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City –Size Distribution In Pakistan

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Abstract: In every country there are cities of different sizes. In general large cities are small in number and small cities are large in number. Researchers have investigated if there is any pattern in city-size distribution. This has resulted in finding three patterns. They are expressed by three laws or rules, namely Law of Primate city, Rank-size rule and Rank-size classes (City-size pyramid). This paper is concerned with city-size distribution of Pakistan. An attempt has been made to find out, whether the city-size distribution of Pakistan conforms with any of the three patterns stated above. If not, is there any other pattern? The study has been made in historical perspective so that the changing pattern may also be brought out.

Keywords: City-size, Law of Primate, Rank-size rule, City-size, Pyramid

1. INTRODUCTION

In every country cities of different size exist. This has attracted the attention of geographers for quite sometime. Attempts have been made to find if any pattern exists in such a distribution. This has resulted in pointing out three patterns, namely Rank-size rule (Christaller, 1966). This paper makes an attempt to find whether city-size distribution of Pakistan fits in any of these patterns.

Pakistan is a country with low level of urbanization. In 1901 only 9.8 percent of the total population lived in urban places. After that a steady increase took place. In 1951 urban dwellers were 17.8 percent and in 1998 32.5 percent. It is estimated that by A.D. 2030 the percentage will be about 50.0 percent (Pakistan Economic Survey, 2011).

The significant growth in urban population took place after the creation of Pakistan **(Table 1).** After 1947, urban areas of Pakistan gained much importance in terms of commercial, industrial and administrative activities. The highest intercensal urban growth took place during the period 1961-1972(table 1), which was the period of industrial expansion in Pakistan which resulted in rural to urban migration and eventual growth of cities. A striking feature of urbanization in Pakistan has been the increasing concentration of urban population in relatively large cities, notably Karachi, Lahore, Faisalabad and Rawalpindi. In Pakistan there are only a few large cities, fair number of intermediate cities and a comparatively large number of small cities. Within this general framework the city-size distribution in Pakistan has been examined by applying three recognized patterns, i.e. Rank-size rule, Law of Primate city and City-size Pyramid distribution.

Table 1: Pakistan—Urban Population As Percent Of Otalpopulation And Intercensal Growth.

Census year	Urban Population (Percentage)	Intercensal Population Growth (Percentage)
1901	09.8	------
1911	08.7	04.3
1921	09.8	21.9
1931	11.8	34.6
1941	14.2	45.0
1951	17.8	49.0
1961	22.5	60.4
1972	26.5	79.5
1981	28.3	36.7
1998	32.5	77.5
2008(estimated)	36.8	----
030(estimated)	50.0	----

Source: Population Census of Pakistan

2. MATERIALS AND METHODS

In the study of City-Size relationship, Auerbach was the first, who noticed the rank-size relationship in 1913 in the study of German cities. He postulated an empirical relationship between the rank and their size and found a linear pattern on double logarithmic graph paper. Lotka later found that law of urban concentration indicated by the hundred largest citiesofTheUnited States was (rank) $0.93 \times \text{Size} = \text{Constant}$.

A number of researchers have noted the empirical relationship, but it was (Zipf 1949), This rule states that there is a relationship between the size of a town and its rank. If the towns of a country are ranked in a descending order by population, the largest city (rank one) will be twice as large as the second largest, three times as the third largest,four times as large as the fourth largest.Thus if the rank of a city is known its population can be found out by dividing the population of the largest city of country by the rank of the city in question. It is expressed mathematically:

$pr = \frac{Pi}{r}$ where: Pr is the population of a city ranked r

Pi is population of the largest city r is the rank of city

For example, London was seven times larger than the second city, Liverpool, Copenhagen was nine times larger, Mexico city was five times larger, and Bangkok was twenty five times larger. These cities not only

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dominate in terms of population only but also in economy, social status and national identity

Christaller put forth the concept of rank-size classes of urban settlements or central places (Christaller, 1966). According to him the cities form hierarchical groups according to their sizes. In an isotropic surface in every class there will be a fixed number of cities. The number will depend upon the functional system of the hierarchical order. Christaller has put forth three systems namely marketing, transport and administrative system. In marketing system there will be one centre of the highest order, three in the next lower group, and nine in the third lower group. The number of centres will increase uniformly in multiple of three down to the lowest order. If the cities bar graphs, they will form a pyramid. The ratio between two successive classes is expressed as "K" values.

To study city-size distribution in Pakistan data about cities and their population in different periods were required. For this purpose population of urban settlements in the census years 1951, 1961, 1972, 1981 and 1998 were obtained. To examine the patterns of city-size distribution in Pakistan population data of cities of different census years were applied on the Law of Rank-Size rule, the Law of Primate city and the Law of City-Size Pyramid.

3. RESULTS AND DISCUSSION

Rank-Size rule when applied to Pakistan brings out that in 1998, the third largest city (Faisalabad) was five times smaller than the largest (Karachi), the 10th (Islamabad) was eighteen times smaller **(Table 2).** This was the situation in previous censuses also. Rank-size rule envisages that there should be a continuum of cities from the highest to the lowest rank. Therefore, if the population and rank of the cities are plotted on a double-log paper they will fall in a line. A look at the graphs of cities of Pakistan for 1951, 1961, 1972, 1981 and 1998 show that they do not form straight lines **(Fig.1,2,3,4 and 5).** They have kinks particularly in the upper part.

Table 2: Rank and size of Pakistan's 12 Largest Cities

City	Rank	Actual Population (1998)	Theoretical Population $Pr = \frac{pi}{r}$	$r = \frac{Pi}{Pr}$
Karachi	1	9339023	9339023	---
Lahore	2	5443495	4669511	1.71
Faisalabad	3	2008861	3113007	4.64
Rawalpindi	4	1409768	2334756	6.62
Multan	5	1197384	1867805	7.79
Hyderabad	6	1166894	1556504	8.00
Gujranwalla	7	1132509	1334146	8.24
Peshawar	8	982816	1167377	9.50
Quetta	9	759941	1037669	12.3
Islamabad	10	529180	933902	17.6
Sargodha	11	458440	849002	20.4
Sialkot	12	421502	778252	22.1

Source: Population Census of Pakistan, 1998

There is a dearth of cities of middle order (100,000 to 250,000) which is contrary to rank-size rule. A region to which rank-size conforms must be complete (Stewart, 1958). Pakistan was created in 1947. Before that it was a part of the British India. As such it is a new country and is developing slowly into region. In a situation like this it too early to expect rank-size rule to be applied.

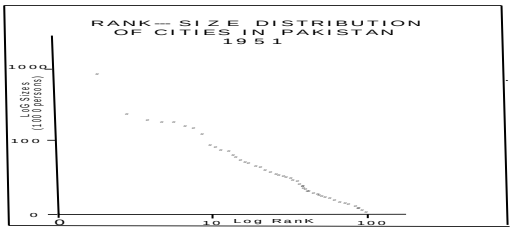


Fig 1 Rank size distribution of cities in Pakistan 1951

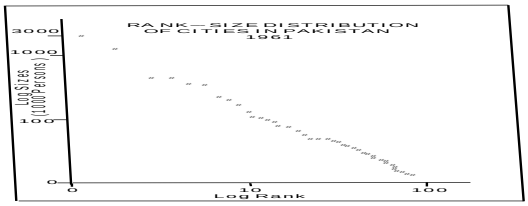


Fig 2 Rank size distribution of cities in Pakistan 1961

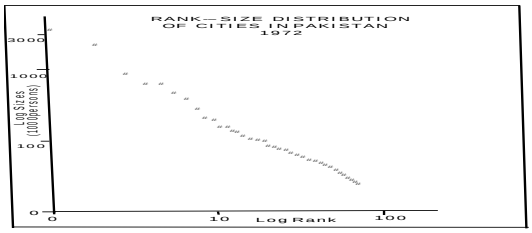


Fig 3 Rank size distribution of cities in Pakistan 1972

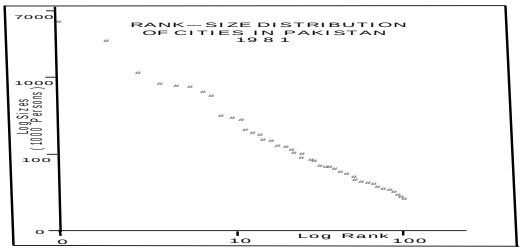


Fig 4 Rank size distribution of cities in Pakistan 1981

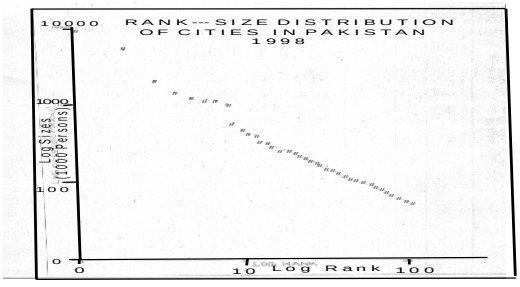


Fig 5 Rank size distribution of cities in Pakistan 1998

In a region or country exhibiting rank-size distribution of cities, primacy is non-existent. On the contrary primacy in Pakistan is on the increase. Karachi the largest and Lahore is the second largest city. They dominate the urban scene. With the passage of time they are leaving behind other cities.

Between Karachi and Lahore, Karachi is growing at a faster rate and the gap between the two is increasing (Table 3). As such Helbock came to the conclusion that

Rank-size rule does not apply to Pakistan (Helbock, 1975, p.320). This has been confirmed by Heitmann, Robinson, and Salter (1977, p.464), Khan (1991, p.281) and Memon and others (1993, p.96).

An examination of the cities of Pakistan bring out that Karachi and Lahore are the two cities which dominate the urban scene (1951, 1961, 1972, 1981 and 1998 Censuses). They together accounted for more than one-third of the urban population of Pakistan throughout the period from 1951 to 1998 (Khan, 2005). The numbers of intermediate size cities probably population (20,000-1,00000) were 128 in 1981 which increased to 215 in 1998. Their percentage share in the total number of cities in 1981 was 33.6 which increased to 47.7. The number of small cities (Less than 20,000) were 223 in 1981 which decreased to 186 in 1998 whereas its share decreased from 58.6 percent in 1981 to 41.3 percent **(Table 3).** The percentage share in the total number of cities is also affected by the Census Organization of Pakistan.

Pakistan may be looked upon as country with two primate cities Karachi and Lahore. Of the two Karachi is more dominant and its dominance is getting accentuated. Karachi was 1.3 times larger than Lahore in 1951 and 1.8 times in 1958 **(Table 3)**. It was 4.5 times larger than the third largest city in 1951 and 4.6 times in 1998. The primacy index for Pakistan (the ratio of population of largest city to the combined population of the four largest cities) has also registered increase from 1951 to 1998 **(Table 3).** In 1951 it was 45.8 and in 1998 it was 52.3. This shows that Pakistan is shifting more towards primate city-size distribution.

Table 3: Indices of Primacy for Pakistan

year	Ratio Between Population of first City(Karachi)& Second City(Lahore)	Primacy Index: Population of Karachi as Percent of the combined population of four largest cities	Population of Karachi as Percent of the total Urban Population
1951	1.3	45.8	19
1961	1.5	48.1	20
1972	1.6	49.3	21
1981	1.8	51.8	22
1998	1.8	52.3	22

Source: Population Census of Pakistan

Pakistan however does not conform to Law of primate city fully. The Law of primate city envisages that the primate city dominates the scene in a decisive manner such as Bangkok, Wellington and Lima.Karachi does not possess this dominating position. Berry also came to the same conclusion. (Berry, 1961) studied the city-size distribution of 38 countries. He concluded that there are some countries which conform to Primate-city distribution and there are some countries which conform to rank-size rule. There is a third category of countries which are intermediate in character and Pakistan is one of them. Ahmad also confirmed this conclusion (1967). Berry thus rejected the applicability of Rank-size rule and Law of Primate city Pak. Therefore it is worthwhile to investigate whether it can be explain by some other principle. With this end in view an attempt was made to find out whether pyramid distribution is applicable to Pakistan.

The Law of Primate City when applied to Pakistan envisages that theoretically the largest city is one and the second large group has three cities. Therefore 'K' value becomes three. The "K" value of the next group is also three as there are three cities in the higher group and nine in the next lower group (3:9).Thus in a perfect hierarchical order 'K" value will be constant. The cities when represented in a graph by size-classes will form a perfect pyramid. But this is an ideal theoretical situation. Can this be applied to Pakistan?

Pakistan is a country where resources are not uniformly distributed. Transport systems are not developed equally. Population is not uniformly distributed. The cities are not equally spaced. Furthermore prior to 1947 Pakistan formed a part of economic system of British India.

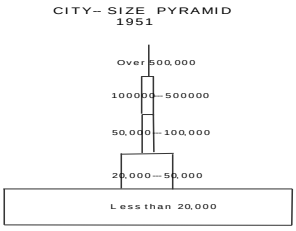
As such it is unthinkable that the cities by size-class will form a perfect pyramid and that the 'K' value of various classes will be constant. With this constraint in mind let us examine the cities of Pakistan by size-clas[ses.

As a first step the cities were divided into five classes by size **(Table 4).** Cities larger than population of 500,000 formed the highest group, the next lower group cities with population ranging from 100,000 to 500,000 and the lowest group included cities with population less than 20,000. These classes have been formed for convenience. These groups can be changed if somebody desires. The analysis of the data presented in the **(Table 4)** shows that 'K" values of various classes were far from uniform in 1951 and 1961. It ranged from 1.0 to 5.5 in 1951 and from 1.0 to 5.4 in 1961. The bar graphs representing these data are also far from forming a perfect pyramid. The situation changed in 1972, 'k' values ranged from 1.4 to 3.9.

Table 4: Pakistan—Number of cities and 'K" vales by size classes

City-size	1998 Cities	1998 'K'	1981 Cities	1981 'K'	1972 Cities	1972 'K'	1961 Cities	1961 "K'	1951 Cities	1951 'K'
Less than 20,000	186	1.2	223	2.3	229	3.9	212	5.4	156	5.5
20,000---50,000	155	2.5	95	2.8	58	2.7	39	3.9	28	4.0
50,000---100,000	60	1.5	33	1.5	21	1.4	10	1.0	07	1.0
100,000--500,000	40	4.4	21	2.6	15	3.0	10	5.0	07	3.5
Over 500,000	09	---	08	---	05	---	02	---	02	---
Total	450		380		328		273		199	

Source: Population Census of Pakistan



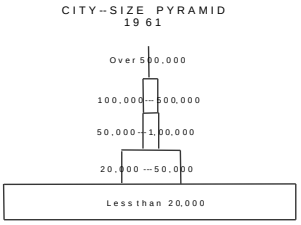


Fig. 6 City size pyramid 1951 **Fig 7 City size pyramid 1961**

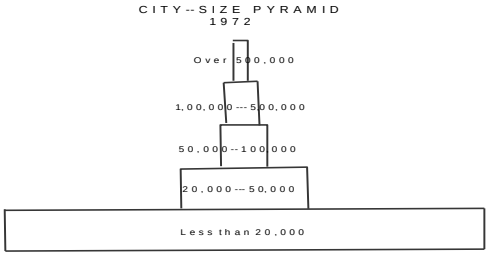


Fig 8 City size pyramid 1972

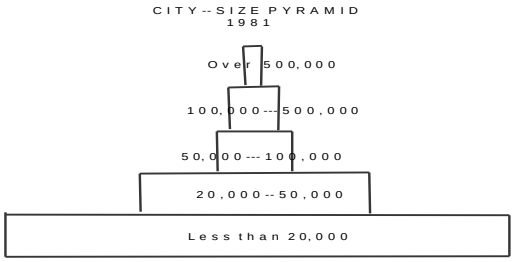


Fig 9 City size pyramid 1981

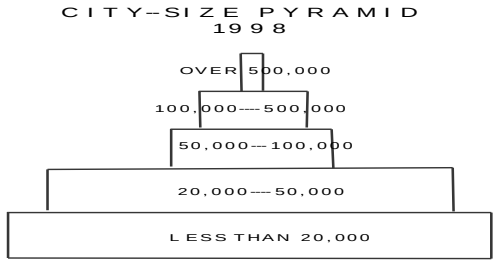


Fig 10 City size pyramid 1998

In 1981 'K" values acquired a more uniform pattern. The extreme values ranged from 1.5 to 2.8. In 1998 the range of "K" value increased, ranged from 1.5 to 4.4. This was because of the deficiency of less than 20,000 and over 500,000 cities. The pyramids of 1951, 1961, 1972 and 1981 clearly exhibit that paucity of cities in the group of 50,000—100,000 is the main cause of distortion. However the pyramid of 1998 and K values exhibit that deficiency of Less than 20,000 and over 500,000 cities is the main cause of distortion. With the increase of lower order and higher order cities the "K" value and the pyramid will be become more uniform. This can be achieved by improvement in transport and expansion in manufacturing, trade and service sectors. Thus it has been concluded that city-size distribution in Pakistan can be best explained by City-size Pyramid distribution **(Fig 6, 7, 8, 9 and 10).**

4. CONCLUSION

It is a common observation that cities differ in size. The distribution of cities by size has been explained by three laws, namely Rank-size rule, Law of Primate and Pyramid distribution. Pakistan is a country of low level of urbanization, poor economic structure and poor transport network. With these Pakistan neither conforms to the Rank-size rule nor to the Law of Primate city. The city-size distribution in Pakistan is best explained by the City-size pyramid distribution.

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