APPLICATION OF RANDOM REGRET MINIMIZATION MODEL WITH CONVEXITY-CONCAVITY PARAMETER FOR BINOMIAL MODE CHOICE ANALYSIS

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by

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I call on the LORD in my distress, and he answers me..

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LIST OF ABBREVIATIONS

RUM	:	Random Utility Maximum
RRM	:	Random Regrete Minimisation
VoT	:	Value of Time
SP	:	Stated Preference
RP	:	Revealed Preference
occ	:	Occupation / Type of work
AI	:	Accesibility & Intermodality
AIint	:	Accesibility & Intermodality : Ingress Time
AIinm	:	Accesibility & Intermodality : Ingress Moda
AIinc	:	Accesibility & Intermodality : Ingress Cost
AIEgt	:	Accesibility & Intermodality : Egress Time
AIEgm	:	Accesibility & Intermodality : Egress Moda
AIEgc	:	Accesibility & Intermodality : Egress Cost
AIMtf	:	Accesibility & Intermodality : Motif of Travel
TP	:	Travel Pattern
TPFreq	:	Travel Pattern : Frequency
TPT var	:	Travel Pattern : Time Variance
TPTol VarTT	:	Travel Pattern : Variable of Travel Time
SOCDotrip	:	Social : doing trip
SOCsex	:	Social : sex
SOCInc	:	Social : income
SOCCMcO1	:	Social : car and motorcycle ownership 1
SOCCMcO2	:	Social : car and motorcycle ownership 2
SOCCMcO3	:	Social : car and motorcycle ownership 3

SOCCMcO4	:	Social : car and motorcycle ownership 4
SOCCMcO5	:	Social : car and motorcycle ownership 5
SOCCMcO6	:	Social : car and motorcycle ownership 6
SOCMarSta	:	Social : Marital status
SOCAge	:	Social : Age
SOCChN	:	Social : child Number
SOCHoOwn	:	Social : Home owned

APLIKASI RANDOM REGRET MINIMIZATION MODEL DENGAN PARAMETER KECEMBUNGAN-KECEKUNGAN UNTUK ANALISIS MODE PILIHAN BINOMIAL

ABSTRAK

Pada tahun 2008 teori Random Regret Minimization (RRM) telah dibangunkan, telah memudahkan pembangunan teori tingkah laku pengundian (tingkah laku pilihan), di mana keadaan tingkah laku pilihan mengurangkan penyesalan yang mungkin timbul daripada pemilihan. Teori RRM mempunyai pendekatan yang berbeza daripada pendekatan sebelum ini yang dikenali sebagai Utility Memaksimumkan Rawak (RUM), yang dibangunkan berdasarkan teori ekonomi yang menekankan penggunaan rasional dalam proses pemilihan.

Kajian tesis ini bertujuan untuk menunjukkan perbezaan dalam keputusan analisis RUM dan RRM dalam kes mod proses pilihan. Dalam kajian yang menggunakan parameter kecekungan dan kecembungan, boleh menentukan kecenderungan penumpang mengenai memilih sifat-sifat mod yang dipilih. Penyelidikan ini dilakukan dengan memilih sampel penumpang di laluan Bandung-Jakarta, yang mana penumpang boleh memilih dua mod pengangkutan, iaitu kereta api dan perjalanan bas. Dari soal selidik yang diberikan kepada 1200 responden, masing masingnya 633 dan 386 revealed preference dan stated preference data telah diperolehi dan dianalisis.

Model RP untuk pilihan mod antara Bandung ke Jakarta dengan perjalanan perniagaan / kerja terkesan oleh akses ke stesen kereta api atau perjalanan ke stesen bas.

Model RRM dengan parameter cekung dan cembung mempunyai prestasi yang lebih baik daripada Model RUM apabila penumpang memilih tempat yang berisiko (Kerja atau perjalanan perniagaan).

Hasil pengiraan VoT untuk RRM adalah Rp. 15.710, - /jam. VoT ini adalah di bawah VoT normal, iaitu kira-kira Rp. 20.000/jam, tetapi sedikit di atas VoT RUM. Ini menunjukkan bahawa model yang sedia ada menyediakan anggaran yang lebih kurang sama dengan model RUM sedia ada. Kajian ini mempunyai membuat kesimpulan bahawa nilai ϑ = 0.119, bermakna bahawa penumpang adalah cenderung untuk menjadi lebih cekung, sejajar dengan hasil kajian Chorus (2009) bahawa "pada penyesalan fungsi cekung penumpang berhadapan dengan ketidakpastian".

APPLICATION OF RANDOM REGRET MINIMIZATION MODEL WITH CONVEXITY-CONCAVITY PARAMETER FOR BINOMIAL MODE CHOICE ANALYSIS

ABSTRACT

In 2008 Random Regret Minimization (RRM) theory was developed, which facilitated the development of the voting behavior theory (choice behavior), in which a state of choice behavior minimizes regret that may arise from the selection. RRM theory has a different approach than its counterparts which is known as Random Utility Maximization (RUM), that are developed based on the economic theory which emphasizes the use of rationality in the selection process.

This thesis study aims to demonstrate differences in the results in the analysis of RUM and RRM in the case of the mode choice process. In this study concavity and convexity parameters were used, which can determine the tendency of passengers regarding selecting the attributes of the chosen mode. Research was done by sampling of passengers on the Bandung-Jakarta route, where the passenger can select two modes of transport, namely rail and bus travel. From the questionnaire given to 1200 respondents, 633 and 386 Revealed Preference and Stated Preference questionnaire were obtained respectively.

RP Model for mode choice between Bandung to Jakarta with business/work trip was affected by the access to the train station or travel bus pool.

RRM model with concave and convex parameter has better performance than RUM model when the passenger chooses the risky choice (Work or Business trip).

The result of VoT for RRM is Rp. 15,710/hour. This VoT are below the normal VoT, which is about Rp. 20,000/hour, but slightly above RUM VoT. This suggests that RRM

2014 provide estimates that is more or less the same as the existing RUM models. This study concludes that the value of $\vartheta = 0.119$, means that passengers tend to be more concave, in line with Chorus (2009) that states “at regret concave function passenger are faced with uncertainty”.

CHAPTER ONE
INTRODUCTION

1.1 Background

Transportation mode selection, the first step in transportation planning process, is probably one of the most important planning elements (Ortuzar, 2002). The rapid expansion of public transportation throughout major cities in the world requires an investigation on how commuters select their vehicle for their daily activities. The preferences of commuters naturally determine the vehicle mode selection. Such preferences can be influenced by the purpose of the trip, the social and economic circumstances of the commuters themselves, the rules, and the available vehicle attributes.

Generally, commuters of public transportation have different preferences about how they select a vehicle. The development of models that can explain the preference of passengers regarding their chosen mode of public transport option will contribute to the improvement and development of existing public transport.

Logit models have been widely used to determine the mode choice models in which the alternative are different transport modes. Another proposed transportation model is the spike model, a parametric model that can be used to estimate the willingness to pay, and which enables specific respondents to have zero willingness to pay.

Other more complex modeling types use structural equation modeling (SEM). SEM is a modeling technique capable of handling a large number of endogenous and

exogenous variables, as well as latent variables specified as a linear combination of the observed variables (Golob, 2001).

In the development of transport theory, Cherchi (2009) described how the regret theory evolved. The said theory was developed from the failure of economic theory to explain how people behave (choice behavior) and choose (choice preferences) from the available options.

Regret theory is a theory developed from the behavior to choose (choice behavior) in a state of uncertainty. During its development, the theory was used in various disciplines, such as marketing, micro economy, psychology, management, and transportation (Chorus, 2010).

Since the mid-seventies, the majority of disaggregate travel demand models (with logit basis model) are based on the notion of random-utility-maximization (RUM) (Marschak, 1960; Manski, 1977). These RUM models assume that a traveler selects the one that has the highest utility when faced with several travel options.

Random regret minimization (RRM) is rooted in regret theory (Bell, 1982; Fishburn, 1982; Loomes and Sugden, 1982). RRM asserts that an individual's choice between alternative is based on his or her wish to avoid the situation whereby a discarded alternative turns out to be more attractive than the one chosen, which would cause regret. Hence, the individual is assumed to minimize anticipated regret when choosing between alternatives, as opposed to maximizing utility.

Numerous papers have compared RUM and RRM modeling results (Chorus, 2012). All the reviews compared the multinomial choice in a variety of fields, such as travel mode (Chorus, 2010), information acquisition (Chorus, 2010), parking (Chorus, 2010), shopping destination (Chorus, 2010), travel mode (Pathan, 2011), online dates (Chorus

and Rose, 2011), leisure destination (Thiene et al., 2012), departure time (Chorus and de Jong, 2011), vehicle type (Hensher et al. 2012), road pricing policies (Chorus et al., 2012). Specifically, Pathan (2011) conducted a study for modal choice in the UK using stated preference data, indicating sthe similarity of results (best fit) on multinomial choice from both models.

In 2010, Chorus created a new model of regret which sought to improve the model he developed in 2008. The fundamental differences between the models are:

1. The 2008 RRM model postulated that the model is based on experience and only anticipated the best of predetermined alternatives; and

2. The 2008 model specifications have a non-smooth likelihood function, which causes difficulties on the derivation of marginal effects and elasticity.

On the latest model of random regret minimization, this limitation has been alleviated. The model has been anticipated for all alternatives and has a smooth function at likelihood function.

In the first model study RRM (2008), Chorus et al. has applied the model to the selection of vehicles (cars and trains) with different attributes of travel time, travel costs, waiting times and seat availability. The convexity-concavity parameter was used to indicate the weight of a person's assessment of the difference between the attribute values. Convexity and concavity parameter is the counterpart of Q-function that plays a central role in the original microeconomic regret-theoretical framework developed by Loomes and Sudgen (1982). The RRM Model differs from the original framework in the sense that the model considers multi-attribute choice and that do not hypothesize a symmetrical regret-rejoice function (Chorus 2008).

Chorus et al. (2010) have not assessed the effect of the convexity–concavity parameter for the selection mode choice of a journey when the new formula was proposed.

Results of the studies conducted by Chorus in 2010 and 2014 show differences in the results of the modeling using the RRM with RUM. Regarding mode choice, the difference in the models will affect the amount of estimated volume of vehicles that will cause traffic congestion in a particular route.

The use of mass transportation, such as railway, is a priority in many countries. The purpose of using such public transport is to be able to replace a private or public vehicle with a small capacity. The train has advantages regarding energy and environmental concerns, whereas the railway presents the additional benefit of not burdening the road network, unlike buses (Bradley, 2007).

Indonesia is currently building its transportation infrastructures, such as toll roads and railway networks. The development of a network of transportation infrastructure can affect the development of modes of transport that serve them. The infrastructure of highways and railways linking Jakarta and Bandung serve as an example. Bandung and Jakarta are connected by a toll road whose traffic indicates a decreasing trend of passengers who choose the train as the their main mode of transport, while from 2009 to 2012, the number of passengers have decreased about 50% (Ningsih, 2013).

This research will examine the types of attributes that affect the modal choice between Bandung to Jakarta, the behavior of passengers on weighing the attributes (convex and concave parameters), and the comparison among the models by using a statistical method.

1.2 Problem Statement

The modal choice as the third step in the transport planning, which has an important role in the calculation of how much usage or the need for public transportation. Research conducted in 2010-2014 showed that the RRM models could provide better estimate models than the RUM models. RRM created in 2010, did not adopt the parameters of concavity and convexity, which in 2008 these parameters were used in the writing of the RRM (parameter used to determine the characteristics of passengers regarding assessing differences in the attributes of alternative modes). It required a study to demonstrate the application of RRM in calculating the modal choice, and comparing them with models that already exist such as RUM and RRM 2008.

1.3 Research Goals and Research Questions

Based on the above arguments, this thesis will examine the application of RRM in the selection of travel modes, which is the first step in transportation demand planning. Comparison shall be made with the results obtained with the previous model in the determination of the utility-maximizing alternative. The primary goals of this thesis are:

To develop a model that can demonstrate the use of regret minimization as a method for mode choice selection analysis. This aim will be achieved through identifying the parameters that can show the influences of an individua'sl attitude to the weight among choices attribute.

According to these research goals, the following research questions are expected to be addressed: