

Zipf's law for andhra  
pradesh cities and  
towns (1951 – 2001)  
essay



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## Zipf's Law for Andhra Pradesh Cities and Towns ( 1951 - 2001 )

## Abstraction

The distribution of urban population takes topographic point among colonies of differing sizes along a continuum from little towns to large metropoliss. The procedure of urban growing is closely related to the size distribution of cities/towns. Merely a limited figure of statistical distributions have been used to analyze the size distribution of metropoliss of states or parts. Basically, there have been merely three: the Lognormal distribution, the Pareto distribution and a peculiar instance of the later, the rank size distribution, known popularly as Zipf's jurisprudence. Auerbach ( 1913 ) , Singer ( 1936 ) and Zipf's ( 1949 ) demonstrated that the metropolis sizes distribution could be approximated by a Pareto Distribution:  $Y = Ax^{-?}$ . Zipf's jurisprudence collapses into the normally used rank size regulation. A better apprehension of the Zipf's coefficient is important. The cogency of the rank size regulation flexible joints on this advocate holding a value near to one. In this probe we have computed the extent of downward prejudice of Zipf's jurisprudence and studied form of the Pareto Coefficient.

## Zipf's jurisprudence for Andhra Pradesh Cities and Towns ( 1951-2001 )

## 1. Introduction

Many empirical informations that obey power jurisprudence distribution can frequently be observed in both natural and societal scientific disciplines. For illustration the relationship between the frequence and magnitude of temblors, the size distribution of islands, wealth and income distribution in

societies are known to obey the power-law distribution. The distribution of urban population takes topographic point among colonies of differing sizes along a continuum from little towns to large metropoliss. The survey of urban growing by size category of metropoliss and towns could assist us to understand the phases of urban development. The procedure of urban growing is closely related to size distribution of metropoliss and towns.

Auerbach ( 1913 ) , Singer ( 1936 ) and Zipf ( 1949 ) demonstrated that the City Size Distribution could be approximated by a Pareto distribution

$$Y = Ax^{-\beta} \quad (\text{or}) \quad \log Y = \log A - \beta \log x$$

where,  $x$  is the population of a metropolis ;  $y$  is the rank of the metropolis if metropoliss are ordered from the largest metropolis to the smallest,  $A$  and  $\beta$  are invariables. If  $\beta = 1$ , Zipf's jurisprudence collapses into the normally used rank size regulation. This implies that in the instance of metropoliss, the 2nd largest metropolis is half the size of the first and the 3rd largest metropolis is one 3rd the size of the largest and so on. If  $\beta > 1$ , it suggests that the 2nd largest metropolis is more than half of the largest metropolis and the 3rd largest metropolis is more than a 3rd of the largest metropolis and so on. If  $\beta < 1$ , suggests that the 2nd largest metropolis is smaller than the half of the largest metropolis and so on. Linearizing this relationship between rank and size utilizing a long transmutation it is any to gauge negative expand.

## 2. Zipf's jurisprudence: A brief literature reappraisal

Many research workers estimated the Pareto advocate to prove the Zipf's jurisprudence. When the value of the Pareto advocate is non different signifier one, so it is said that the Zipf's jurisprudence holds, otherwise Zipf's jurisprudence is rejected. In a classical paper, Rosen and Resnick ( 1980 ) find that the advocate in 32 out of 44 states exceeded one. Using a new and larger cross-country informations, Soo ( 2005 ) rejects the Zipf's jurisprudence for 53 out of 73 states utilizing ordinary least squares ( OLS ) and 30 out of 73 utilizing Hill calculator. The big scattering of advocates is a divergence from Zipf's jurisprudence. However, this divergence is to interpreted as robust grounds against Zipf's jurisprudence. Parr ( 1985 ) has applied Pareto jurisprudence of income distribution for the analysis of metropolis constructions. He has computed Pareto coefficient as a step of interurban concentration and shown how this coefficient varies through clip within a state. On the footing of grounds from 12 states, he has stated that over a clip a state tends to expose a U-shaped form in the grade of interurban concentration and explored the assorted bases for the temporal form of concentration within a state. Gabaix and Ioannides ( 2004 ) , for case, demonstrate that the OLS arrested development well underestimates the standard mistake so as to reject Zipf's jurisprudence much excessively frequently. Nitsche ( 2005 ) analysed 515 estimations from 229 surveies of the rank size relationship and found that two tierce of the estimations coefficients and between 0. 80 and 1. 20 with average estimation of 1. 09. Eeckhout ( 2004 ) suggests that the value of the advocate is sensitive to the pick of sample size. Soo ( 2007 ) performed a trial of Zipf's jurisprudence utilizing informations for Malayan Cities from five population nose counts ( 1957, 1970, 1980, 1991 and 2001 ) and concluded that Zipf jurisprudence

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is rejected for the periods except 1957, in favor of a metropolis size distribution that is more unequal than would be predicted by Zipf's jurisprudence. Subbarayan ( 2009 ) studied in item the size distribution of metropoliss in Tamilnadu ( 1901-2001 ) .

Most of the old probes are restricted to arrested developments of log size on long rank for a fixed sample. One restriction is that the fixed sample can non know apart the instance that Zipf's jurisprudence is non to be rejected, it is a opportunity consequence that a certain sample size from the instance that the true distribution of the metropolis size is non Pareto distribution. A better apprehension of the Zipf coefficient is important. The cogency of the rank size regulation flexible joints on this advocate holding a value near to one. In this probe we have computed the extent of downward prejudice of Zipf's jurisprudence and studied form of the Pareto coefficient.

### 3. Data, Model and Methodology

#### 3. 1. City Size Distribution in Andhra Pradesh ( 1951-2001 )

A demographic profile of Andhra Pradesh and India based on 2001 nose count is given in the undermentioned tabular array.

Table 1: Demographic profile of Andhra Pradesh and India ( 2001 Census )

	Andhra Pradesh ( in million )	India ( in million )
Entire Population	76. 21	1028. 73

Decadal Population Growth	14. 59	21. 54
Population Density ( per sq. km. )	277	324
Sexual activity ratio	978	933
Literacy	60. 47	64. 84
Percentage of urban to entire population	27. 04	27. 78

#### Definition of Urban country

The definition of an urban unit in the Census of India 2001 is as follows:

1. All topographic points with a Municipal Corporation, Municipality, Cantonment Board or Notified Town Area Committee, etc.
2. All other topographic points that satisfied the undermentioned standards:
  1. A minimal population of 5000,
  2. At least 75 % of the male working population should be engaged in non-agricultural chases and
  3. A denseness of population of at least 400 per sq. kilometer. ( 1000 per sq. stat mi ) .

All topographic points, which have been notified under jurisprudence and have local organic structures like municipal corporations, municipalities, municipal commissions, municipal boards, municipal town commissions,

camp boards, notified countries, notified country commissions, town commissions, town countries, town boards, town municipalities, healthful boards etc. , irrespective of their demographic features have been included in the class of towns.

#### Basic statistics of Urban population in Andhra Pradesh

The basic statistics of urban and rural population harmonizing to 2001 nose count are given in the undermentioned tabular array.

Table 2: Population of Tamil Nadu by sex and abode: 2001

Andhra Pradesh	Male	Female	Entire population	Sexual activity ratio
Urban	1, 05, 90, 209	1, 02, 18, 731	2, 08, 08, 940	965
Rural	2, 79, 37, 204	2, 74, 63, 863	5, 54, 01, 067	983
Entire	3, 85, 27, 413	3, 76, 82, 594	7, 62, 10, 007	978

The entire figure of urban inhabitants in Andhra Pradesh as per the Population sum of the Census of India 2001 is 7, 62, 10, 007. Males figure 3, 85, 27, 413 while females entire 3, 76, 82, 594. The entire figure of urban inhabitants in the state is 285, 354, 954 consisting of 150, 135, 894 males and 135, 219, 060 females. The per centum of urban population to entire

population in the state works out to 27.78% as against the ratio of 27.08% in Andhra Pradesh. Andhra Pradesh ranks ten percent in footings of its urban population 2001.

#### Datas on City Size Distribution

India has really rich beginning of information for urban surveys. The nose count volumes, both at the National and the province and territory degrees, provide a mine of information for rural and urban topographic points for a period of 100 old ages. It is besides chief beginning of information for temporal surveys concentrating in the recent yesteryear. The nose count besides provides informations on intra - metropolis spacial units. The nose count periods used are: 1901, 1911, 1921, 1931, 1941, 1951, 1961, 1971, 1981, 1991 and 2001.

#### Urban size category under Indian nose count

Census of India classifies urban Centres into six categories. Urban Centre with population of more than one hundred thousand is called a metropolis and less than one hundred thousand is called a town. Cities suiting population between one to five million are called metropolitan metropoliss and more than five million are mega metropoliss. Majority of metropolitan and mega metropoliss are urban agglomerations. An urban agglomeration may dwell of any one of the undermentioned three combinations:

1. A town and its adjoining urban branches,
2. Two or more immediate towns with or without their branches and



3. A metropolis and one or more adjoining towns with their branches together organizing a immediate spread.

Examples of urban branch are railway settlements, university campus, port-area, military camp located within the gross bounds of a small town or small towns immediate to the town or metropolis.

Urban population by size categorization is based on the followers:

Class-Population

I-Greater than 1, 00, 000

II-50, 000 - 1, 00, 000

III-20, 000 - 50, 000

IV-10, 000 - 20, 000

V-5, 000 - 10, 000

VI-Less than 5000

City Size Distribution in Andhra Pradesh ( 1901-2001 )

The figure of metropoliss / towns for each nose count twelvemonth under six categories is given in the undermentioned tabular array.

Table 3: Tamil Nadu: City Size Distribution ( No. of Cities / Towns )

	& A ; gt ; 1, 00, 50, 000-1, 00, 20, 000-50, 10, 000-20, 5, 000-10, & A ; lt ; 5, 000	> 1, 00, 50, 000-1, 00, 20, 000-50, 10, 000-20, 5, 000-10, 000	> 1, 00, 50, 000-1, 00, 20, 000-50, 10, 000-20, 5, 000-10, 000	> 1, 00, 50, 000-1, 00, 20, 000-50, 10, 000-20, 5, 000-10, 000	> 1, 00, 50, 000-1, 00, 20, 000-50, 10, 000-20, 5, 000-10, 000	> 1, 00, 50, 000-1, 00, 20, 000-50, 10, 000-20, 5, 000-10, 000
190 1	0	0	11	38	35	0
191 1	0	1	12	39	36	1
192 1	0	2	13	41	35	7
193 1	0	8	11	50	32	3
194 1	0	10	21	46	34	0
195 1	5	11	34	54	19	3
196 1	10	9	50	45	14	0
197 1	13	18	63	37	10	1

198	22	33	67	24	10	1
1						
199	36	42	68	22	6	0
1						
200	47	52	56	33	21	2
1						

### Basic consequences on metropolis size distribution

It may be stated that the procedure of urbanisation in Andhra Pradesh is chiefly large-city oriented. Importantly the portion of category I metropoliss has been turning up consistently through all decennaries in the century. Here, we analyze the changing construction of urban population across size category of colonies over the past 10 nose count decennaries. The turning top weightiness has been examined in the context of motion of towns across the nose count and besides outgrowth of new urban centres. It may be observed that the Class I metropoliss dominate Andhra Pradesh's urban scene in footings of their portion urban population. In 1901, the portion of category I metropoliss was 31.33 % whereas category V and VI towns had 11.18 % and 0.09 % of the urban population, severally. The portion of category I towns has bit by bit increased from 1931 onwards. The addition was maintained in the undermentioned decennaries upto 1991. In the instance of category IV and category V towns, we find that there is a downward motion from 1931 onwards and upto 1991. It is besides observed

that for category II and category VI towns there is oscillating motion between 1931 and 1991.

### 3. 2 Model and Methodology

Let us visualise Zipf's jurisprudence utilizing the illustration given by Gabaix ( 1999 ) . He has considered the state US and ordered the metropoliss with population figure 1 New York, figure 2 Log angels and so on. In the Y axis log of the rank is placed and log of the population is placed in X axis. Then we got a consecutive line with swills near to -1 and the same is given below:

The common manner of gauging the incline of the line in the graph above is as follows:

$$\log ( R_i ) = ? - ? \log ( S_i ) + N'' \dots\dots [ 1 ]$$

where Roentgen  $i$  is the rank of the  $i$  <sup>Thursday</sup> metropolis,  $S_i$  the City Size and  $?$  is a changeless term. It is to be noted that equation ( 1 ) is merely log transmutation of the Zipf's jurisprudence which is expressed in the undermentioned signifier

$$\text{Roentgen } i = A \text{ Second } i^{-?} \dots\dots [ 2 ]$$

Several surveies have noted that gauging this look of the Zipf's jurisprudence outputs an OLS prejudice through standard mistakes. To rectify this prejudice, Gabaix and Ibragimov ( 2006 ) offered the undermentioned equation alternatively of equation [ 1 ] .

$$\text{Log } ( R_i - 0.5 ) = ? - ? \log ( S_i ) + N'' \dots\dots [ 3 ]$$

This corrected version is called Rank minus half regulation. In the undermentioned subdivision, we have provide consequences from both versions and remark on the differences that exist between them.

#### 4. Findings and consequences

The following tabular array shows the full-sample consequences of Zipf's jurisprudence. As expected, all metropoliss / towns for all the old ages show high Roentgen <sup>2</sup>-value ( 0. 860 to 0. 951 ) . It is interesting to observe that the estimated coefficients ( b's ) are higher for the OLS prejudice corrected theoretical account than the original uncorrected version. Therefore, we can reason that the uncorrected Zipf's jurisprudence has a downward prejudice on the estimated coefficient. The value of Pareto coefficient for the mention period of survey show a n-shaped form for Andhra Pradesh metropoliss and town and this is in support of the decision arrived by Parr ( 1985 ) .

Table 1. Regression consequences on Zipf's jurisprudence utilizing Cities / Towns informations from

#### Andhra Pradesh

Year	Uncorrected	OLS Bias Corrected	Roentgen <sup>2</sup>	Size
1951	-1. 178	-1. 229	0. 904	126
197	-1. 053	-1. 103	0. 951	142

1

199

-0.937    -0.973                    0.902    174

1

200

-0.772    -0.796                    0.860    211

1

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