

VALIDITY OF RANK SIZE RULE (GEORGE ZIPE, 1949), LAW OF PRIMATE CITY (MARK JEFFERSON, 1939) AND RANK SIZE CLASS CONCEPTS CASE OF SRI LANKA

A.B. Jayasinghe¹, M.K.N.P.K Dissanayake²

¹ Department of Town & Country Planning, University of Moratuwa, Sri Lanka, Email: amilabjayasinghe@gmail.com

² Department of Town & Country Planning, University of Moratuwa, Sri Lanka, Email: niltcp67@gmail.com

ABSTRACT

The geographers, planners and decision makers have introduced different theories and concepts to describe the spatial structure and city size distribution of the regions based on the particular area. The validity of these theories is more accurate when applying these theories to their particular area than the in applying to the other areas of the world.

The Rank Size Rule (George Zipf, 1949), Law of Primate City (Mark Jefferson, 1939) and Rank Size Class are three of the most striking concepts in Economics and geography which describe the spatial structure in the regions. In literature these theories are applied to describe the city size distribution in many countries. The focus of this study is to investigate the validity of the above theory by applying the theory to the cities of Sri Lanka.

The selected Study area includes the entire towns of the Sri Lanka. To carry out the study it was required to determine the urban population of all cities from 1964 to 2012. Therefore for the need of the study, population data was collected from the Department of Census and Statistics. The study only obtained the secondary data. Based on this data the urban population of the entire cities were determined and, and the hierarchy of the cities in Sri Lanka was ranked, because the application of this theories need to identify the hierarchy and rank of the entire cities.

The analysis was carried out by using descriptive analysis method and regression analysis method. At the end of the analysis scattered graphs are provided, graphs and tables which illustrate the result of the application of the above theories. The results show the city size distribution of Sri Lanka is spread according to the Rank Size Rule in Sri Lanka in 2012. From 1964 to 1981 city size distribution of Sri Lanka is according to the Binary pattern of Rank Size Rule. And analysis result was not in accordance with the other two concepts of Law of Pyramid and Rank Size Class. The ultimate result is Rank Size Rule concept is more accurate to explain the city size distribution of Sri Lanka.

The outcome of the study illustrates the validity of The Rank Size Rule (George Zipf1949), Law of Primate City (Mark Jefferson, 1939) and Rank Size Class.

Key Words: Rank Size Rule, Law of Primate City, Rank Size Class, city size

1. INTRODUCTION

The study is focusing on describes the city size distribution pattern of Sri Lanka based on a three different theory such as the Rank Size Rule (George Zipf1949), Law of Primate City (Mark Jefferson, 1939) and Rank Size Class. The theory of the Rank Size Rule is attempted to explain the numerical relationship between population sizes among the cities in USA. According to the theory there is a hierarchical order of cities. The population of the largest city is twice larger as the second largest city population and three times larger as the third largest city population. This Rank Size Rule theory was used to explain the city size distribution in USA.

The theory of Law of primate city is also

explained the city size distribution based on “k” value. The theory explained the primate city is twice as large as the next largest city. This study carries out the application of the Law of Primate city based on the “k” value for describe the spatial distribution of city size.

And the theory of Rank Size Class explains the distribution pattern of hierarchical classes of the cities. The result of a Rank Size Class is illustrated from the pyramid. The pyramid becomes more uniform mean distribution of cities are according to the Rank Size Class

2. METHODOLOGY

All the Sri Lankan small scale towns, medium scale towns and large scale towns select as the study area. Because of analysis should include the different hierarchical level of towns. Reason for that is Rank Size Rule Rank Size Class (City Size Pyramid) and Low of Primate city concept are mainly based on the rank and hierarchy of the cities. Within the regional planning or local level planning studies difficult to identify the different hierarchical level of towns. Therefore select the study area as all Sri Lanka.

For application of the Rank Size Rule concept DSD wise population was considered. Then prepare the population index for the Sri Lankan all DS Division in 1964,1971,1981,2001 and 2012 years. The determinations of the ranks are based on population size of the ds divisions. Then find out the log value of each ds division.

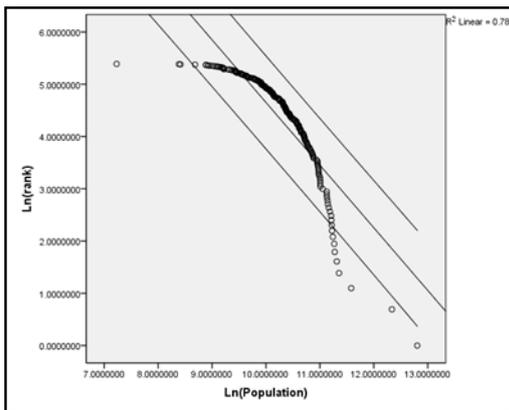
The application of the Rank Size class and Low of primate city concept required to identify the classification of urban hierarchy of the towns. The urban hierarchy also determined by using the urban population.

RESULTS

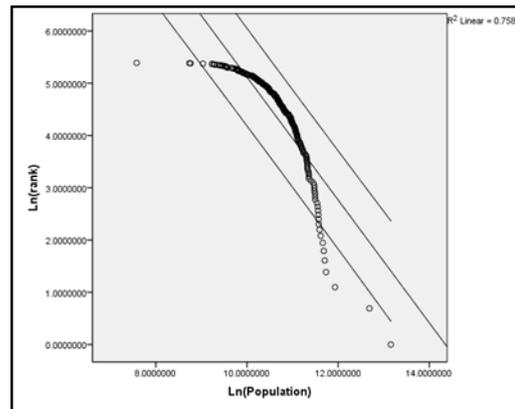
Rank Size Rule

The study used to describe the city size distribution of the Sri Lankan towns from 1964 to 2012 census years by using the Rank Size Rule. The study of analyzing the Rank Size Rule provides the standard Zipf plot for the 235 of the towns Sri Lanka. In this step more precisely plot the log of rank of the towns against log city size. Following illustrates the distribution of the city size according to the Rank Size Rule concept from 1964 to 2012.

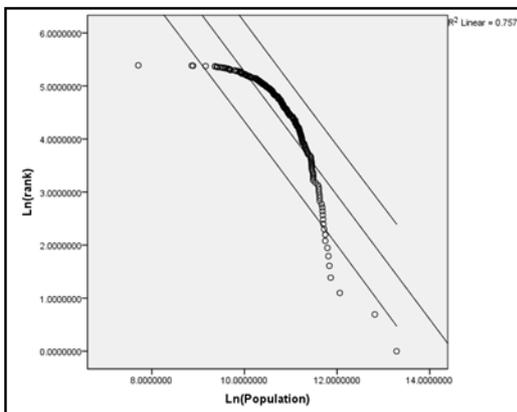
1964



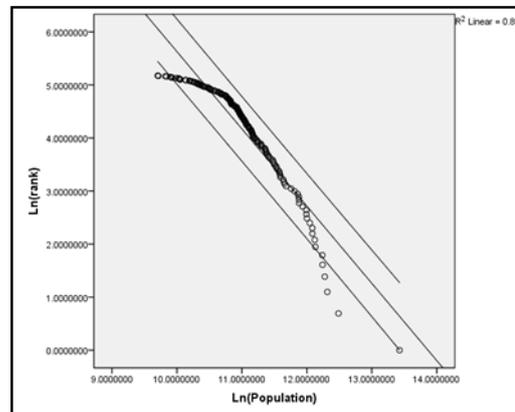
1971



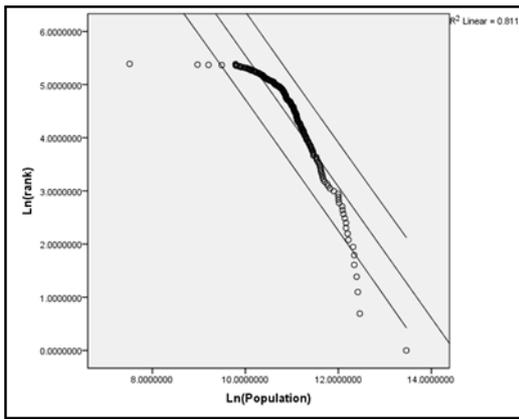
1981



2001



2012



Year	Ln(rank)	R ²	GI_corr.std.error	Findings
1964	16.636- (-1.199)	0.78	0.04503<0.01	Not similar to rank size rule
1971	16.872-(-1.176)	0.75	0.4719<0.01	
1981	16.936-(-1.167)	0.75	0.4727<0.01	Passed binary pattern
2001	20.192-(-1.456)	0.89	0.308<0.01	Increased r ² value
2012	17.88-(-1.233)	0.81	0.4169<0.01	Pattern is theoretically rank size rule

When consider about the above table can identify the evolution of city size distribution in Sri Lanka. It is mentioned value of the r²value gradually increased from 1964 to 2012. The value of the r² is 0.7 in stage of 1964, 1971 and 1981 years. But the value of r² is increased in 2001 and 2012. These two years slope of the linear curve is more similar to the value 1 and the log scales relationship is approximately accurate and more similar to linear curve.

The pattern of the Rank Size Rule is Sri Lanka present in the theoretical rank size rule and passed the Binary Pattern in 1964, 1971 and 1981.

Law of Primate City

When analyzing according to the Law of Primate urban hierarchy classification was considered. When consider about the theory of the Law of primate city, there is a 'k' value. The according to the theory, 'k' value must be constant. When applied to the Law of Primate city concept, the theoretical largest class has only one city and second largest class has four cities. Therefore according to the theory 'k' value becomes a four. Because of 'k' value is determined by the number of lower class cities divided by the next number of upper class cities. According to the theory 'k' value must be four among the next two classes.

City Size	1964 Cities	1964 K	1971 Cities	1971 k	1981 Cities	1981 k	2001 Cities	2001k	2012 Cities	2012 k
>20000	65	0.64	37	0.4	25	0.3	5	0.1	13	0.1
20001-50000	102	2.62	95	1.3	88	1.1	62	0.8	76	0.8
50001-100000	39	13	72	5.1	82	3.6	78	2.5	92	2.4
100001-	3	0	14	14	23	23	31	31	37	37

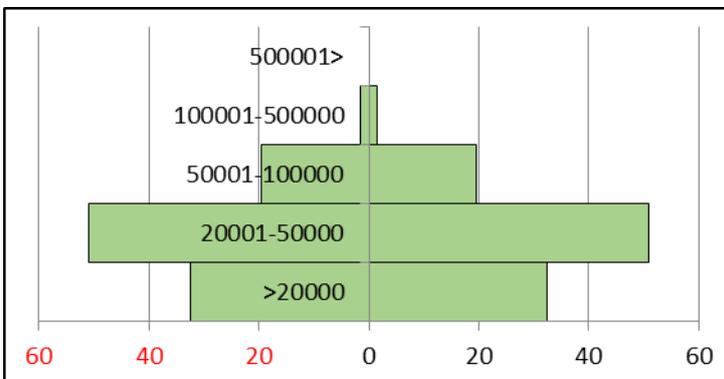
500000										
500001>	0	0	1	0	1	0	1	0	1	0

The above table number 4.4 illustrates the analysis of the 'k' value of various classes in various years. The 'k' value is ranged 0.64 to 13 in 1964 among the hierarchical order of cities. In 1971 it will change from 0.4 to 14 and 'k' value range changed 0.3-23, 0.1-31 and 0.1-37 respectively in 1981, 2001 and 2012. The analyzing of 'k' values represents the huge range between the hierarchical orders of the towns. Main reason behind the huge range of 'k' value is

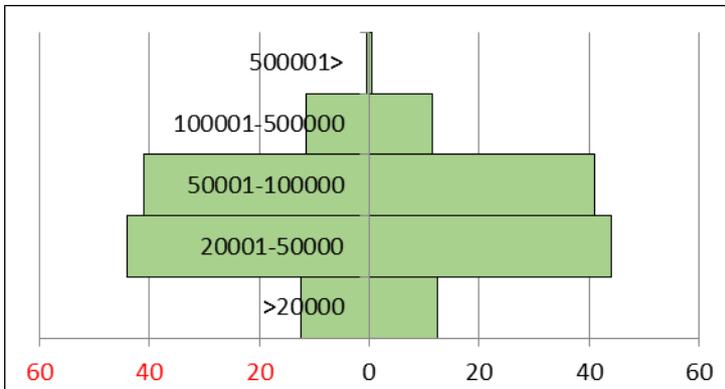
population more than 500001 cities are limited in throughout the years. There is not any number of town's population more than 500001 in 1964. From 1971 to 2012 has only one city population more than the 500001. This is the reason of increase of the range of the 'k' value from 1964 to 2012.

Rank Size Class

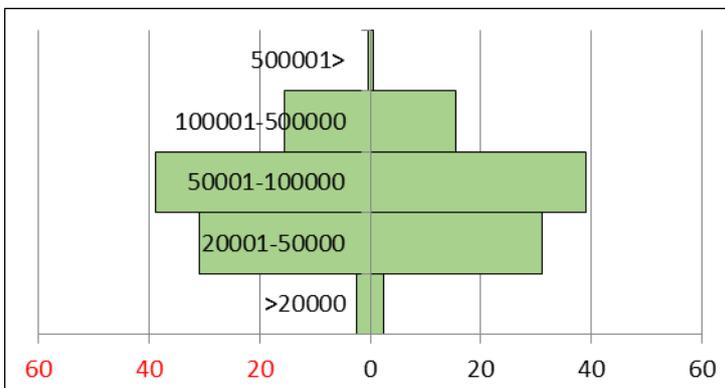
The Rank Size Class concept is also used to explain the city size distribution in Sri Lanka.



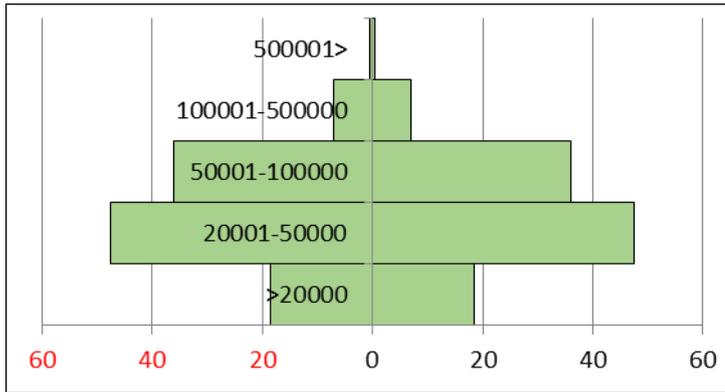
City Size Pyramid 1964



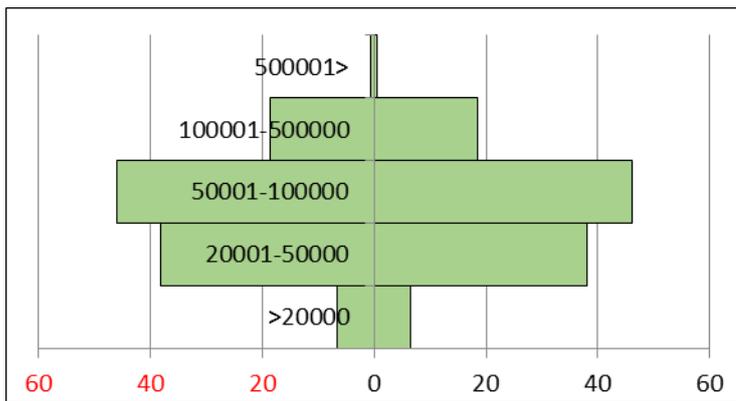
City Size Pyramid 1971



City Size Pyramid 1981



City Size Pyramid 2001



City Size Pyramid 2012

The above pyramids which not illustrates the uniform of the pyramid. Because 'k' value range is higher between the each hierarchies. The year of 2012 pyramid illustrates a number of populations less than 20000 towns are very few compare to the other years. Because less of population data available in the North and North Western province. The above pyramids illustrate the only one town population are more than 500000 throughout the years except the 1964. As well as the range of 20001-50000, 50001-100000, 100001-500000 towns gradually increased the 1964 to 2012. The 'k' values of various classes were not constant in Sri Lanka. It has highest variation in every census year. It is clearly mentioned in the above table. As well as uniform of the pyramid also lost in above five years. If increased of the lower order towns and higher order towns 'k' value will be constant in most probably and pyramid will be become more uniform.

Conclusion

The city Size distribution of the Sri Lanka was similar to the theory of Rank Size Rule in 2012. Result of application illustrate the city size distribution of Sri Lanka is more similar to the theory in 2012 year. When consider about the evolution pattern of the Rank Size Rule Sri Lanka present in theoretical rank size rule and passed the Binary pattern in 1964, 1971 and 1981. It is indirectly mentioned the development of the cities in Sri Lanka. In the Binary stage highest numbers of peoples are concentrated in the very few cities.

But city size distribution was not according to the other two theories of the Law of Primate and Rank Size Class in Sri Lanka from 1964 to 2012. Finally it can say the Rank Size Rule concept is more validity to explain the city size distribution of Sri Lanka than other two concept of Law of Primate and Rank Size Class concepts.

Reference

- Aura reggiani, Peter nijkamp. (2005). The rank-size rule in europe: testing zipf's law using european data, graham crampton .
- Cordoba, J. C. (2013). On the Distribution of City Sizes.
- Gordon Anderson and Ying Ge. (2002). The Size Distribution of Chinese Cities.
- Hsu, W. t. (2008). Central Place Theory and Zipf's Law.
- Jefferson. (1939). The Law of the Primate City.
- Kristian Giesen, Jens Suedekum. (2009). Zipf's Law for cities in the Regions.
- Parr, J. B. (2005). Economic Definition of the city.
- Akhtar S., Dhanani M.R. (2012). City Size Distribution in Pakistan.
- Nishiyamaa Y., Osadaa S. , Morimuneb K. (n.d.). Estimation and Testing for Rank Size Rule Regression.
- Brian J.L. Berry The city size distribution debate: Resolution for US urban regions and megalopolitan areas 2011
- Hinloopen J., Marrewijk C. Comparative Advantage, the Ranksize Rule, and Zipf's Law 2006
- Kim H.U. ,Shrinking Population and Urban Hierarchy 2012