CLASSIFICATION OF ELDERLY BASED ON ECONOMIC SECURITY STATUS- EVIDENCE FROM CLUSTER ANALYSIS

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Population ageing is a prominent demographic feature of Kerala, creating important challenges for ensuring adequate social security and economic well-being among the elderly. This study aims to classify the elderly population in Kerala based on their social security status using cluster analysis, recognizing the heterogeneity in their access to pensions, income sources, health security, and family support. Cluster analysis is employed to group the elderly into distinct categories based on similarities in their socio-economic and social security conditions. The results reveal the existence of multiple clusters representing varying levels of economic security and vulnerability among the elderly.

Introduction

Population ageing is unquestionably the most significant emerging demographic force in the world today. It is the phenomenon in which older individuals (those who are 60 years and above) form a large share of the total population. This process is considered to be an end product of demographic transition or demographic achievement with a decline in both birth and death rates and a consequent increase in life expectancy at birth and older ages. The combination of high fertility and declining mortality during the twentieth century has resulted in large and rapid increases in the elderly population as successively larger cohorts stepped into old age. Further, the sharp decline in fertility experienced in recent times is bound to lead to an increasing proportion of elderly in the future.

Significance of the study

It is quite interesting to note the demographic trends in Kerala, the southern state of India, as it is quite different from the rest of India. The state has an outstanding record in low birth rate and high life expectancy. It is also famed for having a sex ratio in favour of females. The speed of aging in Kerala depends on the fall in the mortality rates, especially among the older age groups. Along with this, a steady decline in birth rate has justified the age structural transition in Kerala. Thus the state has an exceptional age structural transition; from the beginning of the last century, to the last stage of demographic transition, at the beginning of the present century.

Objective of the study

The objective of the study is to classify the elderly people in Kerala according to their economic security status .

Data Sources

The study is based on primary data collected from 400 elderly respondents aged 60 and above from both urban and rural areas of Kollam, Kottayam and Malappuram districts of Kerala using a structured interview

schedule.

Methodology

The effort to classify the elderly people according to their economic security status asks for considering more than one variable which reflect the multidimensional aspects of economic security. Univariate or Bivariate tools of analysis fail to achieve this objective and therefore multivariate statistical tools are to be considered. In this context, the study has identified cluster analysis as a suitable tool.

Cluster analysis, a multivariate statistical tool, is an exploratory tool designed to reveal natural groupings (or clusters) within a data set that would otherwise not be apparent. Among the different procedures by which cluster analysis can be carried out, we have used the hierarchical cluster analysis to identify the ideal number of clusters from the data and have selected the two step cluster analysis procedure to finalise the analysis.

Hierarchical cluster analysis begins by separating each object into a cluster by itself. At each stage of the analysis, the criterion by which objects are separated is relaxed in order to link the two most similar clusters until all of the objects are joined in a complete classification tree. The basic criterion for any clustering is distance. Objects that are near each other should belong to the same cluster, and objects that are far from each other should belong to different clusters.

The algorithm employed by the two step cluster analysis procedure has several desirable features that differentiate it from traditional clustering techniques. Mainly, it helps us to create clusters based on both categorical and continuous variables and also help us to proceed with automatic selection of the number of clusters.

The two step cluster analysis procedure uses a likelihood distance measure which assumes that variables in the cluster model are independent. Further, each continuous variable is assumed to have a normal (Gaussian) distribution and each categorical variable is assumed to have a multinomial distribution. In the context of the present study, empirical internal testing indicates that the procedure is fairly robust to violations of both the assumption of independence and the distributional assumptions to the satisfactory level.

The two steps of the two step cluster analysis procedure's algorithm can be summarized as follows:

*Step 1***:** The procedure begins with the construction of a Cluster Features (CF) Tree. The tree begins by placing the first case at the root of the tree in a leaf node that contains variable information about that case. Each successive case is then added to an existing node or forms a new node, based upon its similarity to existing nodes and using the distance measure as the similarity criterion. A node that contains multiple cases contains a summary of variable information about those cases. Thus, the CF tree provides a capsule summary of the data file.

*Step 2***:** The leaf nodes of the CF tree are then grouped using an agglomerative clustering algorithm. The agglomerative clustering can be used to produce a range of solutions. To determine which number of clusters

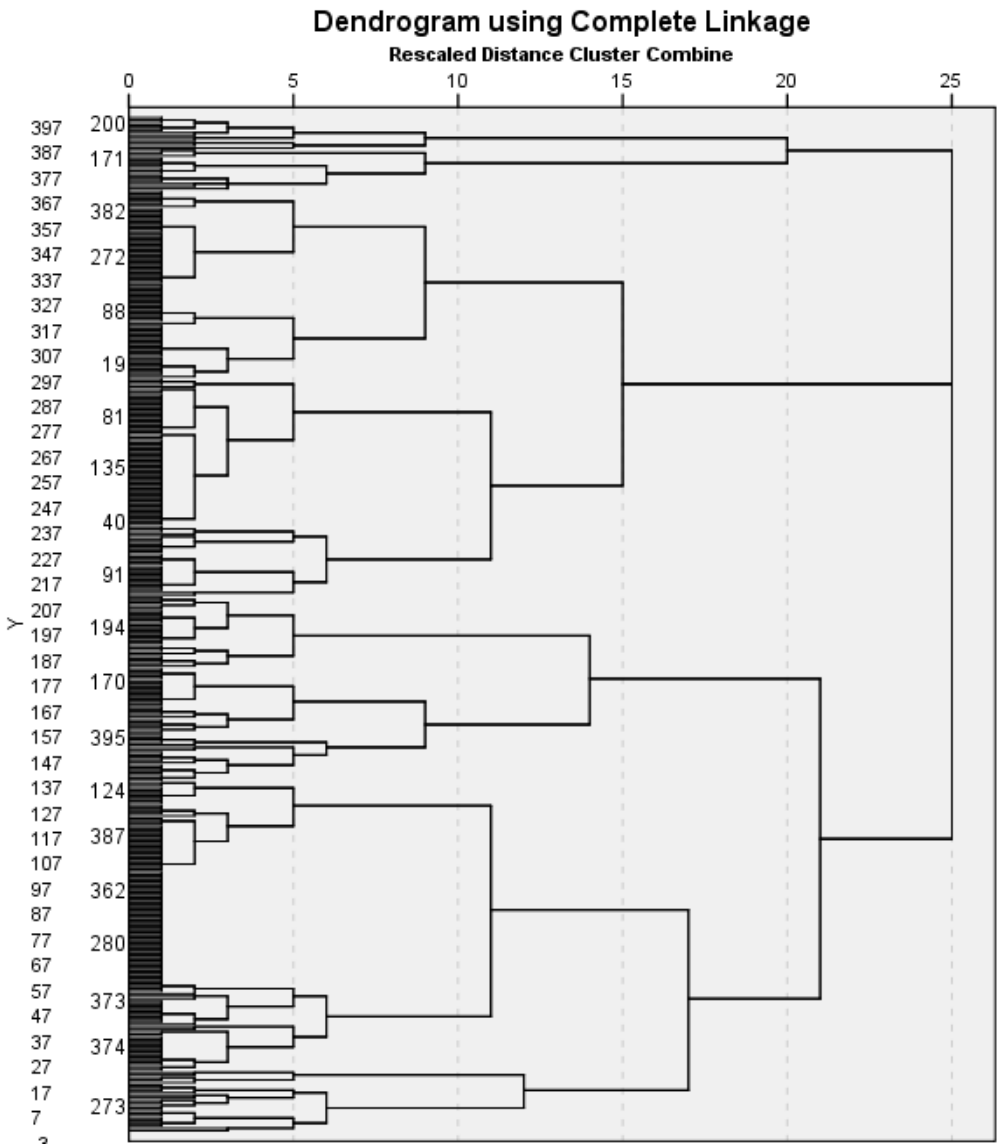
is "best", each of these cluster solutions is compared using the Akaike Information Criterion (AIC) as the clustering criterion.

In the present study, hierarchical cluster analysis attempts to classify the elderly people into different clusters and the resulting dendogram help us to decide the relevant number of clusters. Multiple variables reflecting different aspects of economic security have been used to classify the elderly. The variables, all categorical in nature, are:

- Total Assets Index
- Total Income Index
- Total Liabilities Index
- Economic Dependency Index and;
- Economic Sufficiency Index

The dendogram, which indicates the meaningful number of clusters, is given below as Figure 1.1. It can be easily observed that three clusters are clearly visible, though the sizes of clusters are notably different.

Figure 1.1



With the information on the number of relevant clusters as three, the two step cluster analysis was attempted. The result of the two step cluster analysis is discussed below.

In Figure 1.2, the model summary table indicates that three clusters were found based on the five input variables. The cluster quality chart indicates that the overall model quality is "Fair".

Figure 1.2

Model Summary

Algorithm	TwoStep
Inputs	5
Clusters	3

Cluster Quality

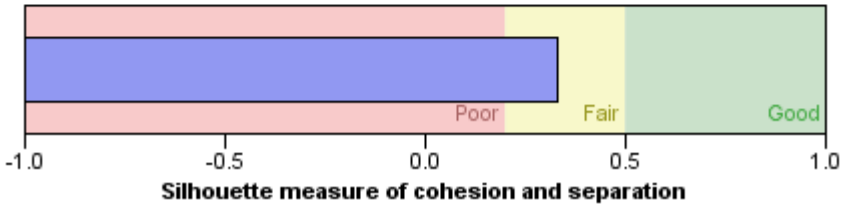
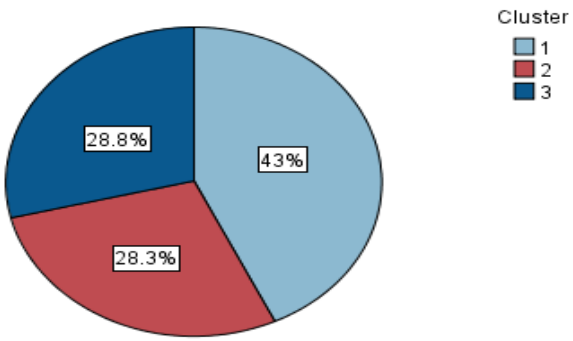


Figure 1.3

Cluster Sizes



Size of Smallest Cluster	113 (28.2%)
Size of Largest Cluster	172 (43%)
Ratio of Sizes: Largest Cluster to Smallest Cluster	1.52

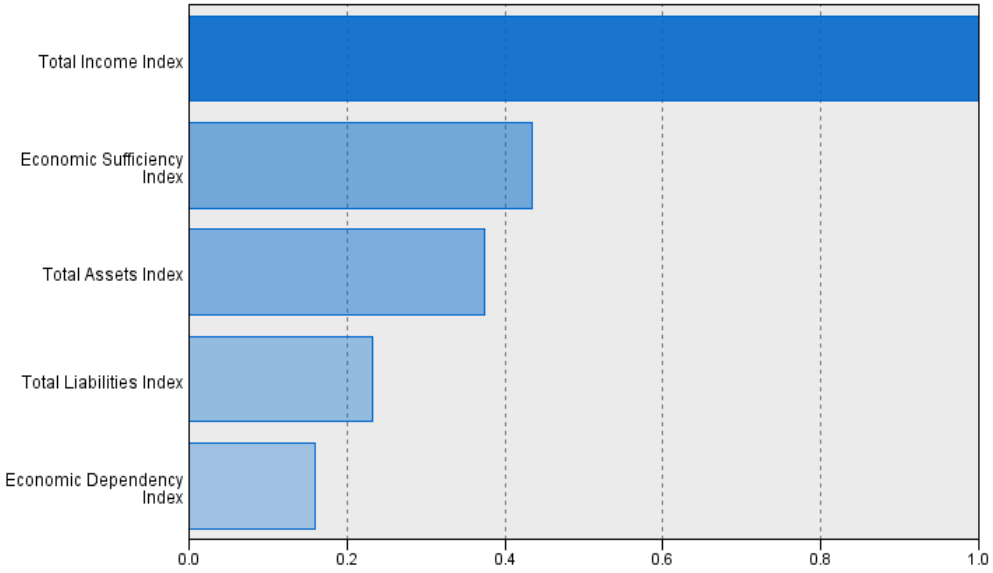
Table 1.1 Cluster Distribution

Cluster	N	% of Total
1	172	43.0%
2	113	28.2%
3	115	28.7%
Total	400	100.0%

The cluster sizes view given in Figure 1.2 and Table 1.1 show the frequency of each cluster. Each slice in the pie chart reveals the number of records assigned to the cluster. It can be seen that 43.0 percent (172) of the elderly were assigned to the first cluster, 28.3 percent (113) to the second cluster and 28.7 percent (115) to the third cluster.

Figure 1.4

Predictor Importance



The relative importance of each variable in the procedure of cluster analysis is given visually in Figure 1.4 Table 1.2 gives the numerical values of the importance score of each variable. As it can be easily observed, Total income index is the most important variable in clustering the elderly into three clusters while economic dependency index is the least important one.

Table 1.2 Predictor Importance

Variables	Importance Score
Economic Dependency Index	0.1594
Total Liabilities Index	0.2315
Total Assets Index	0.3738
Economic Sufficiency Index	0.4343
Total Income Index	1

Now, the clusters can be examined in detail by looking at Figure 1.5 a. Each cluster and its predictor variables are given in each column. The colour coding reveals the relative importance of each predictor variable with regard to each cluster. The category of each variable with highest percentage is indicated in each cell. By examining the figure we may identify cluster 1 as economically ‘unsecure’ cluster of the elders. Likewise, cluster 2 may be identified as ‘partially secure’ cluster and the third cluster as ‘secure’ cluster of the elders.

Figure 1.5 a

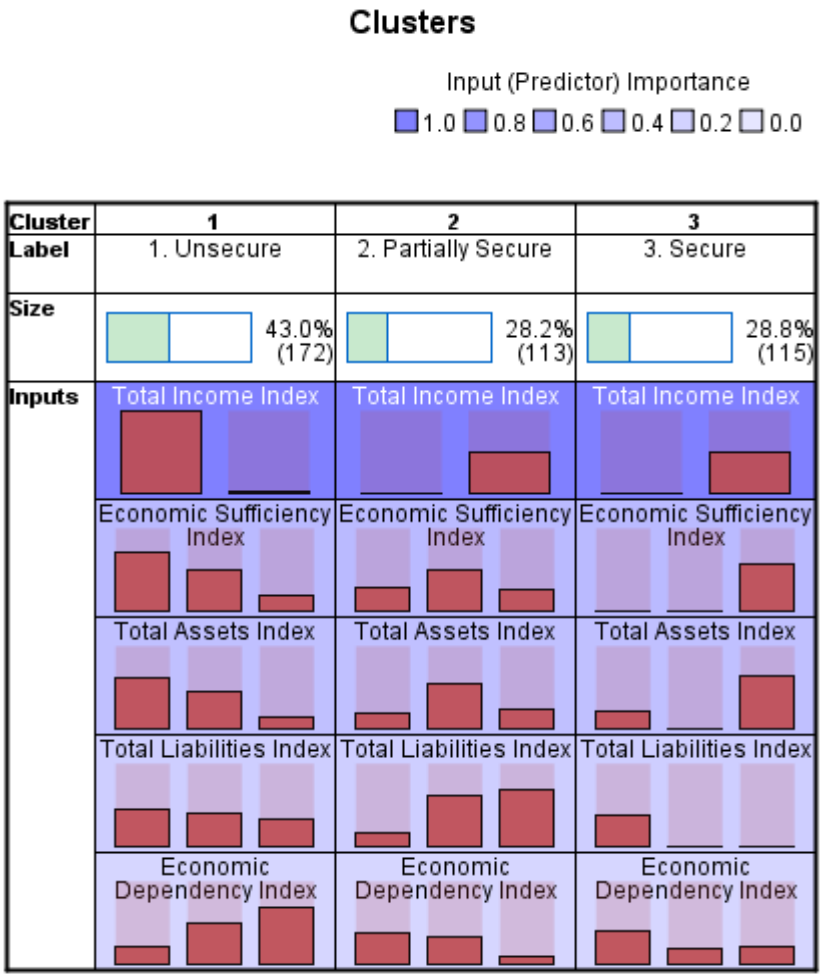
Clusters

Input (Predictor) Importance
1.0 0.8 0.6 0.4 0.2 0.0

Cluster	1	2	3
Label	1. Unsecure	2. Partially Secure	3. Secure
Size	43.0% (172)	28.2% (113)	28.7% (115)
Inputs	Total Income Index Below 1000 (97.7%)	Total Income Index Above 1000 (100.0%)	Economic Sufficiency Index No shortage at all (100.0%)
	Economic Sufficiency Index >1 shortage (70.3%)	Total Liabilities Index Nil (45.1%)	Total Income Index Above 1000 (100.0%)
	Total Assets Index Nil (65.1%)	Total Assets Index Below 10 Lakhs (46.0%)	Total Assets Index Above 10 Lakhs (67.8%)
	Economic Dependency Index Fully dependent (44.8%)	Economic Dependency Index Not at all dependent (54.9%)	Total Liabilities Index Nil (100.0%)
	Total Liabilities Index Nil (79.7%)	Economic Sufficiency Index >1 shortage (44.2%)	Economic Dependency Index Not at all dependent (57.4%)

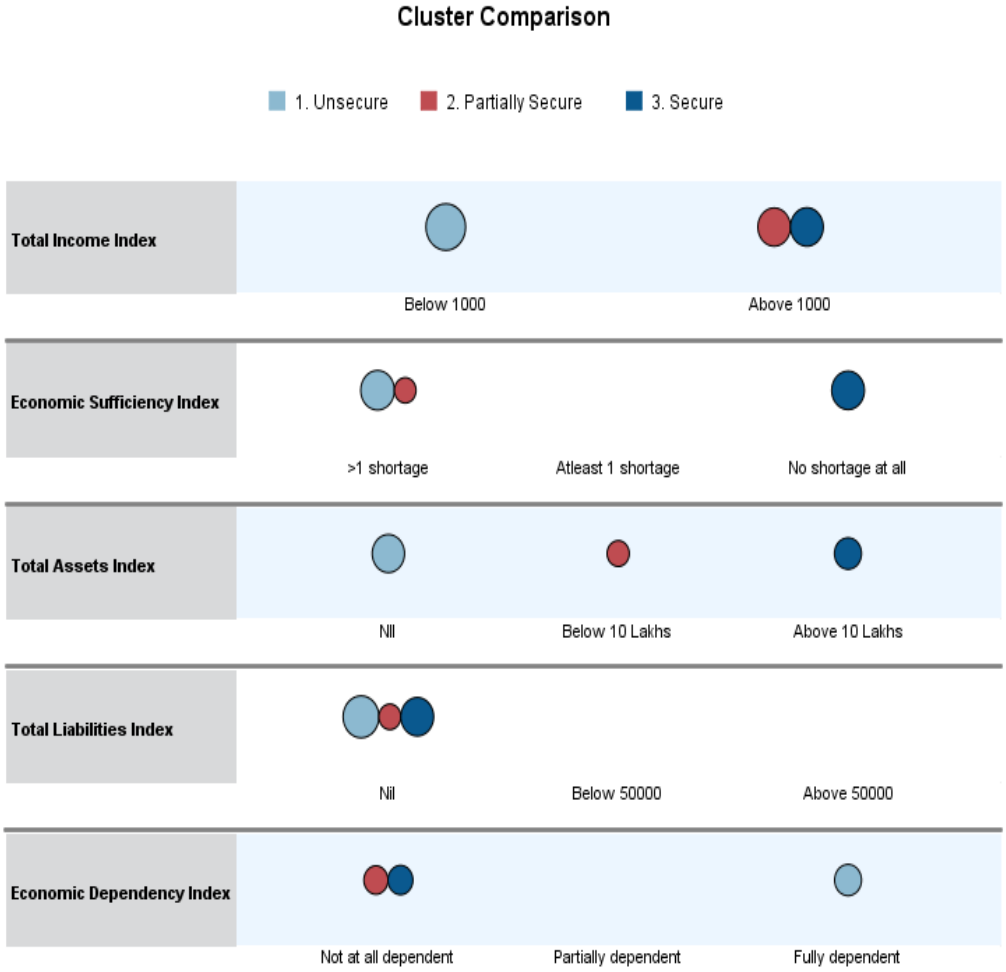
Figure 1.5 b will make the picture clearer. It displays the graphical representation of each variable in all the clusters in separate cells. It facilitates the comparison of the distribution of each variable in all the three clusters.

Figure 1.5 b



The cluster comparison is made more insightful in Figure 1.6. The figure displays dot plots of major categories in each variable. The clusters are denoted with different colours. The size of the dots is proportional to the percentage figure of each category.

Figure 1.6



Conclusion

The study has identified cluster analysis as a suitable tool to classify the elderly people according to their economic security status. In the present study, hierarchical cluster analysis has been attempted to classify the elderly people into different clusters and the resulting dendogram has helped the researcher to decide the relevant number of clusters. Multiple variables reflecting different aspects of economic security have been used to classify the elderly. The variables, all categorical in nature, are: Total Assets Index, Total Income Index, Total Liabilities Index, Economic Dependency Index and Economic Sufficiency Index.

As it can be easily observed, Total income index is the most important variable in clustering the elderly into three clusters while economic dependency index is the least important one. Accordingly cluster 1 may be identified as economically 'unsecure' cluster of the elders, cluster 2 as 'partially secure' and the third cluster as 'secure' cluster of the elders. Among the 400 elderly, the study identified that 43% come under Cluster 1, 28.2% come under the cluster 2 and the only 28.7% under the secure cluster. Thus the majority of elderly that is more than 70% are either partially secure or unsecure and only about a quarter come under the secure category which points out to the gravity of the situation and the need to focus on ageing issues and to take effective measures for improvement in the quality of the life of the elderly in general.

References

- Chakraborti, Rajagopal Dhar, (2004). *The Greying of India: Population Ageing in the context of Asia.* Sage publications, New Delhi
- Chanana, H. B,.. and Talwar, P. P. (1987). *Aging in India: Its Socio-economic and Health Implications.* Asia- Pacific Population Journal, Volume 2, No. 3.
- Government of India (2011). *Situation Analysis of the Elderly in India*, Central Statistics Office, Ministry of Statistics and Programme Implementation.
- Government of Kerala (2005*). A report on the Survey of the Aged*, Department of Economics and Statistics, Kerala.
- Government of Kerala (2009*). Growing Old in Kerala*, UNDP Thematic Study Series 6, HDRC unit, Kerala State Planning Board, Thiruvananthapuram.
- Rajan, I. S., (1999A*). Ageing and Social Security*. In Prakash, B. A. (Ed). Kerala's Economic Development: Issues and Problems, Sage Publications, New Delhi pp 49-70.
- Rajan, I.S. and Mishra,U. S.(1997). *Population Aging: Causes and Consequences*. In Zachariah, K. C., and Rajan, I. S. Kerala's Demographic Transition: Determinants and Consequences. Sage Publications, New Delhi.
- Rajan, Irudaya.S. (2012). *Welfare Fund Boards and Social Security*. In Rajan, Irudaya. S., and Zachariah, K. C.(Eds).(2012). Kerala's Demographic Future: Issues and Policy Options. Academic Foundation, New Delhi.
- Rajan, Irudaya.S.(2006). *Chronic Poverty among the Indian Elderly.* In Mehta, Asha Kapur and Shepherd, Andrew (Eds). Chronic Poverty and Development Policy in India, Sage Publications, New Delhi.
- Rajan, Irudaya.S.(2008). *Aging, Pensions and Social Security* in South Asia. In, Irudaya. S. Rajan (Ed). Social Security for the Elderly: Experiences from South Asia . Routledge, New Delhi.
- Rajan,S.I. (2001). *Social Assistance for Poor Elderly: How Effective?,* Economic and Political Weekly, 36(8), pp 613-617.
- Raju, Siva.S. (2011). *Studies on Ageing in India: A Review.* BKPAI Working Paper No 2, United Nations Population Fund (UNFPA), New Delhi.
- United Nations, Department of Economic and Social Affairs, Population Division (2015). *World Population Prospects: The 2015 Revision.* Key Findings and Advance Tables. Working Paper No. ESA/P/WP.241.
- Zachariah, K. C. (2008). *A Century of Developments in Kerala Demography*: *1951-2051,* in B. A. Prakash and V. R. Prabhakaran Nair (Eds). Kerala's Development issues in the New Millennium, Serials Publications, New Delhi. pp 40-49.