Chapter 7

7.1 INTRODUCTION

The study effort as attempted in the preceding chapters has been tried at establishing the superiority of dis-aggregate models over the aggregate ones through their better policy-responsiveness as a result of their embodied behavioral feature. And on that ground the justification for applying the Multinomial Logit model (MNL) [the most common form of Disaggregate models] towards estimating travel demand for two (2) of the sample cities was based and accomplished. Notwithstanding that the dis aggregate model(s) score far above the aggregate models, they are however, not perfectly immune to deficiencies. Deficiencies exist in the MNL as well as in the other dis-aggregate MODELS. Hence, knowledge aimed at elucidation of their deficiencies and scouring the travel demand literature for models that “do away” with such deficiencies needs to be acquired. Also on the same vein, emerging new thoughts, if any, in travel demand estimation are to be examined.

7.2 LIMITATION (S) OF THE MULTINOMIAL LOGIT MODELS

A major shortcoming of the Multinomial Logit (MNL) model arises from its property of the independence of the relative probability of choice of two alternatives irrespective of the presence or characteristics of other alternatives.

This property known as the “Independence of Irrelevant Alternatives” (IIA) implies that the introduction or improvement of any alternative will have the same proportional impact on the probability of each other alternative. As a result, representation of choice-behaviour is bound to have biased estimates.

7.3 REMEDY TO THE LIMITATION

The most widely known relaxation of the MNL model is the Nested or Hierarchical Logit (HL) model that allows interdependence between the pairs of alternatives in a common group (McFadden, 1978; Ben-Akiva & Lerman, 1985; Borsch-Supan, 1990) and then predict probability choice in them based on the principle of utility-maximization.
7.4 REASONS FOR ITS EXCLUSION IN THE PRESENT STUDY

Two basic limitations come in the way of the application of these types of models in the present analysis.

The present analysis being primarily based on secondary aggregate data is unsuitable for conversion into the desired form that enable their usage in the Nested Logit model.

Besides the usage of the software, a limited version obtained and applied in the present analysis lacks the requisite computational ability, which the Nested Logit model requires in estimating the parameters and determining the probabilistic choice of modes.

7.5 THE DEFICIENCY IN THE DIS-AGGREGATE URBAN TRAVEL DEMAND MODELS

The dis-aggregate models as a whole suffer from a basic deficiency—non-transferability (both geographical and temporal) of the parameter(s). Model transferability implies constant parameter values (apart from the effect of random sampling errors) in various places or times.

Despite the enormous practical difficulties of transferability of parameters, the dis-aggregate travel demand model parameters satisfying to that end is hardly to be found. In almost all cases, the available evidence suggests their transferability (geographical) only after making changes in at least a subset of their parameters (Talvitie & Kirshner, 1978; Dehghari et al., 1981; Horowitz, 1980a; Koppelman & Wilmot, 1982a). In cases of temporal transferability, especially relating to the ability of the random utility model to predict the demand for a new mode of transportation, the unreliability of these models and hence their parameters lie bared (Talvitie & Kirshner, 1978; Train, 1973). Various reasons account for such a deficiency. Three primary ones are

a) the probability distributions of the stochastic / random component of the models’ utility function are usually different in different geographical areas.

b) the inability to acquire sufficient information on the probability distribution of the random components of a newly introduced mode from the probability distribution of the random component of the existing modes.
c) errors in measurement of explanatory variables (especially, level of service variables) and the use of zonal aggregates / proxy variables led to biased model parameters.

7.6 ALTERNATIVE APPROACH TOWARDS MODELLING URBAN TRAVEL DEMAND*

The deficiencies inherent in the dis-aggregate travel demand models have led to newer approaches towards modeling urban travel demand. The objective seems to be in favour of portraying travel pattern in a broader perspective so that the external effects of transportation policies such as sustainability and social implications are viewed in an integrated way. Measuring the activity pattern of individuals was identified as the required tool in such an approach. Thus, the basic unit of measurement so far applied in urban travel demand models (both aggregate and dis-aggregate) i.e. trips are poised for a changeover to activity. The models that emerged in such format however mostly utilized aggregate and dis-aggregate framework in their structural set-up.

The activity-based models based on the up gradation of the traditional four-step approach emerged from the eighties. The model by Fellendorf et al (1996) justifies a special mention in terms of the. In it, the probabilistic activity-chains for a set of homogeneous groups by residential zones are derived from travel diaries in the first instance. These are then transferred into trip-chains between zones and a deterrence function formed by activity-specific attractiveness of the zone beside transport-data, allocates activities to specific destination zones. In the third phase, trip-chains are modally split by a Multinomial Logit Model so as to generate mode-specific Origin-Destination (O-D) tables. Finally, the O-D tables are utilized to develop route-choice and traffic flows.

In utilizing logit models for modeling activity-patterns, the depiction of a multi-stop, multi-purpose trips technically denoted as trip chaining is initially resorted to. Trip-chaining is undertaken through a framework of logit models using data from activity-diary that provides attributes like the time of daily activities or the history of past and present activity chains. Work by Timmerman et al (1996) and Arentze et al (1997) find special

*Pain, Asis Kumar (Jan.-Mar.,2004); "Urban Travel Demand Models: the trend of their development”. Nagarlok (Qtr.ly); Indian Institute of Public Administration, Vol.XXXV,No. 1, New Delhi.
mention in such chain models where dependent choices in a chain, based on utility-
maximizing behaviour of individuals are explicitly modeled. Once such trip chaining is
appropriately modeled, the second phase is concerned with modeling of the activity
pattern in the same framework. It involves a choice of the daily activity patterns from their
characteristics on the basis of utility-maximization. The model by Ben Akiva and Bowman
(1996) is an important one in modeling activity-pattern which breaks down the activity
pattern into a number of partial decisions in a hierarchical decision-structure. A Nested
Logit model helps in determining the hierarchical choice decision.

Though in its infancy, it appears that the activity-based models are more suited to depict
the complex travel-pattern of our cities. Hence, for estimating precise travel demand, a
transition to the appropriate activity-based model seemed inevitable for the cities of the
world. Till that happens, the Indian cities where travel demand estimation that still remains
stationary in the vortex of non-behavioral and policy-insensitive approach can well be
elevated to the more advantageous disaggregate modeling approach (as the one applied in
this analysis) in order to provide a stable platform for framing policies for a more hassle-
free journey.