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Trip Chaining Behaviour of Fast Growing Metropolitan City- Surat

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Abstract: The demand for transportation in urban centres is key factor in choosing the complex activity and travel pattern. Activity Based Platform that is applied at the fully disaggregate level of persons and households. In this work, study area is selected as Surat - a fast growing metropolitan Indian City. Data collection involves socio economic and Personal variables and activity details. Behaviour of person in choosing specific activity pattern is studied, MNL and Nested Logit models are developed for workers, school-goers and housewives. MNL model for trip chaining behaviour is developed and it is concluded that all activity patterns are direct substitute of each other. Nested Logit model is applied to study the activity pattern of Worker and model has been estimated with influencing variables.

Keywords: Activity Pattern, Tour, MNL, Nested Logit, NLOGIT

1. INTRODUCTION

India is the second most populous country in the world with more than one sixth of the world's population. According to the 2011 Census, the urban population grew to 377.1 million as compared to 286.1 million in 2001 census showing a growth of 2.76% per annum during 2001-2011. The level of urbanization in the country as a whole increased from 25.7% in 1991 to 27.82% in 2001 and to 31.14% in 2011, an increase of 3.3 percentage points during 2001-2011 compared to an increase of 2.1 percentage points during 1991-2001.Vehicle Ownership in India is increasing rapidly. The total vehicle population in 2001 was 55 million. It comprised of 70.1% two wheelers, 12.8% cars, jeeps and taxis, 1.2% buses, 5.4% goods vehicle and 10.5% other vehicles. The total vehicle population in 2015 was 210 million. It comprised of 73.5% two wheelers, 13.6% cars, jeeps and taxis, 1% buses, 4.4% goods vehicle and 7.5% other vehicles. As compared to the year 2001, the share of two wheelers changed by 3.40%, the share of cars, jeeps and taxis changed by 0.80%, the share of buses changed by -0.2%, the share of goods vehicle changed by -1% and the share of other vehicles changed by -3%.Urbanisation and Increase in Vehicle Ownership in the country leads to large demand for transportation in Urban areas. People of metropolitan city have complex decision of choosing

travel and activities. Activity based platform of travel demand modelling has advantage in capturing complex behaviour of people. One of the main advantage of trip chaining behaviour is that it captures the interaction of people in between time, space, activities and trips. This interaction is unable to capture by trip based modelling approach, so it is very necessary to capture trip chaining Behaviour of individual person who are making trips. Therefore, it is very necessary to study the trip chaining behaviour of people for activity pattern selection.

2. LITERATURE REVIEW

Most of traffic problems in Indian cities are due to increase in vehicle ownership, urbanisation and poor public transport services etc. Socio economics of people are playing important role in transportation planning of any city. Various factors are influencing travel behaviour like Age, Income and working status of people will decide travel making behaviour of people (Grieco, 2011). As trip based approach is used to simulate the socio economics of the people with no of trips generated in order to calculate travel demand. Oyedepo *et al.* (2009) observed that the people with higher income and more automobile availability produce more trip than people with low income and less automobile availability. Also, home based other trip purpose takes the largest percentage (52%) of people in Ado Ekiti while non home based and home based work contributes 31% and 17% respectively. Land use pattern of city is also affecting the transportation planning. In India, most of the land is mixed land use. Trip based approach is helpful in simulating the land use as variables in transportation planning but, it has got certain limitation with respect to activity based approach. Pinjari and Bhat *et al.* (2010) formulated difference between activity and trip based approach as trip based approach finds only number of trips generated and does not consider spatial and temporal variation of trips. So, endeavour of researcher has shift from trip based approach to activity based approach. Recker (2001) developed bridge between travel demand modelling and activity demand modelling by developing mathematical programming formulation which is used to identify similarities and differences between traditional trip based approach and activity based approach.

As main objective of every transport planner is to increase the modal share of public transport and to study factors affecting the choice of public transport of city. Due to lack of public transport, people will choose private transport and undergo trip chaining. i.e., people will choose complex activity pattern. Bowman *et al.* (1995) introduced activity based disaggregate model system with activity schedules to solve complexity in travel behaviour. Authors formulated Activity based approach which consists of overall structure for the day's activities and travel. Activity pattern includes (a) the primary - most important-activity of the day (b) the type of tour for the primary activity, including the number, purpose and sequence of activity stops; and (c) the number and purpose of secondary -additional - tours. Activity based model is designed to capture interactions among an individual decisions throughout a 24 hour day by explicitly representing tours and their interrelationships in an activity pattern. Golob (1995) developed simultaneous model of household activity participation and trip chain generation. Author considered activity demand which produces trip generation and creates demand for trip, trip demand produce travel time demand. Both Time budget effect and trip chaining behaviour are considered by author to derive the activity travel demand. Davidson *et al.* (2007) has synthesized first practice and operational research on activity based travel demand modelling. Authors found that Activity based model incorporate sequence of activities and disaggregate time of day travel decisions which are important for addressing critical planning questions and policies such as parking policy, toll strategies and

congestion pricing schemes, high-occupancy-vehicle facilities, air quality analysis, testing impacts of demographic scenarios, and long-term scenarios with a shorter workday duration.
Socio-economic and Land-use of any city plays important role in framing the activity pattern of people. Rao *et al.* (2016) developed relation of activity and travel with socio demographics. This paper focused on designing a new survey instrument called activity-travel diary, method of administration, and analysis of activity-travel behavior in the context of developing countries. The study provided crucial insights on designing an appropriate survey instrument for collecting huge amounts of activity oriented travel data in the cities of developing countries like India. Simple multinomial Logit model was estimated by considering all the household and socioeconomic variables along with the mode-specific constants in defining the utility of different mode choices. Pendyala *et al.* (1998) developed activity-mobility simulator which is capable of simulating changes in individual activity and travel behaviour that may be brought about by a change in the transportation system. This algorithm simulates impact of transportation policies and simulates change in activity and travel pattern. Xuedong *et al.* (1999) developed relationship between socio-demographic, activity participation and travel behaviour. The exogenous variables in this analysis are socio-demographic characteristics, and the endogenous variables are descriptors of the individual's activity participation and travel behaviour. Activity participation is captured by the amount of time spent on each a set of activity categories.

After reviewing literature motioned above, it is found that most of work done in activity demand modelling is simulation of activity pattern with socio-economics of the people. Some of literatures have developed rule-based algorithm which capture behaviour of people in activity demand modelling. Few of them used multinomial Logit model to capture the behaviour people in individual choice making because, Behaviour of choosing individual activity patterns is independent and irrelevant of individual alternatives (IIA) and IIA is the main property of Logit model. But, main research gap is effect of variables which are influencing time budgeting haven't considered in the modelling of activity travel demand. Choice of activity pattern is complex phenomenon which can be very explained by both Multinomial and Nested Logit structure. Most of researchers have used multinomial Logit model as tool to simulate the behaviour of people in choosing activity pattern. One of the important property of Logit model is all choices are directly substitute of each other, i.e. they follow the property of Independent of Irrelevant Alternative. But, in reality all activity patterns for different category of persons (Worker, School-Goers, Housewives) are not direct substitute of each other, there are more likelihood of person to choose particular activity pattern instead of another activity pattern from particular branch of patterns. Such behaviour mostly captured by nested Logit. In this study, Nested structure is applied to check the behaviour of people in choosing activity pattern.

3. METHODOLOGY

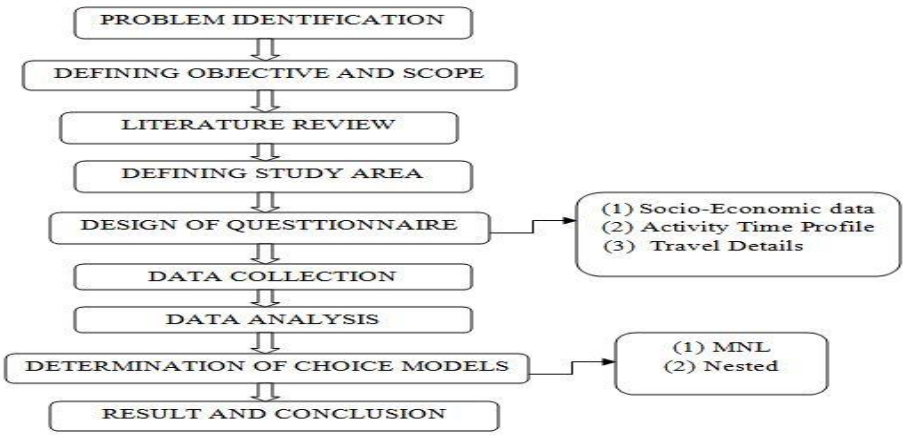

Figure 1 Flowchart showing the Methodology

Figure 1 Flowchart showing the Methodology adopted for present work. After defining the problem, objective and scope of the study are determined. Main objectives are (i) to study and analyze activity pattern and trip chaining behaviour of household members,(ii) to study travel the behaviour decisions with respect to activity pattern,(iii) to analyze the activity pattern at disaggregate level and finally (iv) to develop tour based travel demand model. After deciding the objective and scope, literature reviews of all developing countries are discussed in the domain of activity demand modelling. Study area is considered as Surat city, second city in Indian state of Gujarat with population of around 5.2 million. . Home Interview Survey is adopted to collect the data with the help of stratified random sampling technique. A very well designed questionnaire is used to get the response from the households. Questionnaire includes attributes related to socio-economics, activity time profile and travel characteristics of individual at disaggregate level. Socio-economic details involve age, gender, working status, vehicle ownership, income etc. Activity time allocation profile will consider all the time spent on different activities in a day. Travel details involves trip purpose, travel time and travel cost, start and end time of trip and frequency of trip. Most of the studies carried out on activity travel demand modelling in India (Research @ Indian Institute Technology Madras and Bombay) used 0.05 % of population and it is found that this sample size is sufficient in representing overall behaviour of population in Indian condition. In this study, total population of Surat is nearly 46 Lakh as per census so we considered around sample size 2300 in this study. The survey is conducted throughout the city to cover maximum variation in response. Further, data analysis of activity pattern is carried out at disaggregate level. Three categories are considered mainly workers, school-goers and housewives. After analysis of activity pattern choice models are developed workers, school-goers and housewives. Multinomial Logit model and Nested Logit Models are adopted to capture the choice behavior for all the category of travelers.

3. DATA ANALYSIS

Data collected from activity travel dairy and travel details are considered for the development of activity pattern for three different category of people namely Worker, School-Goers and Housewives. Activities performed by persons are categorised into Work, Education, Maintenance, Recreation and In-Home activities and is shown in Table 1.

Table 1 Symbol for Activities

Activity Symbol & Name	Activities
W (Work)	Private Service, Government Service and Business.
M(Maintenance)	All Maintenance related activities like all types of Shopping, Medical check-up
L (Recreation)	All Leisure activities like Recreation
S (Education)	All activities of Education including School, College and Tuition
H (In-Home)	All activities performed at Home

Total time period of individual person is divided into Open periods and Block Period. Block Period is the time of day which individual has to compulsorily required to be spent for Work activity. Open period is the remaining period of total day after subtracting Block period. In the Given Paper, Block Period is related to Blocked Time.

3.1 Activity Pattern for Worker

There are totally 12 activity patterns available for workers out of which 9 activity patterns are considered because of valid numbers. Table 2 shows the activity patterns for Workers. But choices for activity pattern are 9, so it is difficult to apply the model with 9 choices. To solve this problem, Post-hoc Analysis is carried out considering travel time as criteria and total activity patterns are divided into 4 groups which consist of Activity pattern with single destination, Activity pattern with multiple destination and Home based tour and Activity pattern with multiple destination non-home based tour. They are AP1(H-W-H, Activity Pattern with Single Destination and Home based Tour), AP2 (H-W-M-H, H-M-W-H, H-M-W-M-H, Activity Pattern of Multiple destination with Non-Home-Based Tours), AP3 ((H-W-H, H-L-H) (H-W-H, H-M-H) Activity Pattern of Multiple destination with Home Based Tours), AP4 ((H-W-H-W-H), (H-W-H-W-H, H-L-H), Activity Pattern of Multiple destination with Home Based Tours). Four Groups of workers are really capturing behaviour in choosing activities in sequence. From which transportation planner get idea of workers in performing activity and travel with respect to space and time and it helps for planning of transportation systems in city with respect to Space and Time.

3.2 Activity Pattern for School-Goers

Activity pattern for school going student are observed on daily basis which are shown in Table 3. About 15 activity patterns are observed for school going students. Out of 15 activity patterns, 5 activity patterns have significant numbers, so in modelling of tour, only five activity patterns are considered.

3.3 Activity Pattern for Housewives

Activity pattern of housewives are studied. It is found that 5 activity patterns are found and all activity patterns are taken into consideration in the modelling of Housewives. Table 4 shows activity pattern for Housewives.

Table 2 Activity Pattern for Workers

Sr. No.	**Activity Patterns**	**Percentage**

AP 1	H-W-H	49.3
AP 2	H-W-M-H	15.2
AP 3	H-W-H-W-H	9.6
AP 4	H-W-H, H-M-H	7.0
AP 5	H-M-W-H	3.8
AP 6	H-W-H, H-L-H	2.0
AP 7	H-M-W-M-H	1.7
AP 8	H-W-H-W-H, H-L-H	1.7
AP 9	H-W-M-H, H-L-H	1.5
AP 10	H-W-H-W-M-H	1.0
AP 11	H-M-W-L-H	0.9
AP 12	H-W-H-W-H, H-M-H	0.9

Table 3 Activity Pattern for School-Going Student

Sr .No.	**Activity Patterns**	**PERCENTAGE**
AP 1	H-S-H	67.3
AP 2	H-S-H,H-L-H	12.2
AP 3	H-S-H-S-H	9.0
AP 4	H-S-H-S-H,H-L-H	6.8
AP 5	H-S-M-H	1.3
AP 6	H-L-H	0.8
AP 7	H-S-L-S-H	0.8
AP 8	H-S-H,H-M-H	0.6
AP 9	H-W-H	0.5
AP 10	H-L-S-H	0.1
AP 11	H-M-S-H	0.1
AP 12	H-S-H,H-R-H	0.1
AP 13	H-S-H-S-H, H-M-H	0.1
AP 14	H-S-M-H,H-L-H	0.1
AP 15	H-S-M-S-H	0.1

Table 4 Activity Pattern for Housewives

Sr. No.	**Activity Patterns**	**Percentage**
AP 1	H-L-H	41.7
AP 2	H-M-H	32.5
AP 3	H-M-H,H-L-H	14.4
AP 4	H-W-H	7.0
AP 5	H-R-H	4.3

4. MODELLING OF ACTIVITY TOUR

In order to capture the behaviour of individual in choosing activity pattern, Multinomial Logit model (MNL) is applied for worker, school-goers and Housewives. Nested Logit model is framed for individual category of person and validated by using NLOGIT Software. Probability Values for individual constant are above 95 %confidence interval for school-goers and housewives categories, so model is failed for School-Goers and Housewives also. But Nested Logit model is well fitted and validated for worker catagory.

4.1 MNL Tour Choice Model (MToCH)

MToCH is Series of Multinomial choice models which are developed for all categories of people namely Worker, School-Goers and Housewives.

4.1.1 MNL for worker

Multinomial Regression is developed by considering tours as dependent variables and Travel time (TT) at Primary destination, Gross Income (GI), Monthly Expense (ME) and Blocked Time (BT).

4.1.1.1 Framed Utility Equations

Utility equations framed for worker are shown by set of Equations 1.

$$U(AP1)= a0+a1*(TT)$$
$$U(AP2)=b0+b1*(TT)+b2*(TI)$$
$$U(AP3)=c0+c1*(TT)+c2*(ME)$$
$$U(AP4)=d0+d1*(TT)+d2*(ME) \quad (1)$$

4.1.1.2 Calibration of Multinomial Logit Model (MNL) for Workers

Calibration of model is done by NLOGIT 5.0 Platform. Table 5 shows validation of Multinomial Logit Model for Workers.

Table 5 Calibration of Multinomial Logit Model for Workers

Variables	**Coefficient**	**Probability (|z|>Z)**
A0(Constant)	-16.417	0.0009
A1(TT)	0.0612	0.0000
B0(Constant)	-15.35	0.0021
B1(TT)	0.0697	0.0001
B2(TI)	-0.0001	0.0000
C0(Constant)	37.51	0.0000
C1(BT)	-0.116	0.0000
C2(ME)	0.00142	0.0026
D0(Constant)	-0.1784	0.0375
D1(TT)	-0.3528	0.0008
D2(ME)	0.0169	0.0001
Number of observations	= 546	
Log Likelihood	= - 242.93668	

4.1.1.3 Model Discussion

Utility of choosing activity pattern 1 increases as 0.061 times with unit increase in Travel time at primary destination. Utility of choosing activity pattern 2 increases 0.06968 times as unit travel time increases means non-home-based trip chaining increases as travel time increases. Utility of choosing activity pattern 2 decreases 0.001 times as unit increase in gross monthly income means people of LMIG (Low Medium Income Group). LIG (Low Income Group)will not go especially for shopping and recreation where HMIG(High Medium Income Group) and HIG (High Income Group) people go for big shopping. Utility of choosing activity pattern 3 decreases 0.11608 times as unit increase blocked time means people with more blocked time has less chances to perform home based multi destination tours. Utility of choosing activity pattern 3 increases 0.00142 times as unit increase in monthly expenditure means people will perform special shopping and recreation tours are those who are having more income. Utility of activity pattern 4 decreases 0.3528 times as unit increase in travel time and increases 0.0169 times as unit increase in Monthly Expense.

4.1.2 MNL for School-Goers

Activity Pattern of school-going person is studied at disaggregate level. In order to capture the behaviour of school-going person, Total Income(TI), Monthly Expenditure(ME), Travel Time(TT), Blocked Time(BT), Vehicle Ownership(VO), Activity Time at Secondary Destination(ATSD) are taken as alternative specific variables and following utility equations we get from the data**.**

4.1.2.1 Framed Utility Equations

Framed utility equations for School-goers are shown by set of equations 2.

U(AP1)=a0+a1*(TI)+a2*(ME)+a3*(TT)
U(AP2)=b1*(ME)+b2*(BT)+b3*(VO)+b4*(ATSD)
U(AP3)=c0+c1*(ME)+c2*(TT)
U(AP4)=d1*(ME)+d2*(ATSD)
U(AP5)=e1*(VO)+e2*(ATSD)+e3*(TT) (2)

4.1.2.2 Calibration of Multinomial Logit Model for School-Goers

Calibration of model is done by Multinomial Logit model for school-goers. Table 6 shows validation of Multinomial Logit model for School-Goers. All the probabilities values are within 95% interval. Except two-three variables, all the variables are the best explained by models. Maximum number of observations for school-goers are 770 which are more than workers and housewives also and maximum likelihood function for school-goers is found to be -242.936.

Table 6 Calibration of Multinomial Logit Model for School-Goers

Variables	**Coefficient**	**Probability (|z|>Z)**
A0(Constant)	-64.3	0.0000
A1(TI)	0.25*10^-4	0.0034
A2(ME)	0.0576	0.0000
A3(TT)	1.82	0.0000

B1(ME)	0.1939	0.0000
B2(BT)	-0.929	0.0000
B3(VO)	24.51	0.0000
B4(ATSD)	4.32	0.0000
C0(Constant)	102.79	0.0000
C1(ME)	-0.1754	0.0170
C2(TT)	-2.52	0.0000
D1(ME)	-0.1349	0.0000
D2(ATSD)	4.57	0.0000
E1(VO)	-6.55	0.0000
E2(ATSD)	-3.21	0.0000
E3(VO)	2.304	0.0000
Number of Observations = 770		
Maximum Log-Likelihood = - 242.93668		

4.1.2.3 Model Discussion

Utility of AP1 increases 0.000025 times with unit increase in Total Income, increases 0.0576 with unit increase in Monthly Expenditure and 1.89 times with unit increase of Travel time to Primary destination. Utility of AP2 increases 0.1938 times with unit increase in Monthly Expenditure, decreases 0.9289 times with unit increase in Blocked Time, increases 24.5 times unit increase of Vehicle Ownership and increases 4.32 times with unit increase in Activity Time at Secondary Destination (ATSD), Utility of choosing AP3 decreases 0.0174 with unit Monthly Expense and decreases with 2.526 with unit increase of travel time. Utility of choosing AP4 decreases with 0.1349 times with unit increase in Monthly Expense and increases 4.57 times with unit increase in Activity time at Secondary Destination. Utility of choosing AP5 decreases 6.55 times with unit increase in Vehicle Ownership (VO), decreases with 3.21 times with unit increase in Activity Time at Secondary Destination (ATSD) and increases 2.304 with unit increase in Travel time.

4.1.3 MNL for Housewives

Activity Pattern of Housewife is studied at disaggregate level and MNL model is developed. In order to capture the behaviour of people in choosing activity pattern, Age, Blocked Time (BT), Total Income (TI) and Vehicle Ownership (VO) are considered as dependant variables.

4.1.3.1 Framed utility equations

Framed utility equations for Housewives are shown by set of equations 3.

$$U(AP1)=a0+a1*(AGE)+a2*(TI)+a3*(BT)$$
$$U(AP2)=b1*(TI)+b2*(VO)$$
$$U(AP3)=c1*(AGE)+c2*(TI)+c3*(VO)+c4*(BT)$$
$$U(AP4)=d1*(AGE) \qquad (3)$$

4.1.3.2 Calibration for MNL Model for Housewives

Calibration of MNL model for Housewives is done by using NLOGIT 5.0 Platform. Table 7 shows validation of MNL model for Housewives.

Table 7 Calibration of MNL for Housewives

Variables	Coefficient	Probability (|z|>Z)
A0(Constant)	12.75	0.0000
A1(AGE)	-0.299	0.0000
A2(TI)	0.00021	0.0000
A3(BT)	-0.00322	0.0377
B1(TI)	0.83*10^-4	0.0069
B2(VO)	1.22	0.0000
C1(AGE)	-0.3412	0.0000
C2(TI)	0.00026	0.0000
C3(VO)	4.01	0.0000
C4(BT)	-0.0438	0.0500
D1(AGE)	0.0736	0.0008
Number of Observations	= 343	
Maximum Likelihood	= -186.1578	

4.1.3.3 Model Discussion

Utility of Choosing Activity pattern 1 decreases 0.299 times with unit increase in Age, increases 0.00021 times with unit increase in Total Income and decreases 0.0322 times with unit increase in Blocked Time. Utility of Choosing Activity pattern 2 increases 0.83 *10^-4 with unit increase in Total Income and increases 1.22 times with unit increase in Vehicle ownership. Utility of Choosing activity pattern 3 decreases 0.3122 times with unit increase in AGE , increases 0.00026 times with unit increase in Total Income, increases 4.015 times with unit increase in Vehicle Ownership and decreases 0.00438 times with unit increase in Blocked Time (BT). Utility of choosing activity pattern 4 increases 0.0739 with unit increase in AGE.

4.2 Nested Logit Tour Choice Modelling (NToCH)

MNL model is applied for worker category people but, But, Home based multi destination tours and Non-Home based multi-destination tours are not direct substitute of each other. So it is necessary to apply the Nested Logit Model to study activity tour behaviour of person.
Figure 2 shows structure for Nested Logit model of Worker.

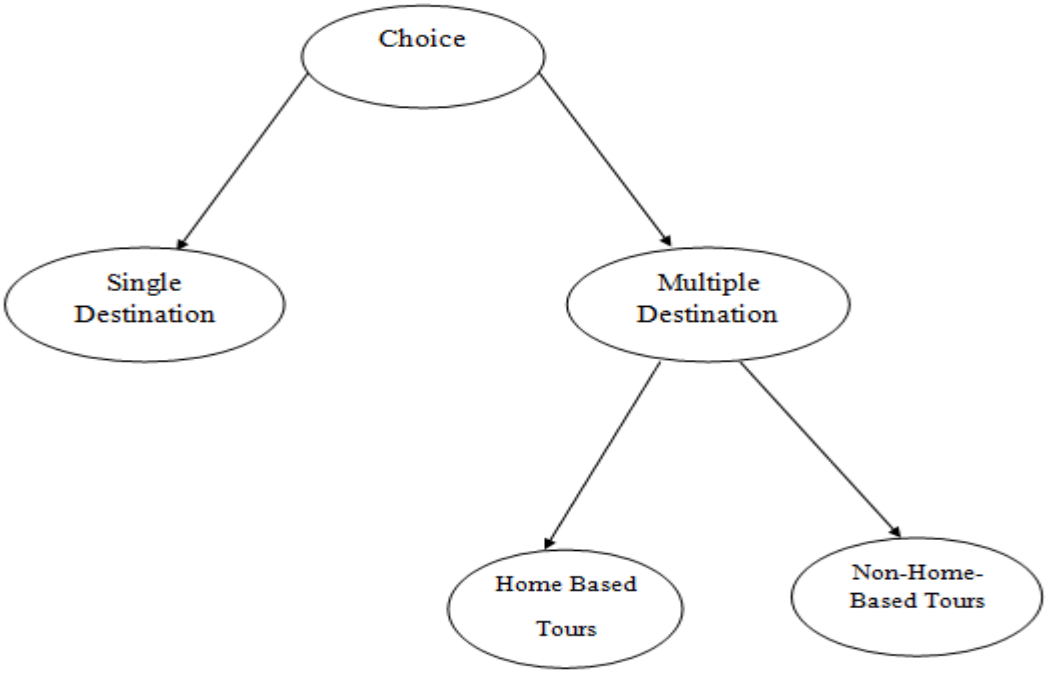

Figure 2 Structure for Nested Logit Model of Worker

Above Figure shows structure for Nested Logit model, where Home based multi-destination tours and Non-Home based Multi destination tours are not direct substitute of each other. Variables considered for choice models are Working Members (WM), Gross Income (GI), Blocked Time (BT) and Vehicles per Working Member (VEWM). Following are the Utility equations get from data of excel sheet.

4.2.1 Framed Utility Equations

Framed utility equations for Housewives are shown by set of equations 4.

$$U(SINGLE,AP1)= a0+a1*(WM)+a2*(GI)$$
$$U(MULTI) = \theta1*logsum(e^{U(HB)}+e^{U(NHB)})$$
$$U(HB)=\theta2*logsum(e^{U(AP3)}+e^{U(AP4)})$$
$$U(AP2)= b1*(VEWM)+b2*(BT)$$
$$U(NHB,AP3)=c1*(BT)+c2*(GI)$$
$$U(AP4)=d0+d1*(TT)+d2*(VO) \quad (4)$$

4.2.2 Model Calibration

Model calibration is done for Nested Logit model. Following Table shows model validation for nested structure. Table 8 shows model validation for Nested Logit model. Total number of observations are 546 for workers. The Maximum Likelihood function for worker is found to be -242.93668.

Table 8 Calibration for Nested Logit Model

Variables	**Coefficient**	**Probability** (|z|>Z)

A0(Constant)	-1.22	0.0000
A1(WM)	0.2057	0.0000
A2(GI)	0.634*10^-5	0.0000
B1(VEWM)	-18.97	0.0000
B2(BT)	0.1363	0.0078
C0(Constant)	-0.053	0.0093
C1(BT)	0.00025	0.0041
D0(Constant)	11.4	0.0061
D1(TT)	-1.33	0.0000
D2(VO)	21.35	0.0000
Θ1=0.164 ,	Θ2=0.729	
Number of observations	= 546	
Log Likelihood	= - 242.93668	

4.2.3 Model Discussion

Model shown above is nested Logit model where Θ1=0.164 and Θ2=0.729. Utility of Choosing Activity pattern 4 decreases 1.33 times with unit increase in Travel time means as travel time increases worker will not come for lunch and activity pattern 4 increases 21.358 times with unit increase in V.O. Utility of Choosing Activity pattern 3 decreases 0.053 times with unit increase in Blocked Time means probability of choosing multiple destination with Home based tours decreases as blocked time increases and utility of Choosing activity pattern 3 increases 0.00025 times as unit increase in Gross income means HIG and HMIG people will do more special recreation and shopping trips. Utility of Choosing Activity pattern 4 decreases 1.33 times with unit increase in travel time means worker will not come for lunch at Home if they have more travel time at primary destination. Utility of Choosing activity pattern 4 increases 21.35 times with increase in V.O. Utility of Choosing Activity pattern 2 decreases 18.97 times with unit increase in Number of Vehicles per working members means shopping trips are carried out by Housewife or other members of Household than workers. Utility of choosing activity pattern 2 increases 0.1363 times with unit increases in Blocked Time. Utility of Choosing activity pattern 1 increases 0.2057 times with unit increase in Working Member means as working members increases then workers have more chance tour with only single destination without having trip chaining as there are more chances of other working member to perform trip chaining.

5. CONCLUSION

- People in Metropolitan city behaves complex tour pattern on daily basis with different activities in single tour.
- Choice of tour pattern is influenced by socio-demographics of people at individual and household level and activity time allocation profile.
- People are trying to optimize total time available in a day, so choice of activity pattern is also affected by 'Time Budgeting' i.e., activity time allocated by people in a day.
- Multinomial model is capturing behaviour of person in choosing daily activity tour for each category of person namely Worker, School-Going Person and Housewife but Nested Logit model is capturing behaviour of worker.

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