

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 7, July 2015

Statistical Study on the Distribution and Concentration of Urban Population

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ABSTRACT: The distribution and concentration of urban population has been studied by Percentage method and Gini's concentration ratio using Pareto model. In this article urban population of all districts in Tamil Nadu state as per census 2001 and 2011 were considered for the empirical result. The urban population of districts had moved into the district size class 1541350 – 4700000, when the time is increased. The percentage of the level of urbanization is 44.04% in 2001 census and 48.45% for 2011 census. The urban population had gradually increased from 44.04% in 2001 to 48.45% in 2011. This indicates that the increase is 1.1 times for the last ten years and the Gini's concentration ratio of urban population in 2001 census is 0.1448 and for 2011 census 0.2205. It indicates the low concentration and even distribution of urban population in both the census 2001 and 2011, but the increase in urban population of all the districts was significant in Tamil Nadu State.

KEYWORDS: District Size Distribution, Gini's concentration ratio, Maximum Likelihood Method, Pareto Model, Percentage method, Urbanization.

I. INTRODUCTION

The population of the region are dichotomized with respect to the residential status such as rural and urban. Urbanization is the process of growth with respect to changes in size and structure of the urban population. Urban population refers to the people living in urban areas as defined by National Statistical Office. It has very high density of population. The value for urban population in Tamil Nadu was 27483998 as of 2001 census and 34949729 as of 2011 census. According to 2011 census, of the 7.21 crore Tamil Nadu population, 3.49 crore stay in Urban areas, but 2.75 crore stay in Urban area out of 6.24 crore population as per 2001 census. This indicates that the urban population are having increasing tendency over the span of ten years in Tamil Nadu State. This motivates to propose the Statistical study on the distribution and concentration of urban population using the percentage method and gini's concentration ratio based on Pareto model. The revenue administrative units are described as districts. District size is the population of the District. District size distribution is the distribution of District with respect to their population. District size undergoes changes over time and space. The growth of urban population attracts Demographers, planners, etc to study the changes in size and the structure of the urban population. R.B. Bhagat and soumya Mohanty (2009) in this paper, Emerging pattern of urbanization and the contribution of migration in urban growth. R.B.Bhagat (2011) was studied Emerging pattern of urbanization in India. None of the above study analyse the distribution and concentration of urban population in the districts of Tamil Nadu state.

II. SCOPE OF RESEARCH

In this study the data from 2001 and 2011 census were used. To classify the districts of Tamil Nadu State into five classes on the basis of its size and to analyse the distribution and concentration of urban population in the district of Tamil Nadu State. The present study is mainly based on the secondary source. The districts are the unit of the study. All districts in Tamil Nadu state has been selected for the present investigation. There are 30 districts in 2001 census and 32 districts in 2011 census.

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III. METHODOLOGY

The percentage method and Gini's concentration ratio using Pareto model have been employed to study the distribution and concentration of urban population.

3.1. PERCENTAGE METHOD

$$\text{Percentage of change of urban population} = \frac{\text{Urban Population}}{\text{National Population}} \times 100$$

3.2. GINI'S CONCENTRATION RATIO

The Gini's concentration ratio named after its originator Gini (1912) is twice the area of concentration between the Lorenz curve and the forty five degree line of perfect equality. Gini co-efficient summarises an entire distribution with a single value. It indicates the overall degree of inequality of the distribution. The Gini's concentration ratio lies in between zero and one. Zero imply even or uniform distribution of urban population / perfect equality and one represents a more uneven distribution/ perfect inequality of urban population in all the districts. Lower the value of this ration implies a more uniform distribution of urban population and higher the value of this ratio imply a more uneven distribution. In the present work Gini's concentration ratio represents how well the number of districts is distributed among the size of urban population of districts (the level of concentration of urban population). A method of developing Gini's concentration ratio is described with Pareto model.

3.2.1 PARETO MODEL

The Pareto distribution was first proposed as a model for the distribution of income. It is also used as a model for the distribution of city population in the given area. The Pareto distribution has been described as follows

The district size (x) is assumed to follow Pareto distribution $f(x: a)$, where $f(x: a)$ is described as,

$$f(x: a) = \frac{ak^a}{x^{a+1}}, \quad a > 0; x \geq k$$

Where, k is the threshold district size. Parameters 'a' and 'k' are estimated by using the method of Maximum likelihood (Rao C.R.1973) and obtained as

$$\hat{a} = \left[\frac{\sum \log x_i}{n} - \log k \right]^{-1}$$
$$\hat{k} = \min_{i \leq 1} (x_i)$$

Gini's concentration ratio for district size using Pareto model was described as,

$$\rho = \frac{1}{(2a - 1)}$$

IV. EMPIRICAL RESULT

Urban population of all districts in Tamil Nadu state as per census 2001 and 2011 were used to study the distribution and concentration of the urban population. The districts in Tamil Nadu state were classified into five classes: I:70000-641350,II: 641350-941350,III: 941350-1241350,IV: 1241350-1541350,V: 1541350-4700000.

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Table 1. Distribution of Urban Population (as per census 2001)

Class Interval	No .of districts	Urban Population	Percentage of urban population	District size	Cumulative percentage of urban population
70000-641350	14	4789154	17.4	355675	17.4
641350-941350	5	3618292	13.2	791350	30.6
941350-1241350	3	3427143	12.5	1091350	43.1
1241350-1541350	6	8485652	30.9	1391350	74
1541350-4700000	2	7163848	26	3120675	100
Total	30	27484089	100		

National population = 62405679

Percentage change of urban population = 44.04%

Table 2. Distribution of Urban Population (as per census 2011)

Class Interval	No. of districts	Urban population	Percentage of urban population	District size	Cumulative percentage of urban population
70000-641350	11	3835520	11	355675	11
641350-941350	7	5463961	15.6	791350	26.6
941350-1241350	2	2137121	6.1	1091350	32.7
1241350-1541350	3	4394052	12.6	1391350	45.3
1541350-4700000	7	19119075	54.7	3120675	100
Total	30	34949729	100		

National population = 72138958

Percentage change of urban population = 48.45%

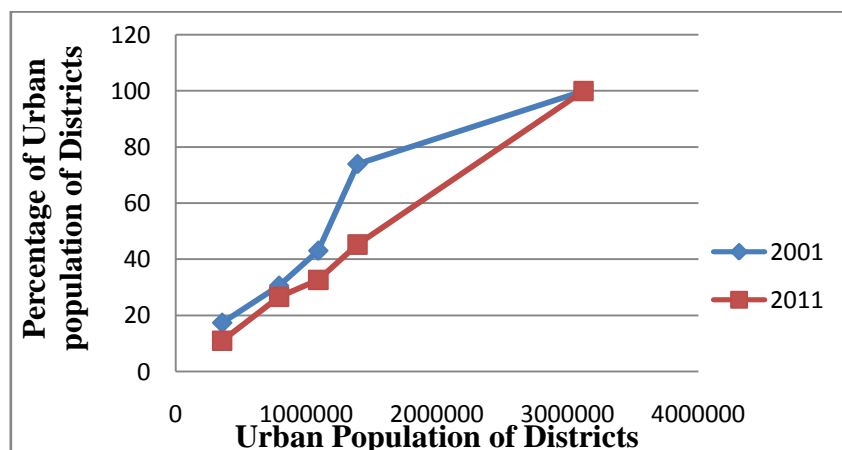


Figure 1. Trend for the Proportional Change of Urban Population of Districts

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The 2001 curve is not similar to 2011 curve in shape. The percentage of first, second, third, and fourth class districts are decreased. However the population of fifth class districts increased from 26% of total population in 2001 to 54.7% in 2011. The cumulative percentage of first, second, third, and fourth class districts and fifth class districts in 2011 were smaller than those in 2001. This means that the urban population of districts had moved into fifth class (1541350 - 4700000) as the time increased.

Table 3. Empirical District Size Distribution for Urban Population (as per census 2001)

District size Interval	No. Of District
70000-641350	15
641350-941350	5
941359-1241350	4
1241350-1541350	5
1541350- 4700000	1

The estimates of the parameter and Gini's concentration ratio are obtained as follows
The estimate of the parameter is,

$$\hat{a} = \left[\frac{174.1217}{30} - 5.5511 \right]^{-1} = 3.9526$$

Gini's concentration Ratio, $\rho = 0.1448$

Table 4. Empirical District Size Distribution for Urban Population (as per census 2011)

District size Interval	No. Of District
70000-641350	12
641350-941350	7
941359-1241350	2
1241350-1541350	3
1541350- 4700000	6

The estimates of the parameter and Gini's concentration ratio are obtained as follows
The estimate of the parameter is,

$$\hat{a} = \left[\frac{177.3734}{30} - 5.5511 \right]^{-1} = 2.7678$$

Gini's concentration Ratio, $\rho = 0.2205$

V. DISCUSSION

The percentage of the level of urbanization in 2001 census is 44.04% and for 2011 census 48.45%. The increase of the level of urbanization among the two periods appeared between 2001 and 2011. This is 1.1 times for the last ten years. These figures about the level of urbanization indicate that the increase of population in urban areas has been significant in all the district of Tamil Nadu state. The concentration ratio in the census year 2001 is less than the concentration ratio in 2011 census. The Gini's concentration ratio for 2001 census is 0.1448 and for 2011 census 0.2205. This indicates more even distribution of the size of urban area in the district of Tamil Nadu state for both the 2001 and 2011, but there is more concentration of the size of urban area of the districts in 2011 than 2001 census.

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VI. CONCLUSION

The empirical result on the distribution and concentration of urban population in districts of Tamil Nadu state has been studied using Percentage method and Gini's concentration ratio based on Pareto model. In this study it has been found that at first, the urban population of districts had moved into the district size class 1541350 – 4700000 when the increased. Secondly the Gini's concentration ratio of urban population in 2001 census is 0.1448 and 2011 census the concentration ratio is 0.2205. This implies more even distribution of the population of urban area in the districts of TamilNadu state for 2001 and 2011 census, but there is more concentration of the size of urban area of the districts in 2011 than 2001 census.

ACKNOWLEDGEMENT

It is with utmost pleasure that we thank to Dr. G. Venkatesan M.Sc., Ph.D., Associate Professor and Head, Department of Statistics, Government Arts College (Autonomous), Salem – 7, Tamil Nadu, India, for his immense help and continuous support to complete this work. The author thanks the referees and editor for constructive suggestions that have improved the content and presentation of manuscript to publish in this journal.

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BIOGRAPHY



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