Aceh International Journal of Science and Technology

Using psychometric data from the stated preference (SP) experiments to search explanatory power for appropriateness of congestion charging policy

Sofyan M. Saleh[1], Sugiarto Sugiarto[2,*], Cut Mutiawati[3], Renni Angraini[4] Muhammad Isya[5]

[1,2,3,4]Civil Engineering Department, Syiah Kuala University, Darussalam, Banda Aceh 23111, Indonesia. Corresponding author, email: sugiarto@unsyiah.ac.id

Abstract – Comprehensive stated preference (SP) experiment was conducted in Jakarta (a capital of Indonesia), where proposal for congestion charge (CC) has been considered as a way to reduce acute traffic congestion. With the government planning a CC scheme, public support is regarded as a prerequisite for its implementation. Therefore, a framework of structural equation model (SEM) is used to search explanatory power for the appropriateness of CC considering unobserved variable (latent variable) from psychometric data obtained from SP questionare. Causal paths among psychological determinants and their strength are measured and analyzed along with proposal acceptability from a psychological perspective. The findings from analysis with a SEM approach shows that a number of psychological determinants provide an explanation for the acceptability of the proposed scheme. The findings from analysis with a SEM approach shows that a number of psychological determinants provide an explanation for the appropriateness of the proposed scheme. Latent variables representing the validity of the CC scheme, such as ACE, APC and REC appear to have a significant explanation. These emerge as psychological determinants contributing a positive correlation with enhancement of appropriateness CC policy. Empirical result further shows that males have positive scores for the latent variables of car dependency (CDC) and inhibition freedom of movement (IFM). Furthermore, the variable of annual income, it has a positive correlation with recognition of the effects of CC in mitigating congestion and environmental problems (REC), car dependency (CDC) and awareness of the problems of cars in society (APC). This means that respondents with higher incomes are more concerned with the problems manifested by motorization while, on the contrary, the path coefficient between annual income (AI) and car dependency (CDC) has a value of 0.270. This discloses an automobile dependency. These findings should provide insight that designing a more acceptable policy in respecting to the acceptance of public in large.

Keywords: Congestion Charge, Stated Preference, Appropriateness, Structural Equation Model, Unobserved Variable

Introduction

Traffic gridlock is emerging as a serious hindrance to economic development in many urbanized areas, including Jakarta (the capital of Indonesia). The Jakarta region accounts for 19% of Indonesia's gross domestic product, amounting to approximately US$ 118.7 billion (BPS, 2010). The population of Jakarta accounts for 10% of the nation's total, and has increased 1.6 times in 20 years – from 17 million in 1990 to 28 million in 2010 (JUTPI, 2012). To mitigate a serious problem of congestion in the capital, congestion charge (CC) is currently under active development and remains under consideration as a way to mitigate acute traffic congestion in Jakarta (Sugiarto *et al.*, 2015a; Sugiarto *et al.*, 2015b; Sugiarto, 2016a; Sugiarto, 2016b). Moreover, the government of Jakarta desires to replace the existing 3-in-1 High Occupancy Vehicle (HOV) policy, which has had insufficient effect in alleviating traffic congestion, with a CC scheme (JUTPI, 2012). A CC policy is regarded as the most effective measure to combat traffic congestion within a city center of Jakarta. Successfully implementations in Singapore, London and Stockholm have effectively mitigated congestion (see e.g. Phang et al., 1997; Olszewski et al., 2006; Eliasson et al., 2006). Although such schemes are capable of reducing congestion, they are at the same time uniquely difficult to implement (May et al., 2010).

Despite a well-established rationale for the successful practice of CC, few cities have attempted such schemes. Rather than technical matters, it is social and legal issues, related to public and political acceptability,

that are the major obstacles to implementation (Zheng et al., 2014). It is argued that most countries with democratic political systems find it hard to implement such schemes. This is confirmed by the experience of several cities that have dropped schemes for lack of public support, such as a proposal in Edinburgh (see Gaunt et al., 2007) and one in New York City (see Schaller, 2010). Understanding this is crucial to any investigation of what might improve public support for such schemes. Support might be affected by whether individuals gain benefits from the scheme or, conversely, find their private mobility affected.

Given an absence of studies from the perspective of an Asian metropolis, we undertake comprehensive stated preference (SP) experiment in Jakarta, where proposal for the CC has been introduced and remain under consideration as a way to reduce acute car-dependence. Our research aims primarily to investigate determinants for the acceptability of the CC proposal in Jakarta, with our main focus is on psychological determinants. With this specific aim of exploring the influences of psychological indicators on psychological scenarios, we employed a structural equation modeling approach to search explanatory power for the acceptance of CC considering unobserved variable (latent variable) from psychometric data.

The rest of this paper is structured as follows. The next section is a survey of related literature on the public response to CC. Section 3 then describes the data set, the modeling framework, the method of model estimation, and the sensitivity measures implemented. Finally, the conclusions of the study are presented at the end of the paper.

Literature Review

Growing personal mobility leads to unsustainable externalities, leading to particular interest in how transport planning policies might moderate the pressures (Cools et al., 2011). It is generally agreed that these issues need to be solved by encouraging changes in activity-travel behavior. In this context, road user charging offers a most effective instrument (Schade and Schlag, 2003). A powerful instrument to deal with extraordinary personal mobility is congestion charging (CC). The ultimate goals of such a policy include achieving efficient infrastructure use, efficient infrastructure provision and improved financial viability. The implementation of CC schemes in Singapore, London and Stockholm that have effectively mitigated traffic congestion has been reported by Phang et al. (1997), Olszewski et al. (2006), Eliasson et al. (2006). However, a public is skeptical in general about accepting a pricing policy, significant opposition arises particularly among car users. Several CC proposals have failed because of lack of public support; for instance, a proposal in Edinburgh (see Gaunt et al., 2007) and one in New York City (see Schaller, 2010). The major challenge faced in implementing road pricing is to design a scheme that is both acceptable to the public and effective in achieving the objective of more sustainable mobility (Francke and Kaniok, 2013). The CC has always been a controversial and debatable concept since it involves the issue of equity. A number of authors, for examples Ison (2000) and Goh (2002) have pointed out that willingness to adopt road pricing depends on political will, public acceptance, budgetary constraints and the availability of alternatives. Furthermore, public approval and social concerns remain a major barrier to implementation (Rentziou et al., 2011).

A rich body of literature can be found on the topic of road pricing acceptability in particular for developed countries. Amongst others, Schuitema et al. (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. Further exploration by Gehlert et al. (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, modes, alternative transport modes and so forth. Looking in particular at behavioral research, there are concepts of interest related to psychological indicators. 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 psychological motivations. Public approval and disapproval strongly correspond to individual perceptions of the policy, such as perceived environmental benefits, improved freedom of movement, knowledge of the charging system and the scheme's revenue allocation (see Falzarano, 2009; Odioso and Smith, 2009; Jaensirisak et al., 2005). In respect to the CC proposal in Jakarta, a preliminary study on public acceptance was carried out by the authors (Sugiarto *et al.*, 2015a; Sugiarto *et al.*, 2015b; Sugiarto, 2016a; Sugiarto, 2016b). Psychometric data was used to assess the influence of public consciousness on the acceptability of charging policy. They found that psychological factors such as

recognition, fairness, awareness of the congestion problem and inhibition of freedom of movement have the most significant influence on determining public approval. However, the influence of latent types of respondent has been neglected in the modeling and assessing public acceptance. To reveal the influence of latent behaviors among respondents, in this paper we applied latent class modeling approach.

Materials and Methods
Data

This study focused on the city center of Jakarta, as shown in Figure 1a. The target zone (destination of respondents) is the central business district (CBD), which is a dense mix of business and commercial areas. The charging zone is within the CBD, which is also the area proposed for TDM measures by the government of Jakarta (see Figure. 1b). 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, the trans-Jakarta bus rapid transit (BRT), so most visitors rely on private automobiles.
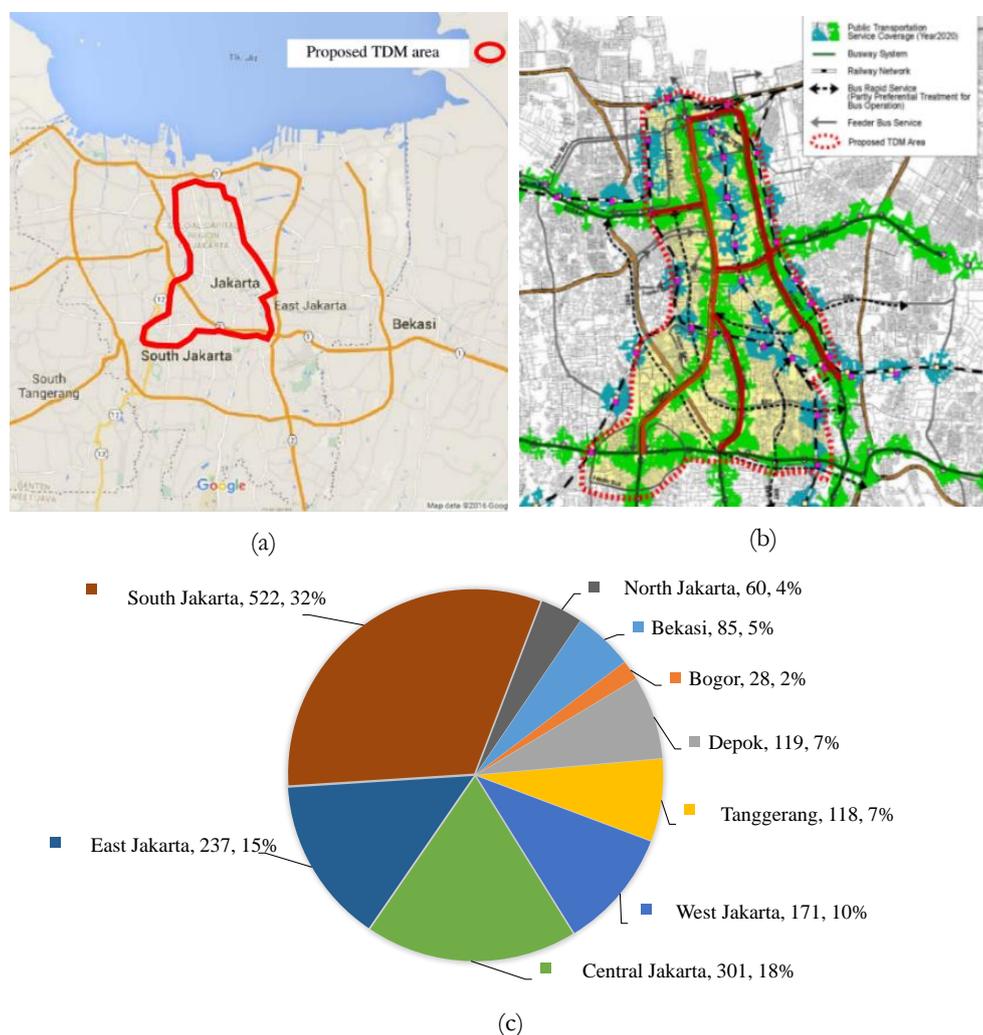

(a)   (b)

(c)

Figure 1. (a) The Jakarta region; (b) the CC zone; (c) distributions of responses (N=1,641)

The stated preference (SP) survey method was used to design questionnaires. The questionnaires were designed to capture relevant information from respondents (visitors to the CBD), such as visitor mobility characteristics, approval of the proposed CC scheme, expectation of changes in mobility habits and socio-demographic attributes (see Table 1).

Table 1. Summary of questions in stated preference questionnaire

No	Category	Description
1	Visitor mobility characteristics	Purpose of trip, number of accompanying persons, and mode choices
2	General opinion of CC, traffic congestion and the environment. Respondents were asked to choose a response from a 4-point Likert scale to road pricing (i.e. 1. well accepted; 2. accepted; 3. not accepted; 4. not accepted at all)	Recognition, acceptability, and fairness of CC, Inhibition of freedom of movement by CC
		Consequences of CC implementation
		Opinion on present level of urban transport services
		Opinion on city center transport and environment
		Extent of recognition of environmental issues
		Opinion on government policies and opinion on use of revenue from CC policy
3	Respondent's mobility responses to introduction of road pricing	Awareness of possible different visit behavior on day of survey under different charge schemes
4	Individual socio-demographic characteristics	Gender, age, driver's license, employment status, annual income
5	Daily mobility attributes	Trip purpose and frequency, mode used, frequency used private mode, frequency used transit

Table 2. Respondent's mobility attributes

Respondent's mobility attributes		Percentage (%)
(a) driver's license	Hasn`t driver`s lisence	29.5
	Has driver`s license	70.5
(b) mode used	Private mode	50.4
	Public mode	49.6
(c) purpose of visiting CBDs	Out for a walk/drive	6.7
	Studying/lesson	11.5
	Entertainment/shopping	28.0
	Meeting/sales/trader	5.5
	Work	48.3
(d) frequency of visiting CBDs	1 day/month or less	11.4
	2-3 days/month	13.0
	1-2 days/week	12.6
	3-4 days/week	16.7
	5 days/week or more	46.3
(e) frequency of using car.	1 day/month or less	22.0
	2-3 days/month	11.5
	1-2 days/week	10.8
	3-4 days/week	15.2
	5 days/week or more	40.5

Shortly thereafter, respondents were asked to answer a set of questions regarding the CC proposal, designed to capture their intentions with respect to such a scheme. This set of questions was related to the individual's psychological motivations corresponding to several indexes, including the appropriateness of the CC, recognition of the CC's ability to mitigate congestion and improve the environment, car dependency and related problem, inhibition of freedom of movement and doubts about the merits of the CC. Furthermore, data were collected by direct interviews and questionnaire sheets completed by enumerators. The survey was conducted in November 2013 in the city center of Jakarta. Target respondents were visitors, including commuters, shoppers, commercial visitors and employees of business establishments. A total 1,998 responses were collected but after cleaning up missing data 1,641 samples were utilized in this study. Sample distributions based on origin (home address) are illustrated in Figure. 1c. It appears that South Jakarta, Central Jakarta and East Jakarta are predominant in the sample, accounting for about 522 (32%), 301 (18%) and 237 (15%) of responses, respectively, and the rest of the responses are distributed among the remaining municipalities.

Data Profile

Considering travel behavior of respondents, Table 2 describes respondents' 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, 50.4% of respondents used private modes to visit the CBD. Turning to the purpose of the CBD visit, work and going to school are predominant, accounting for about 59.5% of the sample. Similarly, 63% of respondents visit the CBD quite often (3-5 days/week or more), with a possible reason for this being that nearly 60% of trip makers are commuters (working or studying). As expected, the data reveal that approximately 55.7% of respondents frequently use car (3-5 days/week or more). In contrast, 33.5% of respondents quite infrequently use car (up to 3 days/month). It seems that respondents prefer to use their own mode compared to public transit. This may result not only from the flexibility of private modes, but also because there is only one pleasant means of public transit serving the corridors.

Table 3. Respondent's demographic distributions

Respondent's demographic distributions		Percentage (%)
(a) age	40 years or more	13.3
	30 to 39 years	25.7
	20 to years	49.9
	Under 20 years	11.1
(b) gender	Male	51.9
	Female	48.1
(c) employment status	Not working	1.5
	Housewife	4.1
	Student	25.5
	Working	69.0
(d) annual income	24 million IDR or more	7.7
	12-24 million IDR	19.2
	6-12 milion IDR	32.4
	below 6 million IDR	40.7

Looking to respondent's socio-demographics charaterictics, 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% are employed, with less than 6% of the sample being housewives or unemployed. Commuters dominate the respondents, with nearly 95% of them making mandatory trips to the CBD as workers and students. Notably, approaching three-quarters of the sample have a low annual income. That is, about 73.4% of the respondents have an annual income below 12 million IDR. According to BPS (2010) a household with an annual income below 22 million IDR is classified as a low income household.

Modeling framework of a latent variable model

In this paper, we estimate latent variables from psychometric data that we obtained from stated preference experiments. The approach used is a common one: confirmatory factor analysis with covariates, formerly known as the multiple-indicators multiple-causes (MIMIC) model, by Joreskog and Goldberger (1975). The model explains inter-relations between observed variables and latent variables by minimizing the distance between the sample covariance matrix and a covariance matrix predicted by the model (Buehn and Schneider, 2008). Systematically, the MIMIC model consists of a structural equation model and a measurement model, respectively given by:

$$\eta_i = B\,\eta_i + \Gamma x_i + \zeta_i \text{ and } y_i = \Lambda\,\eta_i + \varepsilon_i \tag{1}$$

where y_i is a vector of observable psychological indicators variables, x_i is a vector of explanatory variables that cause η_i, B, Γ and Λ are matrices of unknown parameters to be estimated, and the terms ζ_i and ε_i are measurement errors. Parameters in this study were estimated using LISREL 9.1.

Results and Analysis

The set of sixteen psychology-related questions had ordinal responses, with respondents choosing a response from a 4-point Likert scale. Variable notation, definition and empirical settings for both indicators and causes are summarized in Table 4. The first four variables are related to awareness of the proposed CC scheme, representing an individual's perceptions with respect to the appropriateness of CC adoption, recognition that CC can mitigate congestion and improve the environment, car dependency, and awareness of the problems of cars in society. Two remaining latent variables correspond to the attitudes towards the future prospects of the scheme if implemented, which indicate respondent's expectations with regard to inhibition of freedom movement caused by CC and doubts about the ability of CC to mitigate congestion and environment problems.

Table 4. Description and empirical setting of latent variables, indicators and causes

Var.	Description, variable setting
Latent Variables	
APR	Appropriateness of CC adoption
REC	Recognition that CC can mitigate congestion and improve the environment
CDC	Car dependency
APC	Awareness of the problems of cars society
IFM	Inhibition of freedom movement caused by CC
DEC	Doubts about the ability of CC to mitigate congestion and environment problems
Observed psychological Indicators	
CRP	CC is correct policy, 1=quite right, 4=totally wrong
ACP	CC will be accepted by the public, 1=well accepted, 4=not accepted at all
FRP	CC is a fair policy, 1=quite fair, 4=quite unfair
ICG	CC implementation to improve congestion, 1=quite agree, 4=totally disagree
IGW	CC implementation to mitigate global warming, 1=quite agree, 4=totally disagree
MCG	CC can mitigate congestion, 1=much result, 4=no result at all
MEP	CC 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 mode is necessary in daily life, 1=quite necessary, 4=quite unnecessary
PAV	Public mode 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	CC impede the freedom to drive, 1=no impediment at all, 4=much impediment
IFM	CC impede the freedom of movement, 1=no impediment at all, 4=much impediment
CNV	CC will affect the number visitors to the CBD, 1=much more, 4=much less
DCU	CC will decrease car use, 1=not decrease at all, 4=much decrease
IPU	CC will increase PT use, 1=not increase at all, 4=much increase
EFV	CC expectation of frequency visits to the CBD, 1= not decrease at all, 4=much increase
Socio-demographics	
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

Table 5 shows that latent variables representing the validity of the CC scheme, such as ACE, APC and REC appear to have a good tendency in our data set. These emerge as psychological determinants contributing a positive correlation with enhancement of appropriateness CC policy. Concerning to the results, the gender variable, it appears that males have positive scores for the latent variables of car dependency (CDC) and inhibition freedom of movement (IFM). It seems that male respondents are more dependent on private car use. Consequently, they will perceive CC as inhibiting their freedom of movement.

On the other hand, males have a greater awareness of the problems of cars in society (APC) as compared to female respondents. Interestingly, we found that respondents over 40 years old are more concerned with the appropriateness of CC adoption and have more positive awareness of the problems of cars in society (APC). One possible reason for this is that elderly respondents have relatively greater awareness of the congestion and environmental damage caused by bad auto traffic. This gives them greater expectations for the effect of CC in mitigating congestion and environmental problems.

Table 5. Path coefficients of indicators to the latent variables

		Latent variables					
		APR	REC	CDC	APC	IFM	DEC
		Indicators					
CRP	CC is correct policy	1.000	-	-	-	-	-
ACP	CC will be accepted by the public	0.893	-	-	-	-	-
FRP	CC is a fair policy	0.878	-	-	-	-	-
ICG	CC implementation to improve congestion	-	1.000	-	-	-	-
IGW	CC implementation to mitigate global warming	-	0.996	-	-	-	-
MCG	CC can mitigate congestion	-	-	-	-	1.000	-
MEP	CC can mitigate environmental problems	-	-	-	-	0.997	-
CNL	A car is absolutely necessary in daily life	-	0.867	-	-	-	-
PNL	Public mode is necessary in daily life	-	0.853	-	-	-	-
PAV	Public mode is easy and convenient to use	-	-	-	-	-	0.271
TCG	Traffic is congested in the CBD	-	-	1.000	-	-	-
PED	The pedestrian environment is dangerous	-	-	0.622	-	-	-
CGW	Cars are the major cause of global warming	-	-	-	1.000	-	-
IFD	CC impede the freedom to drive	-	-	-	0.707	-	-
IFM	CC impede the freedom of movement	-	-	0.965	-	-	-
CNV	CC will affect the number visitors to the CBD	-	-	-	-	-	0.204
DCU	CC will decrease car use	-	-	-	-	1.267	1.000
IPU	CC will increase PT use	-	-	-	-	1.302	0.781
EFV	CC expectation of frequency visits to the CBD	-	-	-	-	-	0.302
		Causes					
GD	Gender	0.065	-	0.064	0.170	0.079	0.059
AG	Age	0.285	-	0.030	0.094	0.043	0.048
AI	Annual income	-	0.014	0.274	0.160	-	0.085
ES	Employment status	0.074	-	-	-	-	0.098

Note: variable definitions are given in Table 5; parameters of paths significant at the 5% level; (-) is data not applicable
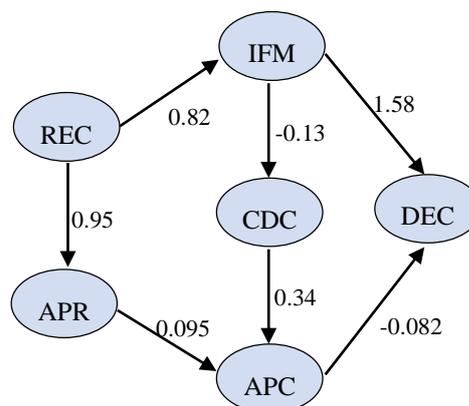

Figure 2. Path coefficients amongst latent variables with significant at the 5% level)

Figure 5 gives the estimation results of the latent variables (shown as ellipses) using the MIMIC model. The factor loadings for both causes (socio-demographics) and indicators (observed psychological indicators) into latent variables are listed in Table 3. Regarding social-demographic attributes, the MIMIC estimation was performed using a stepwise procedure. Initially, we included all subject variables obtained from the

stated preference survey. However, the final model only includes variables that considerably contribute to the model with significance at the 5% level. A number of indices were computed to explain the fit of the model in the model fitting process. The fit indicators include the comparative fit index (CFI=0.92), the root mean square error of approximation (RMSEA=0.09) and the standardized root mean square residual (SRMR=0.07), which all indicators exhibit fairly acceptable fits.

Looking at the variable of annual income, we find that it has a positive correlation with recognition of the effects of CC in mitigating congestion and environmental problems (REC), car dependency (CDC) and awareness of the problems of cars in society (APC). This means that respondents with higher incomes are more concerned with the problems manifested by motorization while, on the contrary, the path coefficient between annual income (AI) and car dependency (CDC) has a value of 0.270. This discloses an automobile dependency. It might reflect the fact that respondents with higher incomes live in surrounding municipalities where public transit services are inadequate, so they likely prefer to use the private mode. Moreover, as expected, employed respondents are unlikely to endorse the appropriateness of CC adoption in Jakarta. This may be partially because of their need to enter the city center more frequently as compared to non-commuter trip makers.

Conclusions

The present paper focuses to search an explanatory power of observed and unobserved (latent variables) factors on the respondent's choice behavior to a congestion charging by considering unobserved variable. a framework of structural equation model (SEM) is used to search explanatory power for the acceptance of CC considering unobserved variable (latent variable) from psychometric data that we obtained from stated SP. Causal paths among psychological determinants and their strength are measured and analyzed along with proposal acceptability from a psychological perspective.

The findings from analysis with a SEM approach shows that a number of psychological determinants provide an explanation for the appropriateness of the proposed scheme. Latent variables representing the validity of the CC scheme, such as ACE, APC and REC appear to have a significant explanation. These emerge as psychological determinants contributing a positive correlation with enhancement of appropriateness CC policy. Empirical result further shows that males have positive scores for the latent variables of car dependency (CDC) and inhibition freedom of movement (IFM). Meaning that male respondents are more dependent on private car use, and they have a greater awareness of the problems of cars in society (APC). Furthermore, looking at the variable of annual income, we find that it has a positive correlation with recognition of the effects of CC in mitigating congestion and environmental problems (REC), car dependency (CDC) and awareness of the problems of cars in society (APC). This means that respondents with higher incomes are more concerned with the problems manifested by motorization while, on the contrary, the path coefficient between annual income (AI) and car dependency (CDC) has a value of 0.270. This discloses an automobile dependency. Empirical findings provide insight that designing a more acceptable policy in respecting to the acceptance of public in large.

References

BPS, 2010. Statistical yearbook of Jakarta, Indonesia. Statistics Bureau of the Republic of Indonesia. Jakarta.

Buehn, A., Schneider, F., 2008. MIMIC Models, cointegration and error correction: an application to the French shadow economy. IZA Discussion Paper No. 3306.

Cools, M., Brijs, K., Tormans, H., Moons, E., Janssens, D., Wets, G., 2011. The socio-cognitive links between road pricing acceptability and changes in travel-behavior. Transportation Research Part A 45, pp. 779–788.

Eliasson, J., Mattsson, L.G., 2006. Equity effects of congestion pricing: quantitative methodology and a case study for Stockholm. Transportation Research Part A 40 (7), pp. 602–620.

Francke, A., Kaniok, D., 2013. Responses to differentiated road pricing schemes. Transportation Research Part A 48, pp. 25–30.

Falzarano, S., 2009. Regionwide congestion pricing study in Chicago: Stated preference survey purpose, approach and outcomes. The 88th Transportation Research Board Annual Meeting. Washington DC. USA

Gaunt, M., Rye, T., Allen, T., 2007. Public acceptability of road pricing: the case of Edinburgh and the 2005 referendum. Transport Reviews 27 (1), pp. 85–102.

Gehlert, T., Nielsen, O.A., Rich, J., Schlag, B., 2008. Public acceptability change of urban road pricing schemes. Proceedings of the Institution of Civil Engineers, Transport 161, pp.111–121.

Goh, M., 2002. Congestion management and electronic road pricing in Singapore. Journal of Transport Geography 10, pp. 29-38.

Ison, S., 2000. Local authority and academic attitudes to urban road pricing: a UK perspective. Transport Policy 7, pp. 267-277.

Jaensirisak, S., Wardman, M., May, A.D., 2005. Explaining variation in public acceptability of road pricing scheme. Journal of Transport Economic and Policy, 39(2), pp. 127-153.

Joreskog, G.K., Goldberger, S.A., 1975. Estimating of a model with multiple indicators and multiple causes of a single latent variable. Journal of the American Statistical Association, 70(351), pp. 631-639.

JUTPI. (2012). Jabodetabek urban transportation policy integration project. Ministry of Economic Affairs of the Republic of Indonesia & JICA, Jakarta.

May, A. D., Koh, A., Blackledge, D., Fioretto, M., 2010. Overcoming the barriers to implementing urban road user charging schemes. European Transport Research Review 2, pp. 53-68.

Odioso, M., Smith, M., 2009. Perception of congestion charging: Lesson for U.S. cities from London and Stockholm. The 88th Transportation Research Board Annual Meeting. Washington DC. USA

Olszewsi, P., Xie, L., 2006. Modeling the effects of road pricing on traffic in Singapore. Transportation Research Part A 39, pp.755-772.

Phang, S.Y., Toh, R.S., 1997. From manual to electronic road congestion pricing: The Singapore experience and experiment. Transportation Research Part E 33, pp. 97-106.

Rentziou, A., Milioti, C., Gkritza, K., Karlaftis, G.M., 2011. Urban road pricing: Modeling public acceptance. Journal of Urban Planning & Development, Vol. 137, No. 1, pp. 56-64.

Schaller, B., 2010. New York's Congestion Pricing Experience and Implications for Road Pricing Acceptance in the United States. The 89th Annual Meeting of the Transportation Research Board, Washington, DC.

Schade, J., Schlag, B., 2003. Acceptability of urban transport pricing strategies. Transportation Research, Part E 3, pp. 45-61.

Schuitema, G., Steg, L., Forward, S., 2010. Explaining differences in acceptability before and acceptance after the implementation of a congestion charge in Stockholm. Transportation Research Part A 44, pp. 99–109.

Sugiarto, S., Miwa, T., Sato, H., Morikawa, T. 2015a. Use of Latent Variables Representing Psychological Motivation to Explore Citizens' Intentions with Respect to Congestion Charging Reform in Jakarta. Urban, Planning and Transport Research 3 (1), pp. 46–67.

Sugiarto, S., Miwa, T., Sato, H., Morikawa, T. 2015b. Understanding the Effects of Various Factors on the Public Response to Congestion Charge: A latent Class Modeling Approach. Journal of Transportation Technologies 5 (2), pp. 76–87.

Sugiarto, S., Miwa, T., Sato, H., Morikawa, T. 2016a. Explaining Differences in Acceptance Determinants Towards Congestion Charging Policies in Indonesia and Japan. Journal of Urban Planning and Development (ASCE). On line first.

Sugiarto, S., Miwa, T., Morikawa, T. 2016b. Recursive bivariate response models of the ex-ante intentions to link perceived acceptability among charge and refund options for alternative road pricing schemes. Transportation Letters: The International Journal of Transportation Research. On line first

Zeng, Z., Liu, Z., Liu, C., Shiwakoti, N., 2014. Understanding public response to a congestion charge: A random-effects ordered logit approach. Transportation Research Part A 70, pp. 117-134.