Volume : 3 | Issue : 9 | September 2014 • ISSN No 2277 - 8179

Research Paper

A Comparison on Socio-Economic Status of Tirunelveli and Thoothukudi Districts Using Fuzzy Stochastic Model

Statistics

KEYWORDS : Below Poverty Line, Critical Difference, Least Significant Difference, Fuzzy logic

Arumugam.P	Department of Statistics, Manonmaniam Sundaranar University, Tirunelveli-627012
Sathya Sivagami.N	Department of Statistics, Manonmaniam Sundaranar University, Tirunelveli-627012

ABSTRACT

Socioeconomic status is commonly conceptualized as the social standing or class of an individual or group. It is often measured as a combination of education, income and occupation. For this study, the Below Poverty Line (BPL) of southern districts of Tamil Nadu such as Tirunelveli and Thoothukudi districts are considered. In this paper, for analyzing the significance of which blocks are differ from other blocks in both two districts. The one of the critical difference test is used and also SAS program is implemented for this work.

1. INTRODUCTION

Socioeconomic status is an individual's or group's position within a hierarchical social structure. Socioeconomic status depends on a combination of variables, including occupation, education, income, wealth and place of residence, sociologists often use socio-economic status as a means of predicting behavior. It is a way of looking at how individuals or families fit into society using economic and social measures that have been shown to impact individuals' health and well being. Socioeconomic status and health are closely related, and SES can often have profound effects on a person's health due to differences in ability to access health care as well as dietary and other lifestyle choices that are associated with both finances and education.

Socioeconomic status is one of those terms typically learned in a seventh grade social studies or civics class and then used in college term papers to subtly suggest a deep understanding of how society works, or perhaps how it should work. While it is understandable that few go beyond a cursory understanding of the construct, among social scientists the term is serious business because it connotes one's position in the social hierarchy, how the hierarchy is structured, and very often one's consequent life chances. In other words, socioeconomic status indicates one's access to collectively desired resources, be they material goods, money, power, friendship networks, healthcare, leisure time, or educational opportunities. And it is access to such resources that enable individuals and/or groups to prosper in the social world. The role of statistical analysis is to study, the significance difference of the people and the region.

2. DATA DESCRIPTION

In this paper, for studying the socio-economic level of Tirunelveli and Thoothukudi districts, the block wise data are considered. There are 19 and 12 blocks (Panchayats Union) in Tirunelveli and Thoothukudi districts respectively. The Tirunelveli and Thoothukudi districts hold 424 and 403 panchayats. For each panchayats the detail of number of people in the below poverty line is given. This BPL list is taken to study socio-economic level of these two districts.

3. METHODOLOGY

If the treatments show significant effect then there would be interest of find out which pair(s) of treatments differs significantly from other. There are four methods for comparing pairs of treatment means.

1. Least Significant Difference (LSD) Method
2. Duncan's Multiple Range test
3. The Newman-keuls test
4. Tukey's test.

3.1. Least Significant Difference (LSD)

This procedure uses the F-statistic for testing $H_0 : \mu_i = \mu_j$

$$t_0 = \frac{\bar{y}_{i.} - \bar{y}_{j.}}{\sqrt{MS_E\left(\frac{1}{n_i} + \frac{1}{n_j}\right)}} \quad \ldots (1)$$

Assuming a two-sided alternative, the pair of means μ_i & μ_j would be declared significantly different if $\left|\bar{y}_{i.} - \bar{y}_{j.}\right| > t_{\alpha/2,N-a}\sqrt{MS_E\left(\frac{1}{n_i} + \frac{1}{n_j}\right)}$.

The quantity

$$\text{LSD} = t_{\alpha/2,N-a}\sqrt{MS_E\left(\frac{1}{n_i} + \frac{1}{n_j}\right)} \quad \ldots (2)$$

is called the least significant difference. If the design is balanced, $n_1 = n_2 = \cdots = n_a = n$ and

$$\text{LSD} = t_{\alpha/2,N-a}\sqrt{\frac{2MS_E}{n}} \quad \ldots (3)$$

To use the fisher LSD procedure, we simply compare the observed difference between each pair of averages to the corresponding LSD. If $\left|\bar{y}_{i.} - \bar{y}_{j.}\right| >$ LSD, we conclude that the population means μ_i & μ_j differ.

3.2. Fuzzy Logic

As an extension of the case of multi-valued logic, valuations ($\mu : V_0 \rightarrow W$) of propositional variables (V_0) into a set of membership degrees (W) can be thought of as membership functions mapping predicates into fuzzy sets (or more formally, into an ordered set of fuzzy pairs, called a fuzzy relation). With these valuations, many-valued logic can be extended to allow for fuzzy premises from which graded conclusions may be drawn.

This extension is sometimes called "fuzzy logic in the narrow sense" as opposed to " fuzzy logic in the wider sense", which originated in the engineering fields of automated control and knowledge engineering, and which encompasses many topics involving fuzzy sets and approximated reasoning. Industrial applications of fuzzy sets in the context of "fuzzy logic in the wider sense" can be found at fuzzy logic.

Volume : 3 | Issue : 9 | September 2014 • ISSN No 2277 - 8179

3.3. Membership Function

Let X is a non-empty set. A fuzzy set A in X is characterized by its membership function A: X $\rightarrow$ [0, 1] and A(x) is interpreted as the degree of membership of element x in fuzzy set A for each x in X. The value zero is used to represent complete non-membership; the value one is used to represent complete membership and values in between are used to represent intermediate degrees of membership. The mapping A is also called the membership function of fuzzy set A.

4. EXPERIMENTAL RESULTS

For the Tirunelveli district, the Least Significant Difference (LSD) of BPL values is

LSD = 140.036

Thus, any pair of block (Panchayat Union) averages that differ in absolute value by more than 140.036 would imply that the corresponding pair of population mean is significantly different. The block averages and the differences in averages are given in the Table 4.1.

Table 4.1. Block (Panchayat Union) wise comparison for Tirunelveli district.

Comparisons significant at the 0.05 level are indicated by ***.				
Block Comparison	Difference Between Means	95% Confidence Limits		
3 - 11	-145.97	-299.92	7.99	
3 - 9	-132.57	-272.17	7.04	
3 - 12	-99.95	-237.11	37.20	
3 - 2	-93.83	-256.12	68.45	
3 - 10	-83.50	-221.42	54.42	
3 - 8	-61.56	-192.03	68.91	
3 - 16	-53.48	-196.14	89.17	
3 - 7	12.11	-117.67	141.89	
7 - 15	-347.39	-458.99	-235.79	***
7 - 13	-264.78	-438.02	-91.54	***
7 - 4	-229.28	-331.97	-126.59	***
7 - 5	-225.65	-342.06	-109.25	***
7 - 1	-174.67	-271.20	-78.14	***
7 - 14	-173.14	-295.45	-50.82	***
7 - 6	-171.99	-277.82	-66.17	***
7 - 11	-158.08	-277.28	-38.88	***
7 - 9	-144.68	-244.66	-44.70	***
7 - 12	-112.06	-208.60	-15.53	***
7 - 2	-105.95	-235.73	23.83	
7 - 10	-95.61	-193.22	2.00	
7 - 8	-73.67	-160.44	13.10	
7 - 16	-65.60	-169.80	38.60	
7 - 3	-12.11	-141.89	117.67	

The marked (***) values indicate pairs of means that are significantly different. And the unmarked pair of means that do not differ significantly and blocks 7 and 15 produces a significantly greater difference than the other blocks.

For the Thoothukudi district, the LSD of BPL values is

LSD = 347.54

Thus, any pair of block (Panchayat Union) averages that differ in absolute value by more than 347.54 would imply that the corresponding pair of population mean is significantly different. The block averages and the differences in averages are given in the Table 4.2.

Table 4.2. Block (Panchayat Union) wise comparison for Thoothukudi district.

Comparisons significant at the 0.05 level are indicated by ***.				
Block Comparison	Difference Between Means	95% Confidence Limits		
6 - 4	131.50	-127.73	390.73	
6 - 2	181.12	-76.60	438.83	
6 - 8	275.39	26.23	524.56	***
6 - 5	278.11	-52.32	608.54	
6 - 10	365.36	131.16	599.55	***
6 - 9	434.72	191.61	677.82	***
6 - 3	451.31	193.60	709.02	***
6 - 1	510.37	228.67	792.07	***
6 - 11	515.39	276.24	754.54	***
6 - 7	519.22	248.52	789.92	***
6 - 12	615.93	372.07	859.78	***
4 - 6	-131.50	-390.73	127.73	
4 - 2	49.61	-169.09	268.31	
4 - 8	143.89	-64.67	352.44	
4 - 5	146.60	-154.39	447.60	
4 - 10	233.85	43.43	424.27	***
4 - 9	303.21	101.94	504.48	***
4 - 3	319.81	101.11	538.50	***
4 - 1	378.87	132.36	625.37	***
4 - 11	383.89	187.41	580.37	***
4 - 7	387.72	153.86	621.57	***
6 - 4	131.50	-127.73	390.73	
6 - 2	181.12	-76.60	438.83	

The marked (***) values indicate pairs of means that are significantly different. And the unmarked pair of means that do not differ significantly, and blocks 6 and 12 produces a significantly greater difference than the other blocks.

The whole observations are considered as Universe of discourse for Tirunelveli and Thoothukudi districts as U_i = [0 1200] & U_j = [0 4000] respectively. This Universe of discourse is partitioned into three lengths of intervals as given below.

u_{i1} = [0 450]
u_{j1} = [0 1600]
u_{i2} = [380 850]
u_{j2} = [1200 2800]
u_{i3} = [780 1200]
u_{j3} = [2400 4000]

Then define these fuzzy sets A_1, A_2, A_3 on the above partitioned Universe of discourse for both districts as

A_1 = low BPL
A_2 = middle BPL
A_3 = high BPL

are to be defined. u_1, u_2 and u_3 are chosen as elements of these fuzzy sets. The membership grades of u_1, u_2, u_3 to each A_n (n = 1, 2, 3) will decide that how well each u_k (k = 1, 2, 3) belongs to u_i or u_j. Then determined the membership of each element in all the fuzzy sets A_n (n = 1, 2, 3) and are expressed as

$A_1 = \{ u_1/1, u_2/0.5, u_3/0 \}$
$A_2 = \{ u_1/0.5, u_2/1, u_3/0.5 \}$
$A_3 = \{ u_1/0, u_2/0.5, u_3/1 \}$

Where u_i or u_j (i, j = 1, 2, 3) is the element and the number below '/' is the membership of u_i or u_j to A_n (n = 1, 2, 3).

The triangular membership function is used to both Tirunelveli and Thoothukudi districts for finding the membership value of each panchayats in the fuzzy sets. It is illustrated in the Figure 4.1 and 4.2.

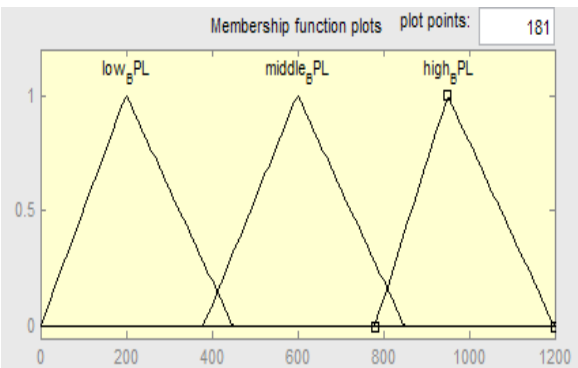


Figure 4.1. Membership function for BPL values in Tirunelveli district.

For instance, in Tiruneveli district, Achankuttam, Ayyanarkulam and Karuvantha are followed low BPL, Ariyanayagipuram, Balapathirampuram and Keelaveeranam are followed middle BPL and Mannarkovil, Kulasekarapatty and Sernthamaram are followed high BPL which is illustrated in Figure 4.1.

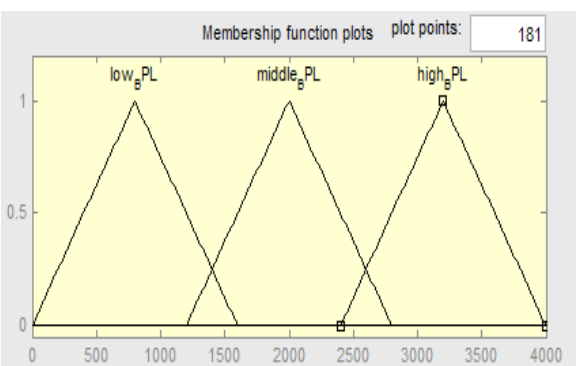


Figure 4.2. Membership function for BPL values in Thoothukudi district.

Similarly, in Thoothukudi district, Aligulam, Dalavaipuram and Kumaragiri are followed low BPL, Mappillaiurani, Karungulam and Seythunganallur are followed middle BPL and Paramankurichi, Venkattaramanujapuram and Inammaniyachi are followed high BPL which is illustrated in Figure 4.2.

5. CONCLUSION

In Tirunelveli district, the blocks Kurivkulam and Valioor give a higher difference than the other blocks, but Valioor has high number of BPL values. Similarly for Thoothukudi district, Udankudi and Pudur blocks highly differing from other, but Udankudi has high number of BPL values. In these blocks, there is a higher difference among number of people in the Below Poverty Line of Tirunelveli and Thoothukudi districts. And also there is a variation between blocks in each district. The number of people under BPL is more than Tirunelveli district when compare with Thoothukudi district. The regime should take more steps to improve the quality of life in this region.

Acknowledgement

The authors acknowledge university grants commission, New Delhi for providing financial support to carry out this work under UGC's Major Research Project.

REFERENCE

[1] Douglas C. Montgomery (1991), "Design and Analysis of Experiments," Third Edition, John Wiley & Sons, New York. | [2] Fisher, R. A. (1925), Statistical Methods for Research workers. Edinburgh: Oliver and Boyd. | [3] Gupta S.P (2008), Statistical Methods, Sultan Chand & Sons Educational publishers, New Delhi. | [4] Kass, R. and Raftery, A. (1995). Bayes factors. Journal of the American Statistical Association, 90(430):773–795. | [5] McLachlan, G. and Basford, K. (1988). Mixture Models: Inference and Applications to Clustering, volume 84 of statistics: Textbooks and Monographs. New York: Marcel Dekker, Inc. | [6] McLachlan, G. and Peel, D. (2000). Finite Mixture Models. New York: Wiley. | [7] Rajagopalan, M. & Dhanavanthan, P. (2012), Statistical Inference, PHI Learning Private Ltd, New Delhi. | [8] Rohatgi V. K. and Md.E. Saleh, A. K. (2011), An Introduction to Probability and Statistics, Second edition, John Wiley & Sons, New York. |