CHAPTER-3
METHODOLOGY

The methodology relating to the current study **on 'Disparities and determinants of Higher Education in India'** is discussed under the following headings:

3.1. Selection of the States;
3.2. Database of the study;
3.3. Hypothesis formulated;
3.4. Concepts used;
3.5. Theoretical framework;
3.6. Techniques of analysis and
3.7. Tabulation and analysis of data.

3.1. Selection of the States:

The study is related to 16 major States of India. They are

Southern Region

Andhra Pradesh
Karnataka
Kerala
Tamilnadu

Northern Region

Haryana
Punjab
Uttar Pradesh
Jammu and Kashmir

Eastern Region

Assam
Bihar
Orissa
West Bengal

Western Region

Gujarat
Maharashtra
Madhya Pradesh
Rajasthan

This is due to fact that these States accounted for 92 percentage of population of the country. (Census of India, 2011)

3.2. Database of the study:

The study covers macro analysis and micro analysis.

Macro Analysis:

To find the disparity from macro perspective, the secondary data was compiled. The required information relating to State wise enrolment, number of universities, colleges, teachers, expenditure on education, population in the age group of 18-23 years, etc., were compiled from the following sources.

1. Annual Report-University Grants Commission of India- Various Issues.
2. Report of Ministry of Human Resource Development, Government of India– Various Issues.
3. Census of India 2011, Registrar General, Government of India, New Delhi.
4. Statistical Abstract of India – Various Issues.
5. Report of National Sample Survey Organisation-64th round-2007-08.
6. Statistics on Women in India 2010-National Institute of Public Cooperation and Child Development and
7. RashtriyaUchchatarShikshaAbhiyan-National Higher Education Mission, Ministry of Human Resource Development of India–January 2013.

For the macro analysis the study covered the time period from 2004-05 to 2010-11 since it is the recent years for which required data are available. The rural-urban disparity in higher education was related to 2007-08 and the analysis of course wise enrolment was related to 2004-05 to 2009-10 since the required data were available only for these years.

Micro Analysis:

The study used the micro analysis, to identify the determinants of enrolment in higher education at the household level and to identify the determinants of choice of

higher educational institutions. For this purpose the primary data was collected by adopting multistage random sampling. **In the first stage**, Coimbatore was selected for the study due to easy accessibility of the investigator.

Profile of the study area:

Coimbatore is the second largest city and urban agglomeration in the IndianState of Tamil Nadu, after Chennai and the sixteenth largest urban agglomeration of India. It is one of the fastest growing tier-II cities in India. It is also known as Manchester of South India. It has an area of 105.5km^2 (41 sq miles). It is surrounded by the Western Ghats mountain range on the West and North, with reserve forests and the Nilgiri Biosphere Reserve on the northern side. The city lies between 10^0 10' and 11^0 30' of the northern latitude and 76^0 40' and 77 ^{0} 30' of eastern longitude in the extreme west of Tamilnadu near Kerala State at an elevation of 432 meters from sea level.

Climate:

Coimbatore has a pleasant climate due to its proximity to thickly forested mountain ranges and the cool breeze blowing through the Palghat gap which makes the consistently hot temperatures pleasant. The mean maximum and minimum temperature varies between 35 °C (95 °F) and 18 °C (64 °F) and the average annual rainfall is around 700 millimeters.

Population:

According to 2011 Census, Coimbatore has a population of 1,050,721 with a sex-ratio of 997 females for every 1,000 males, much above the national average of 929. A total of 102,069 are under the age of six, constituting 52,275 males and 49,794 females. Scheduled castes and scheduled tribes account for 10.27 percent and .07 percent of the population respectively. There are a total of 425,115 workers, comprising 1,539 cultivators, 2,908 main agricultural labourers, 11,789 workers in house hold industries, 23,077 marginal workers, 531 marginal cultivators, 500 marginal agricultural labourers, 1,169 marginal workers in household industries and 20,877 other marginal workers.

Administration:

Coimbatore is a Municipal corporation as well as the headquarters of the Coimbatore District. The city is divided into four administrative zones – East, West, North and South.

Education:

Coimbatore is an educational hub of South India. The average literacy of the city is 82.43 percent, compared to the national average of 72.99 percent. In 2010 Coimbatore has 853 Primary Schools, 290 Middle Schools, 103 High Schools, 140 Higher Secondary Schools and 25 Special Schools for Physically Challenged students. As of 2010, Coimbatore District is home to 7 universities, 78 engineering colleges, 3 medical colleges, 1 law college, 1 Forest College, 1 Air Force Administrative college, 35 polytechnic Colleges and more than 150 Arts and Science Colleges. The city also houses research institutes like Central Institute for Cotton Research, Sugarcane Breeding Institute, Institute for Forest Genetics and Tree Breeding, Indian Council for Forestry Research and Education and Tamil Nadu Institute of Urban Studies. There are also plans to establish a World class university in the region and to convert the Government Arts College into a unitary type university. (Coimbatore city, Wikipedia).

In the second stage, one ward from each zone is selected based on the criteria of accessibility. Table-I represents list of wards in Coimbatore.

Table-I (a)
List of wards in Coimbatore-North Zone

Ward No	Area
1	Peelamedu road, Bharathi colony, Avinashi road, Pioneer Mill road
2	Peelamedu, P.S.G, Avinashi road
3	V.K.Menon Road, Ganapathypalayam road, Tirupur textiles LTD, Vilankurchi road, Vilankurchi part, Coimbatore Medical College
17	HUDCO Colony, Krishnarayapuram, Nava India Road, Peelamedu, Road, Avinashi road
18	G.P.Theatre, Sidhapudur, Avaramapalayam, Ramakrishna hospital, Chinnasamy Road
29	State bus stand, V.K.Menon Road
30	G.P.S.T.1, G.P.S.T.2, G.P.S.T.3, Sathyamangalam road
31	Dr.Radhakrishnan road, Dr.Rajendraprasad road,
32	Nehru Street, Sathyamoorthy Road, Tatabad Street, Pakaria Power Static, PonniaGounder Street, G.P.S.T.1 to 9
33	Tatabad Street, power house, street1, street2, street3, street4, Dr. Radhakrishnan road, subrayan street
65	Nellam, Palayam Road, Nallampalyam, T.T.C
66	Saganur, ShobhaNagar,Rajiv Gandhi Salai, Saganur Main Road, SaganurPalam, Periyasamy layout
67	V.B.G layout
68	Rathinapuri
69	Sathyamangalam road, Saganur, Aramarjeva road,
70	Saganur Road, AramarJeva Road, NakiaammanKovil, L.G.B, Texttool
71	Sathyamangalam Ro ad, Saganur
72	Maniankaranpalyam, Poosripalyam, Ganapthipalyam, Ganapathi Road, Athipalayam, Industrial EState Road, Bharathi Road, Gopalakrishnan Road, Cheranmanagar

Source: Records maintained by Coimbatore Corporation, 2012.

Table-I (b)
List of wards in Coimbatore-South Zone

Ward No	Area
12	Karumapukadai, Saramedu, Annuparpalayam, Garden Huts, Nanajundapuram Pumping Station
13	PulianToppu, Bypass Road
25	Velankulam, L.G.B, Highway Department, Coimbatore Railway Station, L.M.Church, YWCA, Court, K.G.Hopsital, Government Arts College, Government Hospitals, West Club Road, Joseph Convent Road
27	Kalleswara Mills, Uppilipalayam, D.S,.P Office, Grey Town, Dr.Nanjappa Road, Somasundram Mills, ChithampuramPillai Park
28	Kalligarayan Road, Sengupta Street, Central Jail, Bharthiyar Road, Sastri Road, Patel Road, Balasundran Road, Town BusstandKallidoss Road, Rajaji Road
36	G.S and W Mill, Syrian Cherath Road, Krishnaswamy Road
37	Corporation School, Head Quarters Police
38	Union high school road.
39	Ukkadam Bus stand, Bypass road, Chinnakulam, TNSTC Kovai, Royal Theatre
40	Corportaion Office, Ukkadam Bus stand, Bypass road
41	Ramarkoil Street
42	Periyakulam, Kempatt Colony, SelvachinthamaniKolam, Bypass road, NH47 to Cochin
43	Vizhayal Street
44	Raja Street, Edayar Street, Big Bazar Street
45	SubbiahMudhaliar Street, Raja Street, Edayar Street
46	Sukrawarpet, MNG Street
47	Teppakkulam Area
54	Kallamedu

Source: Records maintained by Coimbatore Corporation, 2012.

Table-I (c)
List of wards in Coimbatore-East Zone

Ward No	Area
4	Avainshi Road, Airport, Valluvar Nagar, SIHS colony, Neelikkonampalyam
5	Ondipudur, Trichy Road, Stanes Colony
6	Kasthuri Nagar, Weavers Colony, R.V.Layout
7	Central Studio, Rajalakshmi Mill, Kallimadai, Signallur Tank, Signallur
8	Iyer Street, Dhanabal Layout, Nellikonnampalayam south
9	Cotton Mill Road, Ramanjum Road, Kamaraj Road
10	Masakalipalaym, Villankuruchi, Kamaraj Road
11	Krishnapuram, Varadarajapuram, Uppipilipalyam,Trichy road
14	Sowripalayam, Uppipilipalyam, Perks School, Trichy Road
15	Ramakrishnapuram. Siganallur, China Sowripalayam, GanapathyPalayam
16	Sowripalayam, Pudur, Avinashi Road, Ranaga Villas Mills, Nava India
19	Sidhapudur, Lakshmi mills, Bharathipuram,Avainshi road
20	Nethaji Road
21	Red Field, Pulliyakulam, Ammakulam
22	Pankaja Mill, Trichy Road, Pankaja Mill, Road
23	Naggappa Street, Trichy Road, Sowripalayam, Thiruvalluvar Layout
24	Ramathapuram
26	Kuppusamy Naidu Hospital, Avinashi Road, Current House Road, Red Filed, Abdul Road, Kamaraj Road, Racecourse Road,

Source: Records maintained by Coimbatore Corporation, 2012.

Table-I (d)
List of wards in Coimbatore-West Zone

Ward No	Area
34	NSR Road, Saibaba Colony, Dr.Alegesan Road, Bharathi Perk, Murugan Mill, Rajaannamalia Road, Mettupalyam Road
35	North Railway Station, Home Science College
48	R.S.Puram, Ponnsamy Colony, Lawly Road, Majeeth Colony, Sivaram Nagar
49	Periyasamy road, Venkitasamy Road, Ponnorangam Road, R.S.Puram, Thiyagakumaran Street, Mettupalyam Road,
50	Thadagam Road, Robertson Road
51	R.S.Puram, Arokiyasamy Street, Municipal High School, RamalingaRaod, Venkatpuram
52	Ponniyarajapuram
53	Perur Road, Selvapuram South
55	Perur Road, Priya Nagar, LIC Colony, Kumarapalaym, Telegupalayam, Narasipuram, Chochampudur Road
56	ChokkamnPudur Road, Agriculture Field, Tower Line Road, Ramamoorthy Road, ChokkanPudur, Subramaninadayar Road
57	Agriculture University, Indira Nagar, Gokulam Colony, GCT Staff Quarters, GCT, Telegnupalyam, Bharathi Park Road, Forest College, Lawley Road, Sugarcane Main Road, Bharthiyar Road, Central Cotton Research Centre, Ambedkar Road,
58	Anna Street, Chettipalyam, Krishnampatti, Thondamuthur Road, Seeranaickanpalyam
59	Thirumalyampalyam, KaithariKumastha Layout, Kadathur, Mullai Nagar, Pappanaikenpudur, Puudkinar Street, Indira Gandhi West Street
60	Marudhakonar road, Velandipalayam , Kolimedu
61	TVS Nagar
62	K.G.Layout, Ramalinga Nagar
63	K.K.Pudur, Kaveri Nagar
64	Mettupalayam Road

Source: Records maintained by Coimbatore Corporation, 2012.

In the third stage based on the purpose of the study, information was obtained from the households having the population in the age group of 18-23 years and from students enrolled in higher education. Table-II represents the sampling frame work adopted in the study.

Table-II
Sampling frame work adopted in the study

Sl.No	Ward No.	Zone	Number of Households	Number of Households having population in the age group of 18-23 years	Number of students enrolled in higher education
1	3	North	262	129	151
2	16	East	243	114	133
3	47	South	348	162	184
4	60	West	456	196	245
	Total		1309	601	713

Source: Records maintained in Coimbatore Corporation, 2012.

The base line information was obtained by administering an interview schedule to the head of the family of all the households **(601)** in the selected wards. The information relating to general information about the head of the household, information about the family members, family income, family expenditure, family

property, savings, debt, attitude towards higher education of children, etc were obtained by administering an interview schedule to the head of the household.

The information about the course wise enrolment in higher education, cost of education, motives of higher education, reasons for enrolling in a particular course, reasons for preferring a particular college/universities, facilities available in the college, problems faced and measures required were obtained by administering an interview schedule (Appendix-I) to the person enrolled in higher education in the selected households. As such the study covered**713** students enrolled in higher education.

The primary data was related to **2013-14**. To check the accuracy and reliability of data, the pilot study was conducted in August 2013.

3.3. Hypothesis formulated:

1. There is no significant difference in enrolment in higher education in various States of India.
2. There is no in gender disparity in enrolment in higher education.
3. The enrolment in higher education of scheduled caste do not differ from the enrolment of All categories.
4. The enrolment in higher education of scheduled tribes do not differ from the enrolment of All categories.
5. There is no significant difference in enrolment in higher education in rural and urban areas.
6. Population in the age group of 18-23 years, budget expenditure on higher education, number of universities, number of colleges, number of teachers, etc., are insignificant determinants of InterStatedisparity in higher education.
7. Age of the head of the household, size of the family, family income, type of family, size of the family, educational status of the parent, occupational status of the parent, motives for higher education, cost of higher education and percentage of marks in board examination are the insignificant household determinants of enrolment in higher education and
8. Personal factors and university/college related factors are the insignificant determinants of choice of institution by the students.

3.4. Concepts used:

(i) Higher Education:

A person attending college or university education or any such private institution that ultimately result in awarding a Graduate Degree or Postgraduate Degree as recognised by Government or university or any other agency authorized by Government will be considered as attending college. This will include the study of Arts, Science, Commerce, Home Science, Modern Indian/European languages, Theology, Public Administration, Statistics and other similar subjects. Persons receiving vocational training or attending vocational and professional courses will come under the category of vocational institutions. It includes the study of courses which prepare students for various vocations/ professions such as Agriculture, Teacher Training, Physical Education, Engineering and Technology, Architecture, Fine Arts (Music, Dancing, Sculpture, etc.), Journalism, Library Science, Law, Medicines, Business Management, etc. Therefore all persons attending vocational or professional courses such as electrician, plumber, carpenter, motor mechanic, fitter, stenography, typing, architecture, engineering, computers, nursing, midwifery, pathology, courses of ayurvedic, unaniand other system of medicines; agriculture, dairying, forestry, black smithy, dyeing, tanning, textile, teaching (JBT, B,Ed, M.Ed., etc.); physical education, journalism, library science, fine arts, dress making, visual communication, etc. will be considered as attending Vocational Institutes. Persons attending computer and similar courses offered by different private institutions will also be covered under this category. Engineering Colleges, Medical colleges, Indian Institute of Technology's, Institutes of Business Management, professional courses such as Company Secretary, Chartered Accountant, Law Colleges, etc. are also included under this category.

(ii) Gross enrolment ratio:

Gross enrolment ratio is a measure of people enrolled in higher education in proportion to population in the relevant age group of 18-23 years. It is indicated as follows:

$$\textbf{Gross Enrolment ratio} = \frac{\textbf{Number of people enrolled in post higher secondary classes}}{\textbf{Total population in 18-23 age group}} \times 100$$

(iii)State disparity in higher education:

It indicates the difference in gross enrolment ratio in higher education in various States of India.

(iv) Gender disparity in higher education:

It gives an account of difference in gross enrolment ratio in higher education of men and women.

(v) Rural-Urban disparity in higher education:

It indicates the difference in gross enrolment ratio in higher education between rural and urban areas.

(vi)Social group disparity in higher education:

It indicates difference in gross enrolment ratio in higher education of scheduled caste with that of All categories and scheduled tribes with that of All categories.

(vii) College infrastructure:

College infrastructure refers to adequate civic facilities such as class room, laboratory, hostel, library, canteen, drinking water, toilet facilities, etc.

3.5. Theoretical framework:

There are two options for the students-to enroll in college/university or not to enroll in college/university. The most commonly cited student choice study is Fuller, Manski, and Wise (1982), which uses an expected utility setup to arrive at multinomial logit estimation where respondents choose one of several post-secondary options. Later studies tended to focus on one aspect of the college enrolment decision: tuition fees, financial aid, race, school quality, and parent's education. The effect of rising tuition fees on enrolment rates (i.e., the price sensitivity) receives the most attention in the literature, although the effects of financial aid, school quality, and parent's education, are also studied. Leslie and Brinkman (1987) surveys 25 of these studies and notes nearly all of them find a negative and statistically significant relationship between tuition and college enrolment. After standardizing the results of each work, Leslie and Brinkman find a mean price response of -0.7 percentage points for every $100 (in 1982-83 dollars) increase in tuition fees.

Empirical Model:

Each observation chooses between two options: not attending college (j=1), and attending a college (j=2). Utility maximization determines the choice for each student. The random-utility model approach splits utility into observable and unobservable portions, and compares the differences between expected utilities

(Manski, 1977). For utility $U_{ij}=\bar{X}_i\bar{\alpha}_j + T_{ij}\ \beta+\in_{ij}$ an individual i chooses alternative j if max $\{U_{ij} / j \in J\}$. $\bar{X}_i$is a vector of k variables that vary by individual such as grades, family background controls, and high school characteristics. T_{ij} represents tuition, which varies by individual and alternative. While $\bar{\alpha}_j$ is a vector of coefficients that is specific to each alternative j, β is not specific to each alternative because T_{ij} varies by individual and alternative.

The current study tried to apply this model to find out the determinants of choice of courses by the students.

3.6. Techniques of analysis:

i. Co-efficient of variation (CV):

The coefficient of variation (CV) is a normalized measure of dispersion. The coefficient of variation is defined as the ratio of the standard deviation σ to the mean$\bar{\bar{X}}$.

$$CV=\frac{\sigma}{\bar{\bar{X}}}x100$$

It shows the extent of variability in relation to mean of the population.

ii. Compound growth rate:

The study tries to calculate the compound growth rate of gross enrolment ratio, number of universities, colleges and teachers in higher education by using the following formula:

$$\text{Log } Y = \log a + t \log b$$

Where,

Y = Variables and

t = Time period

$$\text{Compound growth rate} = \text{Antilog } (b-1) \times 100.$$

iii. T-test:

'T' test was used to find out whether there is significant difference in enrolment of scheduled caste students and All Categories, scheduled tribes students and All categories and rural and urban areas. The formula used was:

$$t=\frac{\bar{X}_1-\bar{X}_2}{S} \text{ x } \sqrt{\frac{n_1 n_2}{n1+n2}}$$

$$V=n1+n2-2.$$

iv. Squared Euclidean Dissimilarity Co-efficient Matrix (SEDCM):

The SEDCM has been used to identify the distance in the gross enrolment ratio in higher education among the selected States. Through SEDCM, it could be seen how far each State lay from the other State. The statistical calculation was done by using SPSS 16.00 package.

The Squared Euclidean Distance D_{jk} between j^{th} and k^{th}States has been Stated as follows:

$$D_{jk} = [(X_{1j}-X_{1k})^2 + (X_{2j}-X_{2k})^2 + (X_{3j}-X_{3k})^2 + \ldots\ldots\ldots + (X_{ij}-X_{ik})^2$$

v. Sopher's disparity index:

The disparity in enrolment has been estimated by using Sopher's (1974) disparity index. The index is written as follows.

$$D=\log(X_2/X_1)+\log[(Q-x_1)/(Q-x_2)]^{3.}$$

$$Q=200$$

Where X_1 is the enrolment rate of the first group and X_2 is the enrolment rate of the second group and Q>200. The index as proposed by Sopher lacks in certain desirable properties. Indicating this Kunduand Rao (2000) proposed Q=200 so that deficiency are removed. The current study had used improved version. The value of index ranges from 0 to 1. The lower value indicates lower disparity and higher value indicates higher disparity. The current study tried to find out the gender disparity, rural-urban disparity and social group disparity in higher education by calculating Sopher's disparity index.

In calculating gender disparity in higher education,

X_1 denotes the gross enrolment ratioof women in higher education, and

X_2 denotes the gross enrolment ratioof men in higher education.

In calculating social group disparity in higher education with reference to scheduled caste,

X_1 denotes the gross enrolment ratioof scheduled caste studentsin higher education, and

X_2 denotes the gross enrolment ratioof All categories in higher education.

In calculating social group disparity in higher education with reference to Scheduled tribes,

X_1 denotes the gross enrolment ratioof scheduled tribes studentsin higher education, and

X_2 denotes the gross enrolment ratioof All categories in higher education.

In calculating rural-urban disparity in higher education,

X_1 denotes the gross enrolment ratioof rural area in higher education, and

X_2 denotes the gross enrolment ratioof urban area in higher education.

vi. Gini co-efficient ratio:

The study tried to find out the variations in gross enrolment ratio, number of colleges, number of universities, number of teachers and budget expenditure on higher education. The formula used was:

$$\text{Gini co-efficient ratio} = \frac{N+1}{N-1} - \frac{2}{N(N+1)U} \sum_{i=1}^{n} P_i X_i$$

Where,

P_i=The rank assigned to the State;

X_i=Actual value assigned to the State;

U=Actual value of the States / Number of States and

N=Number of States.

vii.Discriminant analysis:

The study applied discriminant analysis to find out the factors causinginterState disparity in enrolment in higher education. On the basis of gross enrolment ratio in higher education, the States were classified into two groups. The States having gross enrolment ratio higher than the average comprises of Group I. Group II comprises of the States having gross enrolment ratio below the national average. The estimated discriminant function is of the form.

$$\mathbf{Y=b_1X_1+b_2X_2+b_3X_3+b_4X_4+b_5X_5+b_6X_6+b_7X_7+b_8X_8+b_9X_9+b_{10}X_{10}+b_{11}X_{11}+b_{12}X_{12}}$$

Where,

Y= State enrolment in higher education;

X_1= State gross domestic product (Rupees. in crores);

X_2= Population in the age group of 18-23 years (in crores);

X_3= Per capita income (in rupees);

X_4=Budgetexpenditure on higher education (Rupees. in millions);

X_5= Number of central universities;

X_6= Number of Institution of national importance;

X_7= Number of State public universities;

X_8= Number of State private universities;

X_9= Number of Government deemed universities;

X_{10}= Number of Private deemed universities;

X_{11}= Number of colleges and;

X_{12}= Number of teachers;

When Group I was compared with Group II on the basis of measurement of several variables a discriminant co-efficient function which can discriminate between the two groups significantly was derived. To test whether there exists difference between the two groups, the following F- test was used. The formula used was

$$F = \frac{N1+N2(P-1)}{P} - \frac{N1+N2}{(N1+N2)(N1+N2-1)} \times D^2$$

Where,

N_1=Number of cases in Group I

N_2=Number of cases in Group II and

D^2=Mahalanobis D square statistics

In order to find the relative importance of variables that discriminate between the two groups, the relative share of each variable was calculated. The relative share of each variable was calculated as follows:

$$DP^2 = \lambda_1 d_1 + \lambda_2 d_2 + \lambda_3 d_3 + \lambda_4 d_4 \ldots\ldots \lambda_i d_i$$

λ_1 is the co-efficient of the first variable in the discriminant function form representing the two groups,d_1 is the difference in the mean value of the two groups for the first variable. In DP^2, $\lambda_i d_i$ gave the contribution of i^{th} variable to the total distance. Total distance between each variable has been calculated to find out the relatively more important variables that discriminate the two groups. The discriminant function was estimated by using SPSS 16.00 version.

viii. Chi-square test:

The study tried to find out the association between attitude of the head of the household towards higher education of boys and girls with the selected socio economic characteristics by using the formula:

$$\chi^2 = \sum \frac{(O-E)2}{E}$$

Where,

O=Observed frequency and

E=Expected frequency

ix. Binary logistic regression analysis:

The logistic regression is one that specifies a functional relationship between a basically dichotomous dependent variable and categorical independent variables. In fact it is a method of multivariate analysis of the multiple regression model designed to deal with the situation when one has the measurement of presence or absence, occurrence or non-occurrence of some factors. Logistic regression is concerned with modelling the odds of dependent variable and the parameters for logistic are most easily interpreted as they are expressed as odd ratios. The basic form of logistic function is:

$$P=\frac{1}{1+e^{-Z}}$$

When numerator and denominator of the right side of the above equation are multiplied by e^z, the logistic function can be expressed in the following manner:

$$P=\frac{\exp(z)}{1+\exp(z)}$$

Where z is the predictor variable and e is the base of natural logarithm, equal to 2.7182. If z is a linear function of a set of predictor variables then:

$$Z = b_0 + b_1 X_1 + b_2 X_2 + \ldots\ldots\ldots + b_k X_k$$

This expression is substituted in the formula for logistic function. Thus, the function becomes

$$P = \frac{1}{1+e^{-(b_0+b_1x_1+b_2x_2+\ldots\ldots\ldots+b_kx_k)}}$$

Odd ratio is the ratio of the probability of the event occurring to the probability of the event not occurring and is denoted as:

$$Ln(P_i / 1- P_i) = b_0 + b_1 X_1 + b_2 X_2 + \ldots\ldots\ldots + b_k X_k + e$$

Where,

P_i=Probability of the event occurring;

b_o=Constant term;

X_1 to X_k=Independent variables;

$b_1$to b_k=Unknown regression coefficients associated with the independent variables X_1 to $X_k$and

e=Error term representing unobserved variables that influence dependent variable.

The quantity P/1 – P is called the odds.

In the current study the binary logistic analysis was used to identify the household determinants of enrolment of students in professional/non-professional course in higher education.

$$Y_i=\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\beta_5X_5+\beta_6X_6+\beta_7X_7+\beta_8X_8+\beta_9X_9+\beta_{10}X_{10}+\beta_{11}X_{11}+\beta_{12}X_{12}+U_i.$$

where,

Y_i= Y=1; If a student is enrolled in professional course,

Y=0; If a student is enrolled in non-professional course;

X_1=Age of the father (in years);

X_2=Age of the mother (in years);

X_3=Educational status of the father (in years of schooling);

X_4=Educational status of the mother (in years of schooling);

X_5=Occupational status of the father; 1=Agriculture; 2=Office work; 3=Industrial worker; 4=Business.

X_6=Occupational status of the mother; 1=Business; 2=Industrial worker; 3=Office work; 4=Teaching; 5=Construction Worker; 6=Others.

X_7=Family income (in rupees);

X_8=Family property (in rupees);

X_9=Type of family; 1=Nuclear family; 0=Joint family.

X_{10}=Size of family; 1=Small family; 2=Medium family; 3=Large family

X_{11}= Motives for higher education; 1=Employment; 2=To support the family; 3=Prestige; 4=Security; 5=Standard of living; 6=For marriage

X_{12}= Cost of higher education. (in rupees); and

X_{13}= Percentage of marks in board examination in the subjects of Physics/Chemistry/ Maths orPhysics/Chemistry/ Biology.

U_i=Error term.

The binary logistic analysis was estimated by using SPSS 16.00 version.

x. Likertrating scale:

Likertrating scaling technique was used to scale the personal factors determining the choice of institutions and university/colleges related factors determining the choice of institutions. In the Likert scale, the respondent was asked to respond to each of the statements in terms of five degrees of agreement or disagreement.Each point on the scale carries a score of 5-Strongly Agree, 4-Agree, 3-Neutral, 2-Disgree, 1-Strongly disagree.

xi. Cronbach's Alpha:

Cronbach's Alpha is a measure of the extent to which all the variables in a scale is positively related to each other. In fact, it is just an adjustment to the average correlation between every variable. The formula for Cronbach's Alpha is

$$\lambda \text{ Standardized} = \frac{K.\bar{r}}{(1+(k-1).\bar{\bar{r}}}$$

Where K is the number of variables and $\bar{\bar{r}}$ is the average correlation among all pairs of variables. Cronbach's Alpha value range from 0 to 1. The higher the score, the more reliable the generated scale is and Nuttaly (1978) has indicated 0.7 to be an acceptable reliably coefficient. In the current study, Cronbach's Alpha was estimated to evaluate the unidimensionality set of scale items.

xii. Factor Analysis:

Factor analysis is the multivariate technique of research that can be used to analyse interrelationships among a large number of variables and to explain these variables in terms of their common underlying dimensions. The objective is to find a way of condensing the information contained in a number of original variables into a smaller set of variables with a minimum loss of information. Factor analysis can also identify representative variables from a much larger set of variables for use in subsequent multivariate analyses or create an entirely new set of variables, much smaller in number, to partially or completely replace the original set of variables for inclusion in subsequent techniques.

In order to establish the strength of the factor analysis solution it is essential to establish the reliability and validity of the obtained reduction and this is done with the Kaiser Meyer Olkin and Bartlett's test of Sphercity-Kaiser Meyer Olkin statistics is to be greater than 0.5. Bartlett's test of sphericity is testing for the significance of correlation matrix of the variables.

For extracting the number of factors the latent root criterion has been used. According to Hair et al., (1998), the latent root criterion is the most commonly used technique and its rational is that any individual factor should account for the variance of at least a single variable if it is to be retained for interpretation. Each variable contributes a value of 1 to the total eigen value. Thus only the factors having latent root or eigen values greater than 1 are considered significant, all factors with latent root less than 1 are considered insignificant and are disregarded. Another criteria for the number of factors to be extracted is the percentage of variance criterion which

according to Hair et al., (1998), is an approach based on achieving a specified cumulative percentage of total variance extracted by successive factors.

Factor loading is the means of interpreting the role each variable plays in defining each factor. Factor loadings are the correlations of each variable and the factor loadings indicate the degree of correspondence between the variable and the factor. The current study applied factor analysis to identify personal factors and college/university related factors in the choice of institutions.

xiii. Garrett's ranking technique:

Garrets ranking technique had been used to analyze the problems faced by the students in higher education. Under the Garrett's ranking technique the percentage position is calculated by using the following formula:

$$\textbf{Percentage Position}=\frac{100(R_{ij}-0.5)}{N_j}$$

Where,

R_{ij} is rank given for i^{th} item by the j^{th} individual and

N_j is number of items ranked by j^{th} individual

The percent portion of rank observed was converted into scores by Henry Garrett (1961). The score by all the respondents for each factor was added together and divided by the number of respondents experiencing that particular factor. The mean score was arranged in descending order and the corresponding ranks were allotted.

3.7. Tabulation and analysis of data:

The collected data were tabulated and analysed in the following Chapter in '**Results and Discussion**'.

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