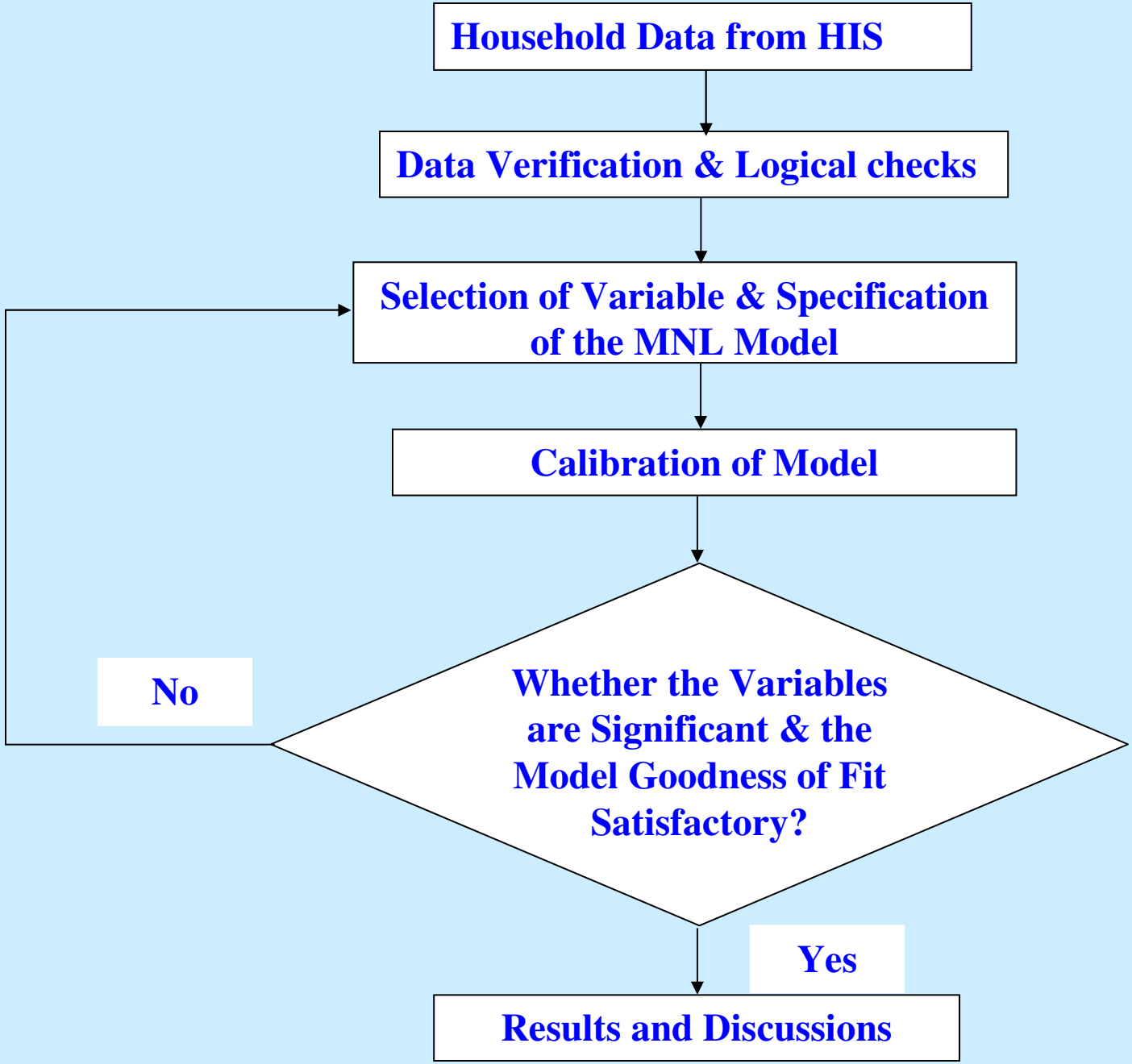
An Example of Discrete Choice Car Ownership Model



RP Car Ownership Model Methodology

Definition of Variables

Variable Code	Description of variable
HOL	House ownership level (categorical variable)
BA	Built up area (categorical variable)
NM	Number of males
NF	Number of females
FS	Family size
NWA	Number of working adults in the household
NNWA	Number of non-working adults in the household
NSGC	Number of school going children in the household
NPMSSC	Number of persons education more than SSC
NPLESSC	Number of persons education less than and equivalent SSC
NCLH	Number of car license holder in household
HHINC	Household Income (categorical variable)
HHTE	Household Travel Expenditure (categorical variable)
NBPHH	Number of business persons in household
NSPHH	Number of service persons in household
NRPHH	Number of retired persons in household
NALPHH	Number of agricultural and labour persons in household
NPAGMF	Number of persons age more than fourty
NPAGLEF	Number of persons age less than and equivalent fourty

Codes Used in RP Data

1. Built-up Area

< 250sq.ft	= 1
250-500	= 2
501-750	= 3
751-1000	= 4
>1000	= 5

2. House Ownership Level

Own	= 1
Rented	= 2
Govt. qtr	= 3
Comp. qtr	= 4

3. Sex

Male	= 1
Female	= 2

4. Occupation

Service	= 1
Farmer/ Labourer	= 2
Business/ Profession	= 3
Student	= 4
Housewife	= 5
Retired/ Unemployed	= 6

5. Education

Illiterate	= 1
Up to SSC	= 2
Up to HSC	= 3
Graduation & above	= 4

6. Income (Rs)

Up to 2000	= 1
2001 - 5000	= 2
5001 - 10,000	= 3
10,001 - 15,000	= 4
15,001 - 20,000	= 5
20,001 - 30,000	= 6
30,001 - 40,000	= 7
> 40,000	= 8

7. Vehicle Ownership

Car/Jeep	= 1
Two Wheeler	= 2
Auto	= 3
Taxi	= 4
Cycle	= 5

8. Driving License

No license	= 0
Two Wheeler	= 1
Car License	= 2

Disaggregate Approach to Model Car Ownership

$$U_{i,n} = V_{i,n} + \varepsilon_{i,n} \qquad (3.1)$$

$U_{i,n}$ = the true utility of household (or individual) *n* for car ownership Level *i (i = 1,2,…., I),*

$V_{i,n}$ = a deterministic component and a function of exogenous variable, and

$$V_{in} = \alpha_i + \beta X_{in} \qquad (3.2)$$

α_i = constant specific to the alternative *i*, β = vector of parameters to be estimated, and X_{in} = vector of attributes for the individual *n* and the alternative *i*

$\varepsilon_{i,n}$ = a random component / error term

The model used was of the multinomial (MNL) form written as

$$P_{n(i)} = \exp(V_{in}) / \exp(V_{jn}) \qquad (3.3)$$

Variables Can Enter in Three Ways

- **Generic Variable**

  Variable that appears in the utility functions of all alternatives in a generic sense and has same coefficient estimate for all the alternatives

- **Alternative Specific Variable**

  Variable that appears only in the utility function of those alternatives to which it is specific and has different coefficient estimate for each of the alternatives

- **Alternative Specific Constant**

  Takes care of unexplained effects

Variable Selection Process

		Variable	
		Policy	***Other***
Correct sign	**Significant**	**Include**	**Include**
	Not significant	**Include**	**May reject**
Wrong sign	***Significant***	**Big problem**	**Reject**
	Not significant	**Problem**	**Reject**

Policy/highly relevant: **Solid theoretical Backing or crucial to model forecasting**

Other explanatory variables: **No theoretical reasons to justify or reject; or not crucial for policy evaluation**

Utility Functions

Final Utility Equations

$V_0 = 4.40$

$V_1 = 0.57\ BA + 0.24\ EMSSC + 1.49\ NCLH + 0.51\ HHINC - 0.28\ FS + 0.23\ NBPHH$

$V_{2,3} = 0.84\ HHINC + 0.27\ BA - 1.74\ HOL - 0.28\ FS + 0.34\ NBPHH$

All variables are alternative specific

Coefficient Estimates & Goodness of Fit Statistics

Multinomial logit log likelihood = - 426.274 (923 observations)

Varible	Coefficient	std.error	t-stat	Relevance of variables
BA	0. 5746	0. 1300	4.4	Specific to 1 car
EMSSC	0. 2376	0. 0805	3.0	Specific to 1 car
NCLH	1. 4960	0. 1950	7.7	Specific to 1 car
HHINC	0. 5057	0. 0645	7.8	Specific to 1 car
FS	- 0. 2870	0. 0764	- 3.8	Specific to 1 car
NBPHH	0. 2262	0. 1490	1.5*	Specific to1 car
HHINC	0. 8367	0. 1050	7.9	Specific to 2 car
BA	0. 2738	0. 2070	1.3*	Specific to 2 car
HOL	-1. 7410	0. 5750	- 3.0	Specific to 2 car
FS	-0. 2802	0. 1170	- 2.4	Specific to 2 car
NBPHH	0. 3427	0. 1940	1.8	Specific to 2 car
0 car constant	4. 4030	0. 4170	10.6	Specific to 0 car
Structural Parameters				
L (0)	-1014.0191	-	-	-
L (c)	- 685.0074	-	-	-
L (θ)	- 426.2742	-	-	-
χ^2	1175.4898	-	-	-
ρ^2 (0)	0.5796	-	-	-
ρ^2 (c)	0.3777	-	-	-
Adj. ρ^2	0.5687	-	-	-

* Not significant at 95 percent confidence level but significant at 90 percent confidence level.

Prediction Success Table

	0 car	1 car	2 car	Observed	% Observed
0 car	603	37	1	641	69.45
1 car	80	160	1	241	26.11
2 car	8	32	1	41	4.44
Predicted	691	229	3	923	100
Prediction %	66.30	24.81	0.33	100	-
%Correctly predicted	99.07	66.39	2.27	-	-