STATED PREFERENCE METHOD

Stated Preference Surveys

- **Based on the elicitation of respondent's statements**
- **Each option is represented as a ‘package’ of different attributes**
- **Variations in the attributes in each package are statistically independent to each other**
- **Ranking (attractiveness), rating (on a scale), choosing most preferred option from a pair or group of them**

Difference Between RP and SP Data

Revealed Preference Data	Stated Preference Data
Based on actual market behaviour	Based on hypothetical scenarios
Attribute measurement error	Attribute framing error
Limited attribute range	Extended attribute range
Attributes correlated	Attributes uncorrelated by design
Hard to measure intangibles	Intangibles can be incorporated
Cannot directly predict response to new alternative	Can elicit preferences for new alternatives
Preference indicator is choice	Preference indicators can be rank, rating, or choice intension
Cognitively congruent with market demand behavior	May be cognitively non-congruent

Attributes and Alternatives

- **Identification of the range of choices**
- **Selection of the attributes to be included in each broad option**
- **Selection of the measurement unit for each attribute**
- **Specification of number and magnitudes of the attribute levels**

Stages in SP data collection

- Identify the range of choices and the attributes to be considered
- Design an initial version of the experiment and survey instrument
- Develop a sampling strategy
- Evaluate the pre-test results

Fundamental SP Design and Problems

- One of the most fundamental designs is Full Factorial Design where all combinations of the attributes levels are considered.
- Example of 3 attributes with two levels is shown below.

		Attributes		
		Travel Cost	**Travel Time**	**Frequency**
Scenarios	1	High	Slow	Infrequent
	2	High	Slow	Frequent
	3	High	Fast	Infrequent
	4	High	Fast	Frequent
	5	Low	Slow	Infrequent
	6	Low	Slow	Frequent
	7	Low	Fast	Infrequent
	8	Low	Fast	Frequent

Continued…

- **Problems**
  - Too many scenarios and games.
  - Trivial questions
  - Contextual constraints
  - The meaning of orthogonality

Existing Methods to Solve the Problems

- Fractional Factorial Design
- Removing Trivial Games
- Contextual Constraints
- Block Design
- Common Attributes over a Series of Experiments
- Defining Attributes in Terms of Differences between Alternatives
- Showing One Design Differently
- Random Selection
- Ratio Estimates etc.

However no single method above solves all problems. Therefore we need to combine some of the existing methods

Experimental Design

- Indicated as factorial design (n^a)

  a = number of attributes n = number of levels
- consider a situation with 5 attributes, 2 at 2 levels and the rest at 3 levels ($2^2 \times 3^3$)

  - 108 all effects

  - 54 principal effects and all interactions

  - 16 only after removing dominant options and options with contextual constraints

Sampling Strategy

- Type of sampling
  - random, stratified, choice based
- Sample composition and size
  - RP studies require large sample
  - SP studies require smaller sample
  - 75 to 100 samples per segment

Identification of Preferences

- Rating

  - on an arbitrary scale (between 1 and 5 or 1 and 10)

- Ranking
- Choice

  - binary choice or group of alternatives

- Choice cum Rating

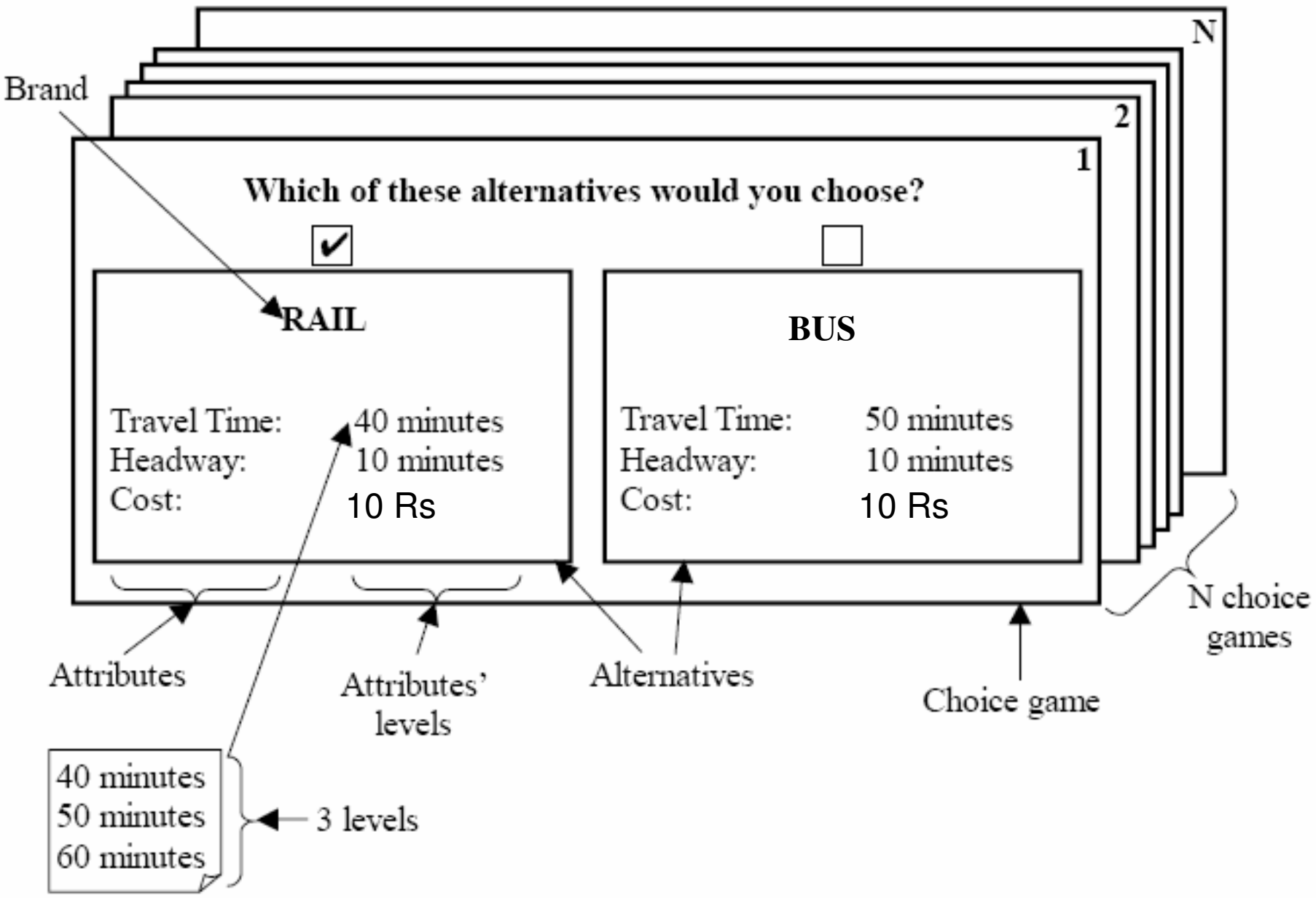
Example of Stated Preference Ranking Exercise

Fare	Interchange	Time on bus	Walk time
70 P	No change	15 mins	10 mins

Fare	Interchange	Time on bus	Walk time
70 P	No change	20 mins	8 mins

Fare	Interchange	Time on bus	Walk time
85 P	No change	15 mins	10 mins

Fare	Interchange	Time on bus	Walk time
85 P	1 change	15 mins	8 mins



Choice-Based SP Questionnaire

Estimation Methods

- Rating Data
  - Least square regression method

    $\theta_o + \theta_1 X_1 + \theta_2 X_2 + \ldots\ldots + \theta_k X_k = r_j$
- Ranking Data

  $U(r_1) \geq U(r_2) \geq U(r_3) \ldots\ldots U(r_N)$

  Can be modeled using discrete choice theory
- , choice and choice cum rating data
  - Discrete choice models

Application of MNL to Ranking Data

- IIA (or MNL) implies that the probability of an observed ranking is a product of MNL's with different choice sets as follows:

$$\text{Prob}(1 > 2 > \ldots > J) = P(1|\{1,2,\ldots,J\})\ P(2|\{2,\ldots,J\})\ \ldots\ P(J-1|\{J-1,J\})$$

where

$$P(i|\{i,\ldots,J\}) = \frac{e^{V_i}}{\sum_{j=i}^{J} e^{V_j}}$$

- Estimate model by creating J-1 observations with choices and choice sets as shown above.

An Example of a Choice cum Rating Stated Preference Experiment

Pune Metro Rail – Salient Features

- Up to 50% reduction in travel times
- Cost of Travel will be comparable to bus Fare
- Trains will run at a convenient frequency of 3 min during peak hours.
- Comfortable Sitting in A/C environment

Metro Rail on the Tracks

Automatic Ticketing Counters

- All stations will be equipped with emergency stop buttons and keeping in mind the Indian milieu along with facilities for physically challenged
- State-of-art computerized ticketing system that saves time and facilitates uninterrupted flow of traffic

- Fully Air-conditioned coaches for hassle free trips everyday
- Passenger Information Display & Public address system at all stations and inside trains

Metro Rail Coach

State-of-the-art Safety Features

a) Automatic door closing with safety features
b) precaution Power Back-up Facility
c) Fire-resistant Coaches
d) Emergency Wireless passenger and driver communication system

Your whole hearted participation in this home interview survey will help in deciding the best routes for this proposed metro rail system

SP Experiment Design

Existing Trip		Metro	
Waiting Time	Stated	Waiting Time	3 Levels
Travel Time	Stated	Travel Time	3 Levels
Travel Cost	Stated	Travel Cost	3 Levels
No. of Transfers	Stated	No. of Transfers	2 Levels
Discomfort	Stated	Discomfort	2 Levels

Choice Scale				
Definitely Existing=1	Probably Existing=2	Can't Say=3	Probably Metro =4	Definitely Metro =5

Attribute Levels in SP Experiment

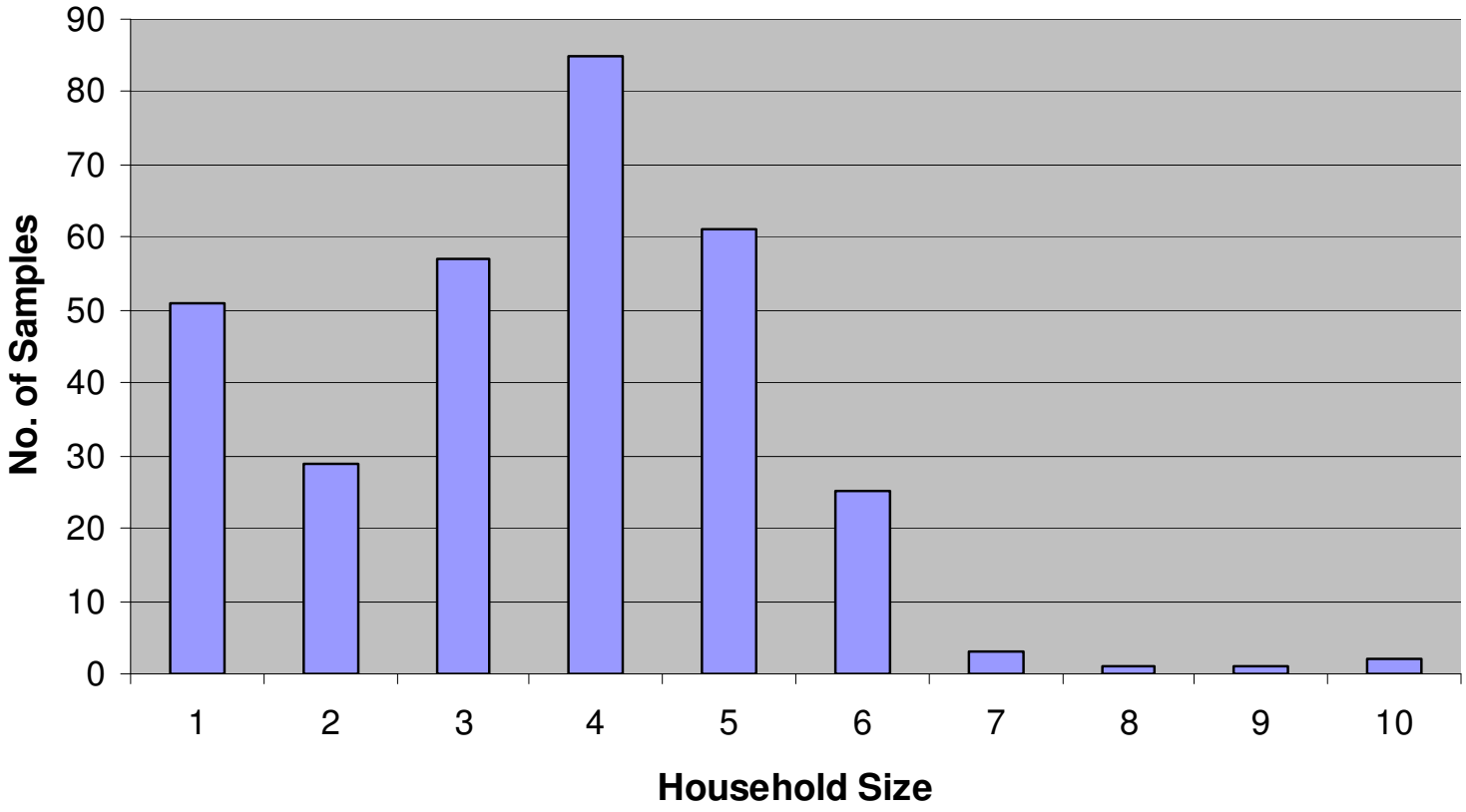
Attribute	No. of Levels	Values	Units
Waiting Time	3	3, 8, 15	Minutes
Travel Time	3	0.5, 1, 1.5 times	Minutes
Travel Cost	3	0.5, 1, 1.5 times*	Rupees
No. of Transfers	2	0, 1	Number
Discomfort	2	1, 2	On a scale of 1-5

*If the present mode is car, the values are 0.25, 0.5, 1 times the perceived cost of travel by car

A Typical SP Option

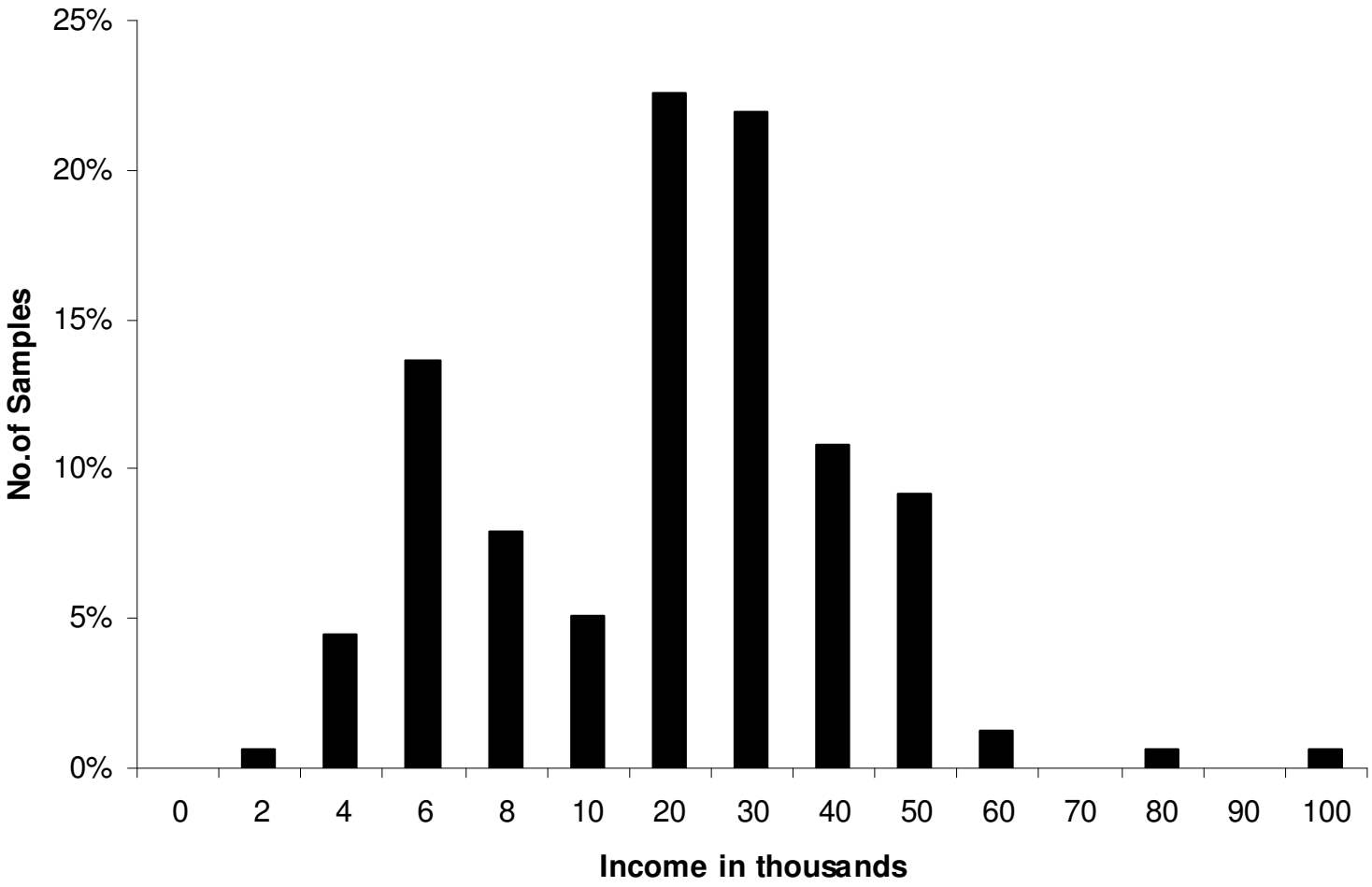
Existing Trip		Metro		
Waiting Time	0	Waiting Time	3	
Travel Time	40	Travel Time	20	
Travel Cost	20	Travel Cost	20	
No. of Transfers	0	No. of Transfers	0	
Discomfort	3	Discomfort	2	
Choice Scale				
Definitely Existing=1	Probably Existing=2	Can't Say=3	Probably Metro =4	Definitely Metro =5

Household Size Distribution of SP Sample

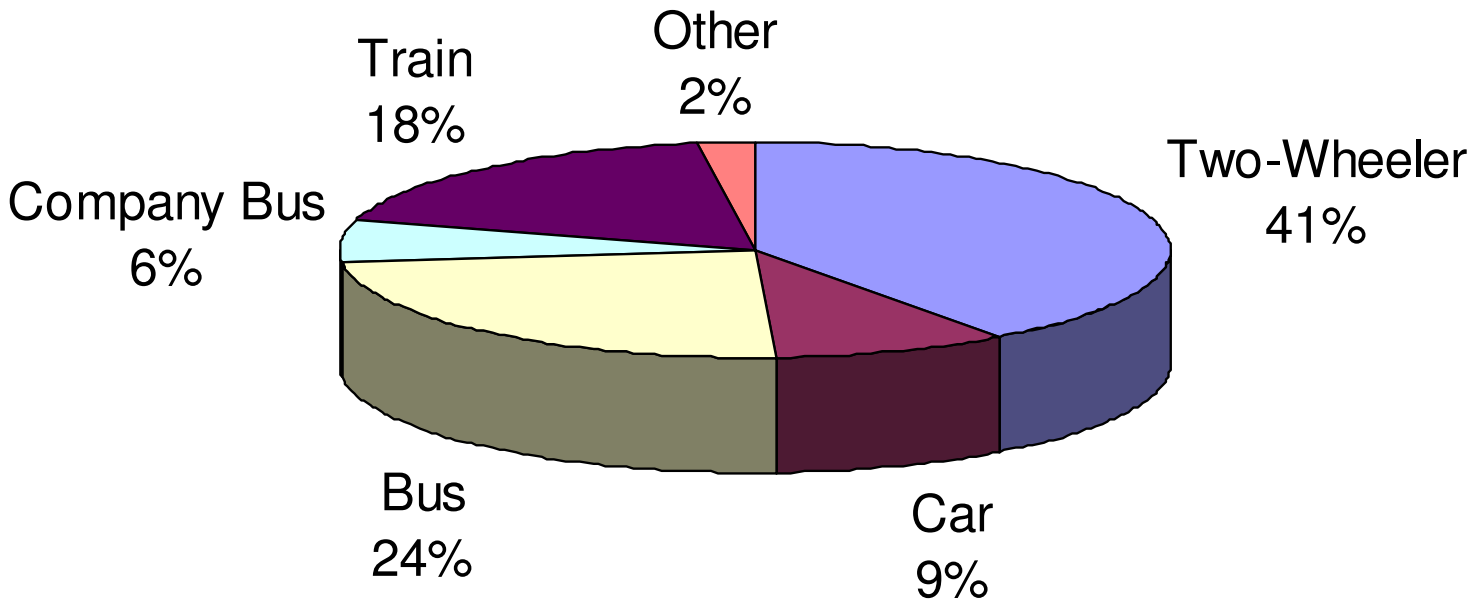


Average Household Size of SP Sample = 3.6

Income Distribution of SP Sample



Mode Wise Sample Distribution from SP



Choice Models

Modewise Binary Logit Models of the following form were developed

$$\Pr(Metro / EM) = \frac{e^{V_{Metro}}}{e^{V_{Metro}} + e^{V_{EM}}}$$

$$V_{Metro} = \alpha\, WT_{Metro} + \beta\, TT_{Metro} + \gamma\, TC_{Metro} + \phi\, TR_{Metro} + \eta\, DC_{Metro} + CONST$$

$$V_{EM} = \alpha\, WT_{EM} + \beta\, TT_{EM} + \gamma\, TC_{EM} + \phi\, TR_{EM} + \eta\, DC_{EM}$$

Calibrated Parameters of Logit Model for Work Trips

Mode	α (WT)	β (TT)	γ (TC)	η (TR)	ϕ (DC)	CONST
TW	-0.0763 (-6.2)	-0.0335 (-6.8)	-0.0592 (-4.7)	-0.8560 (-7.3)	-0.4573 (-7.1)	_
CAR	-0.0835 (-3.2)	-0.0330 (-3.9)	-0.0185 (-2.6)	-1.129 (-4.6)	-0.1441 (-1.3)	0.7519 (3.4)
PT	-0.0212 (-4.2)	-0.0202 (-7.9)	-0.038 (-3.0)	-0.6464 (-8.6)	-0.2993 (-5.0)	-0.9123 (-6.8)

Subjective Values of Attributes

Mode	Waiting Time (Rs./hr)	Travel Time (Rs./hr)	Transfers (Rs. Per Transfer)	Discomfort (Rs. per unit Shift)
Two-wheeler	77	34	14	8
Car	271	107	61	8
Public Transport	33	32	17	8

Use of Computers in SP Surveys

- Possibility of tailoring the experiment to the subject
- Automatic entry validation and routing
- Range and logic checks on responses and pop-up help screens (quality)
- Possible to design experiments including graphical material
- All responses stored directly on disk there are no entry cost nor coding errors.
- Data available immediately for processing
- Interaction with machine as more “serious” matter & punching income with less trouble

  - ALASTAIR, MINT, ACA and most recent is EXPLICIT (powerful graphics)