ツアー概念を用いた非集計交通需要予測モデルの時間移転性に関する研究
A STUDY ON THE TEMPORAL TRANSFERABILITY OF A DISAGGREGATE MODEL SYSTEM FOR THE METROPOLITAN TRAVEL DEMAND ANALYSIS

Nagoya Univ. member S. Kawakami
○ Nagaya Univ. student L. Su
Nagaya Univ. student Y. S. Bae

1. INTRODUCTION

What could be said to be a major innovation in the past 20 years for the analysis of transportation demand was the development of disaggregate travel demand models based on discrete choice analysis methods. One reason is that a model may be transferred to an entirely different scenario without recalibration. However, up to now, the studies with respect to transferability are mainly on the travel mode choice model and few studies on the other kinds of model. As an important application of disaggregate models, Kawakami et al.[(1),(2)] proposed a model system for metropolitan areas, but it is still necessary to analyze the transferability of the model system. Thus, the purpose of this study is to test the temporal transferability of the model system.

2. GENERAL DISCRIPTION OF THE MODEL SYSTEM

Two groups of individuals, non-workers and workers, were considered in the studies by Kawakami et al.. By using the nested logit model, the system incorporated trip generation choice, trip purpose choice, trip destination choice, travel mode choice, and base choice in the sub-system of workers. In sub-system of non-workers, trip generation choice, destination choice and mode choice for the home-based trip, and destination choice and mode choice for the non-home-based trips, were calibrated. In the system, a tour is defined as consisting of all trips between any two bases where the base means home or work place. Then in terms of the utility maximization theory, the assumption was made as: a traveler maximizes the travel utility by each trip in a tour, conditional on the trips which have been made in past and by considering the trip chain going to return his (her) base, which consists of L trips at most. Based on the analysis for the person's trip survey of 1981 in Nagoya Area, L was taken as 1 for workers and 2 for non-workers, meanwhile the traveler was thought of not changing the mode in one tour.

3. PROCESS AND METHODS FOR EVALUATING THE TRANSFERABILITY OF MODELS

In order to investigate whether the model system is transferable, the re-estimation of parameters with the same explanatory variables will be done by using the person's trip survey data of 1971 since the results given in the papers (1) and (2) were obtained based on the 1981's data. Then do

1). Test of Parameter Equality:

$$t_i=(\theta_{Ai}-\theta_{Bi})/[\mathrm{Var}(\theta_{Ai})+\mathrm{Var}(\theta_{Bi})]^{1/2}$$

2). Disaggregate Measures of Transferability:

(a) A statistical test: $TTS_A(\theta_B)=-2[L_A(\theta_B)-L_A(\theta_A)]$

(b) A relative measure: $TI_A(\theta_B)=[L_A(\theta_B)-L_A(MS_A)]/[L_A(\theta_A)-L_A(MS_A)]$

(c) A absolute measure: $\rho_A^2(\theta_B)=1-L_A(\theta_B)/L_A(MS_A)$

3). Aggregate Measures of Transferability:

(a) A absolute measure: $RMSE=(\Sigma_{m,g}\hat{N}_{mg}REM^2_{mg}/\Sigma_{m,g}\hat{N}_{mg})^{1/2}$
(b) A relative measure: $RATE=RMSE_A(\theta_B)/RMSE_A(\theta_A)$
(c) A statistical test: $APS=\Sigma_{m,g}(\hat{N}_{mg}-N_{mg})^2/\hat{N}_{mg}$

where θ_i implies the ith parameter, A and B denote the new and old context, respectively, $L_A(\theta_B)$ is the logarithm of the likelihood that the observed data in application (new) context A were generated by the transferred model estimated in context B and MS means a market share model, whereas $\hat{N}_{mg}$ and N_{mg} are the number of persons, predicted and observed, respectively, to choose alternative m from group g, then $(\hat{N}_{mg}-N_{mg})/\hat{N}_{mg}$ is written by REM_{mg}.

4. DISCUSSIONS ON THE RESULTS

The test for the sub-system of workers has been completed. In 1971, the results of re-estimation give that the sub-system without updating the explanatory variables does not satisfy the utility maximization theory. Now it may be thought that the model system is not transferable. However, since the model system is a complex system and consists of many models in different levels, it may have the partial transferability at some levels. Thus it is necessary to do the maximum likelihood estimation again in terms of the 1971's data. Furtherly, the test for the transferability of the new model system and the new parameters, with respect to the updated explanatory variables, are conversely conducted by using the 1981's data. Similarly, it was found that in 1981, the sub-system estimated by using the 1971's data does not satisfy the utility maximization theory .

However, it should be noted that this study have important significance. Comparing the two maximum likelihood estimation results, it can be, at least, obtained that: (1) the structure of the model system has not been changed; (2) at the levels of mode choice and trip purpose choice, the appropriate explanatory variables are the same, and (3) at the other levels, most of the appropriate explanatory variables are the same, only a few of them are different, and also the new estimation can gain a good deal of enlightenment from the old estimation when choosing the appropriate explanatory variables. As the comments, it can be said that the model system is quite good for travel demand analysis, but it may be too long period to transfer it from one context to another context which is 10 years before or after since many factors have changed. Furthermore, the two estimations were made by letting the non-business purpose trips and the business purpose trips use the same explanatory variables for ease of computation, but if considering the actual situation, of course, they should be described by the different explanatory variables. Then the precision of the analysis for travel demand will be improved and the model system may become more transferable than the present state.

The similar analysis will be also made for the sub-system of non-workers. The results will be presented at the conference.

REFERENCES:

1. Kawakami, S., Y. Hirobata, Y. S. Bae, and H. Nakajima. (1989) A Model System of Worker's Daily Travel Demand Using Disaggregate Behavioural Model, The 11th Pacific Regional Science Conference.
2. Kawakami, S., Y. Hirobata, Y. S. Bae, and H. Nakajima. (1989) A Model System for Non-Worker's Daily Travel Demand Based on Disaggregate Behavioural Model, The 5th World Conference on Transport Research.