, and \( \mu_j \) and \( \mu_{j-1} \) represent the upper and lower thresholds for outcome \( j \). In the SORM model of Equation (3), the thresholds \( \mu \) are assumed to be fixed across individuals. One obstacle to the appropriate implementation of SORM is the single index or parallel line assumption (see e.g. Castro, Paleti, & Bhat, 2012; Long, 1997; Winkelmann & Boes, 2009). Moreover, SORM treats the coefficient \( \beta \) as the same for all ordinal preferences \( J \). That is, by increasing an independent variable, the accumulated distribution shifts to the left or right. However, the slope of the distribution remains unchanged. Rejecting this assumption of a constant threshold and allowing flexibility of the threshold across all outcomes lead to a GORM. The basic idea of GORM is to make the threshold parameter a linear function of the covariates (Maddala, 1983; Winkelmann & Baes, 2009):

\[ \mu_j = \tilde{\mu}_j + \gamma_j x_i \]  \hspace{1cm} (5)

Substitution of Equation (5) in Equation (4) yields:

\[ P_r(y=j) = \Phi(\tilde{\mu}_j - \beta x_i^j) - \Phi(\tilde{\mu}_{j-1} - \beta x_i^j) \]  \hspace{1cm} (6)

where \( \beta_j = \beta - \gamma_j \) since \( \beta \) and \( \gamma_j \) cannot be identified separately, and it is understood that \( \tilde{\mu}_0 = -\infty \) and \( \tilde{\mu}_J = \infty \) such that \( \Phi(-\infty) = 0 \) and \( \Phi(\infty) = 1 \). In order to proceed with a maximum likelihood estimation of the parameter vector \( \beta \) and the \( J-1 \) threshold parameter \( \tilde{\mu}_1, \ldots, \tilde{\mu}_{J-1} \), we rewrite the general probability in Equation (6) into a conditional probability function as below:

\[ L(\beta, \tilde{\mu}_1, \ldots, \tilde{\mu}_{J-1}; y, x) = \prod_{i=1}^{I} \prod_{j=1}^{J} \left[ \Phi(\tilde{\mu}_j - \beta_j x_i^j) - \Phi(\tilde{\mu}_{j-1} - \beta_{j-1} x_i^j) \right] \]  \hspace{1cm} (7)
Then, rewriting Equation (7) into the log likelihood form over the population of $I$ observations, we obtain:

$$
\log L (\beta, \tilde{\mu}_1, \ldots, \tilde{\mu}_{j-1}; y, x) = \sum_{i=1}^{I} \sum_{j=1}^{J} \log \left[ \Phi (\tilde{\mu}_j - \beta_j x_i^j) - \Phi (\tilde{\mu}_{j-1} - \beta_{j-1} x_i^{j-1}) \right]
$$

(8)

By maximizing the log likelihood function represented by Equation (8), the unknown parameters can be obtained. Parameter estimation is distinguished using SORM and GORM which are both written and implemented in GAUSS econometric programming version 3.2.32.

5.3. Estimation result and discussion

In this section, we report estimation result of the relationship among ERP approval and exogenous variables (i.e. levy rate, latent constructs, and daily mobility habits). Two different models of ERP acceptance have been estimated. Initially, we begin estimating parameters with a SORM. Then, GORM is performed. Table 8 displays the estimation results separately for SORM and GORM. As for SORM, we find a significant parameter for all attributes ($t$-value > 1.96) exception for the levy rate has significant coefficient on the 10% level. Interestingly, in the GORM coefficient of parameters are considerably vary across the outcome thresholds, while some parameters have insignificant coefficient below 10% level. However, $\chi^2$ the log likelihood ratio test of the SORM against GORM shows an improvement from 152 to 226, and the AIC value shows the superiority of the GORM.

Variables in Table 8 are all expected to have valuable contribution on the public acceptance of the ERP proposal for Jakarta even if some parameters have significant level below 10%. We may keep that attributes for getting more evidence in revealing implication of the empirical results. Since the independent variables have four categories, we obtained three dependent threshold parameters in SORM and three independent threshold parameters in GORM (see e.g. Long, 1997; Winkelmann & Baes, 2009). Looking at the estimation results, some variables (e.g. LR, PV, and FV) do not differ much between outcome alternatives in GORM models, whereas the remaining variables are considerably different in GORM. Strictly speaking, Table 8 shows that the magnitude of the coefficients (including the $t$-values) varies across outcome categories. Moreover, as we are aiming to assess the observable individual heterogeneity across all outcomes, we utilize the empirical evidence obtained using GORM in the discussions that follow.

The levy rate variable has a negative correlation with public acceptance of the ERP proposal. This indicates that the level of charge plays an important role in gaining public acceptability; that is, the higher the levy, the fewer people will agree with adoption of the ERP and the more likely they are to reject the proposal. Moreover, the appropriateness of ERP adoption (ARP) also correlates negatively with approval. It seems that Jakarta citizens are not prone to accept congestion charging, yet recognition of the effect road pricing (REP) on mitigating traffic-related problems (i.e. congestion and environmental damage) has a positive effect. There is a hint that respondents who understand the scheme will approve of it. That is, respondents who recognize what effects the scheme may have more likely to understand its advantages; there is expectation that they believe the congestion-related problems experienced by motorists can be mitigated through implementation of road pricing. Generally speaking, respondents who lack a clear understanding of the scheme are unlikely to support it.
In respect of the CDC variable, this has a negative sign with respect to approval of the ERP scheme. The more frequently a respondent uses a private car to enter the CBD, the less chance that they will approve of the policy. Part of the reason for this is that, since there is a lack of adequate public transit into the charging zone (with a heavy reliance on Jakarta’s BRT), it is unlikely that people will change to a public transit mode. Consequently, private car users tend to oppose ERP policy and are unlikely to reduce use of their cars. These substantially indicate that inability of auto users shifting their mode to public transport is vital factor on public acceptance. In fact, the capacity of Jakarta’s BRT could not accommodate travelers even if ERP has not implemented yet. Therefore, upgrading quality of services includes providing new buses of Jakarta’s BRT could have help in increasing capacity. Essentially, revenue generates from the ERP charge could be addressed for improving public transit, such as priority for reforming regular buses and increasing capacity of BRT. We believe that spending revenue on the public transit service improvements received the highest level of agreement from citizens. These results could inform to government to gauge public acceptability from revenue allocation perspectives.

In respecting to the variable for awareness of the problem of cars in society (APC) (i.e. awareness of congestion and environmental problems) has a positive sign. The likelihood is that respondents are weary of encountering the collective problem of
congestion, which is manifested in the form of noise and emissions resulting from traffic jams. Respondents probably look forward to any promise of a breakthrough that will cut down traffic congestion and eventually reduce these collective problems. Moreover, the variable for inhibition of freedom of movement (AFM) has a negative sign. That is, respondents think that the scheme will limit their freedom of driving and movement. These perceived obstacles to mobility may contribute considerably to reasons for rejecting the scheme. It is likely that respondents tend to reject ERP because they do not want to limit their mobility habits.

Turning to individual daily mobility attributes, all of them (LD, PV, FV, MU, and FC) have a negative effect on ERP approval. The more licensed drivers (LD) there are or the more frequently respondents visit the CBD (FV), the more likely they are to oppose the scheme. In particular, this applies to commuters who enter the CBD by private car (PV). Opposition also arises from respondents who regularly drive a private car into the CBD. Moreover, the more frequently respondents use a private car to enter the CBD, the more chance that they are set to oppose the scheme. That is, respondents think that the scheme will limit their freedom of mobility which is in line with the variable for inhibition of freedom of movement (AFM) after ERP adoption. This may be because of the complementarity between daily mobility attributes and the latent inhibition of freedom of movement variable.

5.4. Elasticity measures

There are number of ways to interpret the estimated parameters, one common approach is elasticity analysis. Suppose that attributes and its parameters in Table 8 indicate to have an important influence on the acceptability of ERP proposal, so we focus on elasticity values of attributes with respect to the ERP acceptance in the following discussions. Elasticity analysis is conducted in order to provide several insights into implication of the estimation results. In general, econometricians have distinguished an elasticity in two terms, namely direct and cross elasticities. A direct elasticity measures the percentage change in the probability of choosing a particular alternative in the choice set for given percentage change in attributes in the same alternative, whereas cross-elasticity in respect to a given percentage change in attributes of the competing alternative (Hensher, Rose, & Greene, 2005). We used marginal probability effect (MPE) concept to investigate direct elasticity. MPEs can be obtained by taking first derivatives of Equation (6) with respect to the variables of interest which are listed in Table 8. Marginal effects at means are computed in order to demonstrate the elasticity across variables correspond to the probability of the ERP acceptance.

Table 9 summarizes the MPE at the mean values (x) posterior GORM estimation. The marginal effects correspond to the four outcomes of acceptance probability, that is, well accepted (P(ac = 1)), accepted (P(ac = 2)), not accepted (P(ac = 3)), and not accepted at all (P(ac = 4)). It displays that latent attributes are considerably more elastic compared to levy rate and daily mobility attributes. This finding reveals that latent attributes are sensitive contributing factors in determining probability of scheme acceptance. For instance, in respect of REP variable, it appears that a 1% increase in REP brings as many as 2.155, 14.682, 14.212, 2.625 to rise in probability of well accepted, accepted, not accepted, and not accepted at all, respectively. Turning to the levy rate, a 1% increase in levy charges carries about −.076, −.088, −.159, −.005 to fall in probability of well accepted, accepted, not accepted, and not accepted at all, respectively. It seems that levies demonstrate less-sensitive contribution in probability of acceptance.
It should be noted that the government plan is to initially set the ERP charge at 21,000 IDR, with according to the DoT Jakarta, these charges are based on calculation in year of 2009. Moreover, the DoT of Jakarta is studying the levies of the ERP which will be updated from initial 21,000 IDR. If the vehicle is rampant, the levies will be most expensive or vice versa. However, findings from Sugiarto et al. (2014b) and Sato et al. (2014) revealed that higher acceptability (69%) is found considering three levy scenarios, namely 10,000, 21,000, and 35,000 IDR. Thus, we argue that government’s initial levy could not effective in reducing autos dependent. In fact, by observing current situation along operation of 3-in-1 HOV, it shows that a practice has emerged of youths offering to pay a small fee to ride as passengers (called “jockeys”), thereby allowing drivers to meet their occupancy requirements. In most cases, a single occupant vehicle requires two “jockeys” to reach the requirement of three occupants in the car (HOV). For the agreement to work, a driver needs to pay on average 15,000 IDR per jockey in advance before entering the 3-in-1 HOV zone. It means that drivers need to purchase two jockeys to enter 3-in-1 HOV or about requiring to pay 20,000 to 30,000 IDR for one time entering proposed charging corridors. This demonstrates drivers’ financial ability and willingness to spend at least 30,000 IDR to maintain regular entry to the CBD. Accordingly, the higher acceptance of initially set the ERP charge at 21,000 IDR presumably means that such a levy may below respondent financial capability or they may willing to pay charges more than initial set. It should be noted that the higher of acceptance, the less effectively automobile dependency is reduced – yet the barrier of public rejection then falls. These circumstantially evidence that such proposed initial charge would fail to subtract automobile traffic. We encourage that charges between 40,000 and 60,000 IDR should more appropriate initial charges considering in both reducing autos usage and gaining public support. Without doubt, further exploration for defining equilibrium point among charge rate and public acceptance is needed and it remains future work of this study.

Table 9. Summary of direct elasticity across outcomes.

| Marginal effects after GORM | Attributes | dy/dx | S.D | dy/dx | S.D | dy/dx | S.D | dy/dx | S.D |
|-----------------------------|-----------|-------|-----|-------|-----|-------|-----|-------|-----|
|                             | Charge patterns |       |     |       |     |       |     |       |     |
|                             | LV        | -.076 | .064| -.088 | .120| -.159 | .114| -.005 | .031| 2,484 |
|                             | ARP       | -2.544| 4.606| -13.548| 8.088| -13.476| 7.565| -2.616| 1.662| .048  |
|                             | REP       | 2.155 | 4.572| 14.682| 8.037| 14.212| 7.524| 2.625 | 1.657| .047  |
|                             | CDC       | -1.347| 1.148| -1.359| 1.982| -1.957| 1.851| -.749 | .424 | .027  |
|                             | APC       | 1.337 | .766 | .236  | 1.321| .615  | 1.236| .486  | .289 | .035  |
|                             | AFM       | -.506 | .364 | -2.732| .656| -2.019| .620| -.207 | .183 | .035  |
|                             | Latent constructs |       |     |       |     |       |     |       |     |
|                             | ARP       | -2.544| 4.606| -13.548| 8.088| -13.476| 7.565| -2.616| 1.662| .048  |
|                             | REP       | 2.155 | 4.572| 14.682| 8.037| 14.212| 7.524| 2.625 | 1.657| .047  |
|                             | CDC       | -1.347| 1.148| -1.359| 1.982| -1.957| 1.851| -.749 | .424 | .027  |
|                             | APC       | 1.337 | .766 | .236  | 1.321| .615  | 1.236| .486  | .289 | .035  |
|                             | AFM       | -.506 | .364 | -2.732| .656| -2.019| .620| -.207 | .183 | .035  |
|                             | Daily mobility habits |       |     |       |     |       |     |       |     |
|                             | LD        | -.026 | .018 | -.065 | .031| -.067 | .029| -.023 | .008 | .713  |
|                             | PV        | -.014 | .019 | -.069 | .035| -.079 | .033| -.003 | .010 | .239  |
|                             | FV        | -.004 | .005 | -.042 | .010| -.038 | .010| -.008 | .003 | 2.227 |
|                             | MU        | -.077 | .015 | -.049 | .026| -.033 | .025| .005  | .007 | .504  |
|                             | FC        | -.009 | .005 | -.026 | .010| -.028 | .010| -.006 | .003 | 2.590 |

It should be noted that the government plan is to initially set the ERP charge at 21,000 IDR, with according to the DoT Jakarta, these charges are based on calculation in year of 2009. Moreover, the DoT of Jakarta is studying the levies of the ERP which will be updated from initial 21,000 IDR. If the vehicle is rampant, the levies will be most expensive or vice versa. However, findings from Sugiarto et al. (2014b) and Sato et al. (2014) revealed that higher acceptability (69%) is found considering three levy scenarios, namely 10,000, 21,000, and 35,000 IDR. Thus, we argue that government’s initial levy could not effective in reducing autos dependent. In fact, by observing current situation along operation of 3-in-1 HOV, it shows that a practice has emerged of youths offering to pay a small fee to ride as passengers (called “jockeys”), thereby allowing drivers to meet their occupancy requirements. In most cases, a single occupant vehicle requires two “jockeys” to reach the requirement of three occupants in the car (HOV). For the agreement to work, a driver needs to pay on average 15,000 IDR per jockey in advance before entering the 3-in-1 HOV zone. It means that drivers need to purchase two jockeys to enter 3-in-1 HOV or about requiring to pay 20,000 to 30,000 IDR for one time entering proposed charging corridors. This demonstrates drivers’ financial ability and willingness to spend at least 30,000 IDR to maintain regular entry to the CBD. Accordingly, the higher acceptance of initially set the ERP charge at 21,000 IDR presumably means that such a levy may below respondent financial capability or they may willing to pay charges more than initial set. It should be noted that the higher of acceptance, the less effectively automobile dependency is reduced – yet the barrier of public rejection then falls. These circumstantially evidence that such proposed initial charge would fail to subtract automobile traffic. We encourage that charges between 40,000 and 60,000 IDR should more appropriate initial charges considering in both reducing autos usage and gaining public support. Without doubt, further exploration for defining equilibrium point among charge rate and public acceptance is needed and it remains future work of this study.
6. Conclusion

The present study focuses on an ERP scheme proposal for Jakarta and looks particularly for indications as to how to improve public support for the scheme. Insight arises from looking at how the expected effects of the ERP scheme relate to individual intentions with respect to its expected merits. By incorporating responses to survey questions related to psychological motivation into latent variable, we show that the latent variable (appropriateness of ERP adoption, recognition of the congestion-mitigating, and environment-improving effects ERP, CDC, awareness of the problems of cars in society, inhibition of freedom movement caused by ERP, and doubts about the ability of ERP to mitigate congestion and environment problems) have a very significant influence on the public acceptability of the ERP proposal. Further, observable variables (such as levy rate and individual mobility attributes) also strongly explain public support for the scheme. Barriers to acceptance are the desire for levy rate, freedom of movement, and the ability to make transportation mode choices. People do not want to change from the private mode to the public mode, indicating that there is as yet insufficient public transport serving the charging corridors. They desire for a solution to the congestion problems, but more significantly influences their decisions regarding improvement public transit, such as enhancing the capacity of Jakarta’s BRT and speeding Jakarta’s MRT construction. These systems prerequisite must be done prior to the implementation ERP, and eventually public would able to shift their mode from automobiles to public mode conveniently.

This empirical investigation reveals that the latent variables and mobility attributes play more important role in the public acceptance of the ERP proposal compared to levies. Elasticity values show that latent construct attributes have more sensitive values compared to levy rate or even daily mobility attributes. Respecting to levies, with the government plan is to initially set the ERP charge at 21,000 IDR, we found that such an initial levy has high acceptability because of such a levy may below respondent financial capability (currently drivers need to pay on average 20,000–30,000 IDR for hiring two jockeys for entering HOV corridors). This presumably means that such a levy may below respondent financial capability or they may willing to pay charges more than initial set. It should be noted that the higher of acceptance, the less effectively automobile dependency is reduced – yet the barrier of public rejection then falls.

Findings ensure that latent attributes play more important roles in determining public acceptance on the scheme. Therefore, in order to gain the acceptance of the majority of road users, a gradual introduction of ERP is needed to allow users to gain understanding of the scheme, thereby gaining a more acceptable response. These findings might help the government in the design of more effective policy aiming at promoting the adoption of ERP. This study indicates that psychological factors have significant contributions on the ERP acceptance. Additionally, further exploration for defining equilibrium point among charge rate and public acceptance is needed and it remains future work of this study as well as an exploration on the revenue allocation.

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