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Rank-Size Distributions in the Romanian Urban Settlements System

The rank-size rule of settlement distribution in a defined region is applied by the author of this paper on the case-study of the Romanian settlements in order to test a few hypotheses of present and future urbanization patterns. A few alternatives of the national settlement system development in year 2000 are analyzed statistically and evaluated in view of this theory.

This note is not intended to elaborate on the general theory of rank-size distributions in regional settlement systems. It has been done by quite a few scholars and many monographs and papers have treated the rank-size rule applications.

The main objective of this note is to report on empirical work on the distribution of urban settlements that has been carried out in Romania by the author. We intend to relate the findings to a few basic observations made by K. Dziewonski [1] back in 1971 and published in the Papers of the Regional Science Association.

The rank-size distribution analysis of the Romanian urban settlement system is part of a broader research project conducted at I.S.L.G.C. [2] that focused on the future physical patterns of the country. Among other things, the project emphasized the historical, socio-economic and geographic determinants of the national settlement pattern and developed a qualitative analysis of the urban network.

The Romanian Law no. 2/1968 on regional administration of the country defined the following geographical-administrative units:

— 39 counties
— 236 towns and cities (out of which 47 are municipalities)
— 2,706 communes (out of which 147 are suburban communes)
— 13,149 villages (out of which 565 belong to the suburban communes,

while 232 villages are directly subordinated to various municipalities and cities, being part of their administrative territories).

The main indicators that characterize the spatial distribution and the size of the settlements are:

— average density of settlements: 5.6 settl./100 sq. kms
— average density of urban settlements: 1 city/1000 sq. kms
— average density of villages: 5.5 villages/100 sq. kms
— average size of urban settlements: 28,000 inhabitants
— average size of villages: 970 inhabitants

In analyzing the rank-size distribution of urban settlements in Romania, we chose an approach similar to the one suggested by Thomas [3] with a curve which in logprobability form becomes a straight line. The Thomas curve corresponds to the entropy in a dynamic system. Thus we simply computed the logarithms of the urban sizes and the logarithms of the ranks and plotted the results on a diagram. Then we computed the correlation coefficients of the time series distributions over the period 1941—1975 plus the results of empirical studies for the urban settlement system of the year 2000 [4].

We believe that rank-size distributions posses acceptable latent hierarchical structures, which suggests that the rank-size distribution has greater validity and may be considered as a test in the evaluation of hierarchical models of city size.

The log-log size distribution of the Romanian urban settlements shows a lack of big cities — that is, cities having a population of 200,000—600,000 (Fig. 1). The second anomaly in the national settlement system (which disappeared by year 1975) was in the range of 30,000—60,000 population cities, whose number was indeed very small before the sixties.

The empirical analysis shows that the rank-size rule loses its strength in the lower part of the diagram, partly due to the difficulties in defining the urban. By including in our analysis the very small settlements (small suburban communes), we were able to observe the threshold below which the rank-size curve no longer applied. Thus, the urban status would include, along with a large number of towns of 4,000—6,000 people, several very small settlements (1,000—3,000 people).

The diagram for year 1948 shows a post-war decrease in population of most of the cities, excepting the first three cities of the country and the very small towns. By the year 1956 there seemed to be a lack of urban settlements in the range of 30,000—70,000 population. This anomaly was reduced by 1966 and fully disappeared by 1975.

The present urban population is, according to the rank-size rule, evenly distributed throughout the country in most urban size-categories (ranging between 7,000—180,000 people) but the gap between the capital and the second-ranking cities is still there, showing a lack of large cities (300,000—500,000 people).

The empirical observations were verified mathematically by computing the correlation coefficients of the log-log rank-size distributions for each year. The coefficients are generally increasing during the period 1941—1975. They are: 0.958 in 1941; 0.964 in 1948; 0.958 in 1956; 0.974 in 1966; 0.975 in 1975. The only decrease, recorded in 1956, is explained by the changes brought about by the regional-administrative reform in the 50s.

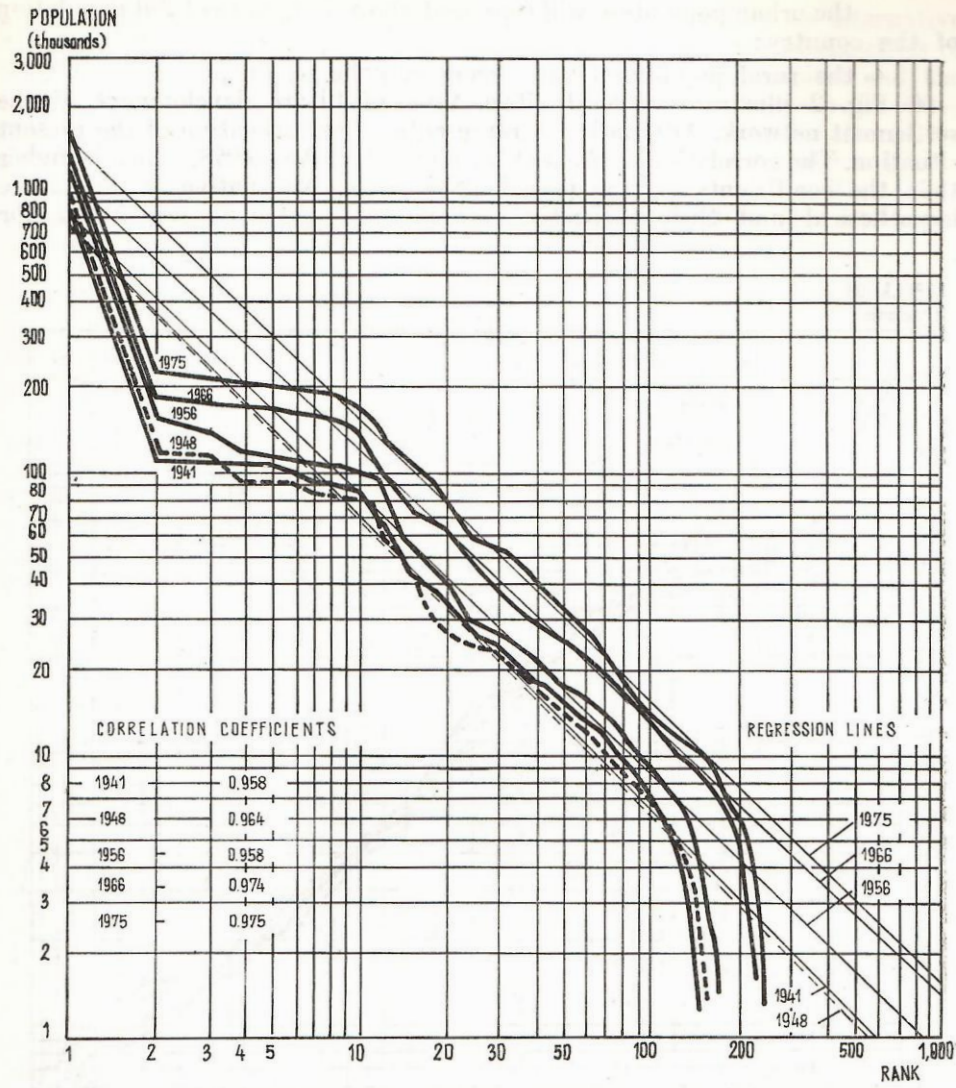


Fig. 1: The rank-size distribution of the Romanian urban settlements in the period 1941—1977.

The pattern of settlements by year 2000 has been studied on various alternatives which specify the size and functional categories of the settlements, their economic and social structure as well as their role and function in the region (especially in the case of urban settlements).

The general demographic evolution of Romania is presumed to be the following:

— the population forecasts for the year 2000 indicate a figure of about 30 million people;

— the urban population will represent about 75% of the total population of the country;

— the rural population will accordingly be of 25%.

Fig. 2 illustrates several alternatives of future development of the settlement network. Alternative A represents an extrapolation of the present situation. The correlation coefficient for alternative A is 0.978, which is higher than the coefficients for the period 1941—1975. Alternatives 1 and 2 are hypothetical and their respective correlation coefficients are 0.992 for

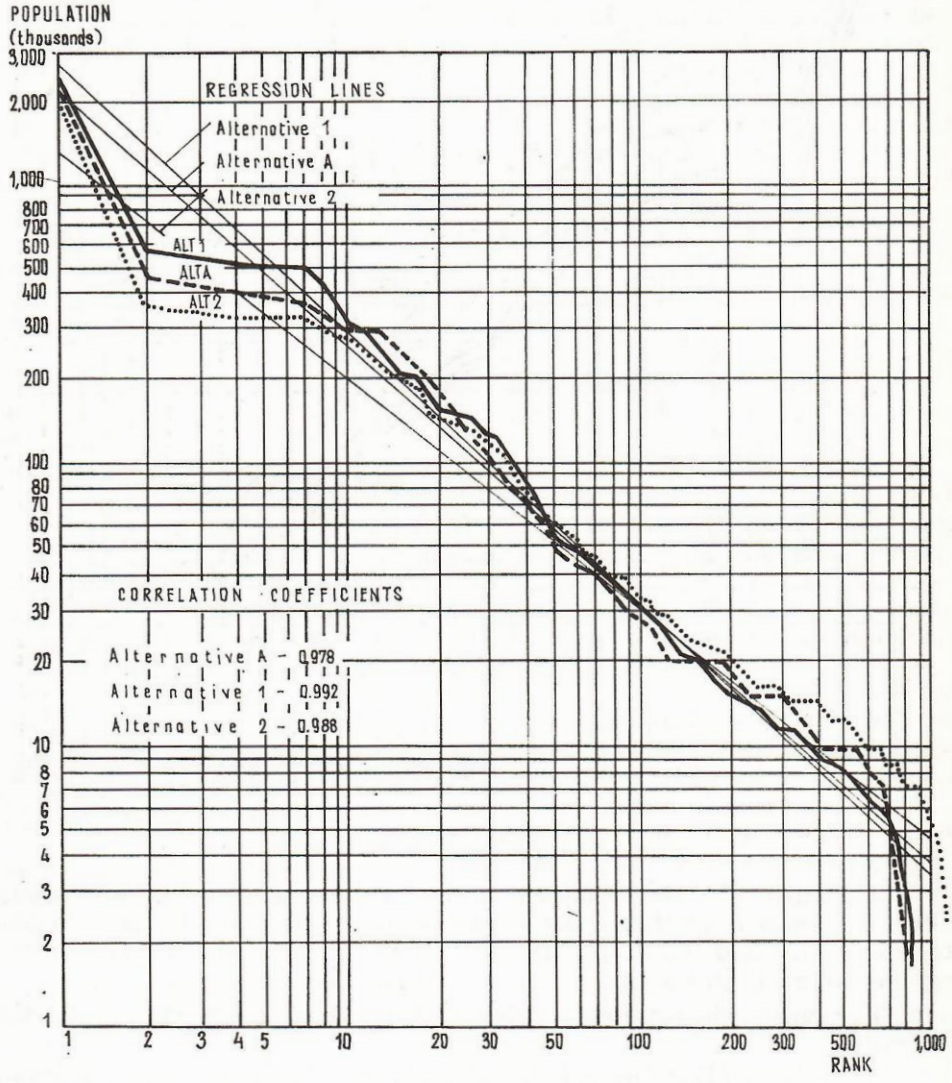


Fig. 2: The rank-size distribution of the Romanian urban settlements in year 2000.

alternative 1 and 0.988 for alternative 2. The higher coefficient for alternative 1 is basically due to the provision in that case for a number of six cities of 500,000—600,000 people, which fills the gap between the capital and the second ranking cities. In alternative 2, the six cities would only reach 350,000—400,000 people each. It may be maintained that another reason for alternative 1 being better than alternative 2 is that the slope of the regression line in alternative 1 (—0.94) is higher than the slope in alternative 2 (—0.79), which presumably stands for a more dynamic behavior of the settlement network in the first case.

In his 1972 paper, K. Dziewonski [1] makes remarks on the use of rank-size distribution analysis of settlement systems. The remarks may be grouped under three headings: a) definition of the object of research; b) correct mathematical formalization; and c) limiting conditions of the final conclusions and applications.

The problem as to what constitutes a settlement unit, especially in the case of the largest and smallest types of settlements is a very important one. Lack of such definition may explain many failures in rank-size analyses. It may also give the threshold below which the rank-size curve no longer applies. The same criticism applies to analyses by classes of settlements. We agree with Dziewonski that the division of settlements into classes should correspond to specific types of settlements; it should never be done mechanically or numerically. We preferred to take the individual settlements in the distribution analysis because for correct analysis, we need a large number of elements within the whole system under consideration.

In what regards the mathematical formalization, the chosen curve has to fit the analyzed distribution, due to the highly inductive character of the analysis. In our case, the fit seems to be quite good, as shown by the values of the computed correlation coefficients.

In order to get more details on the distribution of the largest cities, we computed the correlation coefficients of the log-log rank-size distribution of the largest 20 cities, and then of the largest 10 cities [5]. Fig. 3 shows clearly that the rank-size rule is no more useful in such an analysis, and that can be seen from the evolution of the correlation coefficients over the period 1941—2000. The dynamics of the largest cities does not follow the dynamics of the entire network of urban settlements.

This shows that the rank-size distribution may be treated as a measure of some aspect of the settlement system. It is very difficult to say anything definite about the single elements or points in a distribution because, when ordering the settlement units according to size, we completely destroy their topological structure. The observations concerning a single point have no explanatory or predictive power unless we define the change of the settlement system over time. In the past has been a tendency to stress the importance of the primate city within the whole rank-size distribution. In fact, no one settlement unit is more important than other for the distribution.

However, Fig. 3 shows higher values for the correlation coefficients in alternative 1 over alternative 2 in all cases, which proves that the gradual increase in the value of the correlation coefficients over the period 1941—2000 (for the entire network) is partially explained by the increase in size of the largest cities excepting Bucharest.

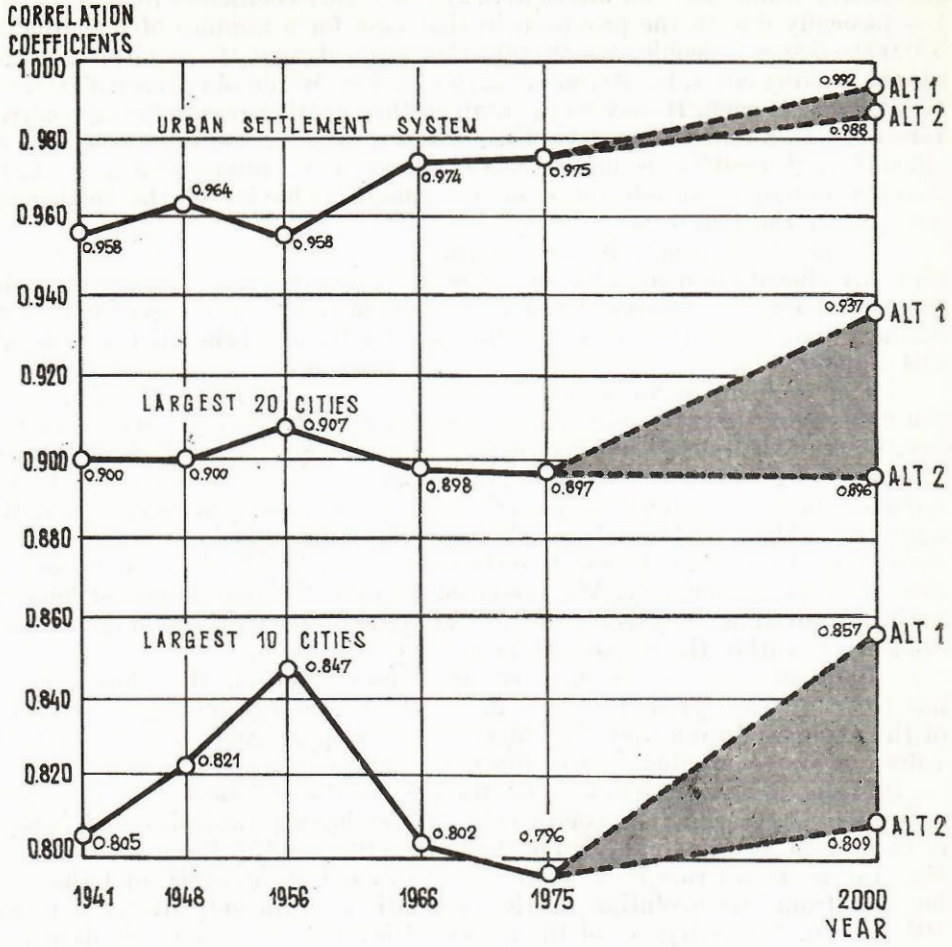


Fig. 3: Rank-size distributions correlation coefficients of the urban settlements system of largest 20 cities, and of largest 10 cities in Romania.

We agree with K. Dziewonski [1] that, although it is impossible (at least with the present state of our knowledge) to define unequivocally, on the basis of rank-size distributions, the relations and interdependencies of individual settlement units, it is possible to discuss the consequences of the growth (even the planned growth) of an individual city or settlement unit for the whole system, taking into account the preservation or disruption of the whole system.

The rank-size rule is a very useful tool in analysing the past and possibly the future evolution of a properly defined settlement system, and a means to locate and subject to further analysis the major gaps and inadequacies in the general structure of the respective system.

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LA LOI DE LA DISTRIBUTION SELON LA GRANDEUR DES LOCALITES URBAINES EN ROUMANIE

La loi concernant la corrélation entre le nombre de la population et la place détenue dans la hiérarchie par les sites humains d'un territoire donné, est appliquée par l'auteur de cet article au cas des localités de Roumanie pour vérifier une série d'hypothèses du processus d'urbanisation. Dans ce sens, on a fait l'analyse statistique et l'évaluation de quelques variantes du développement du réseau des localités en l'an 2 000.

ЗАКОН РАСПРЕДЕЛЕНИЯ ГОРОДСКИХ МЕСТНОСТЕЙ ПО РАЗМЕРУ В РУМЫНИИ

Знакок, затрагивающий корреляцию между численностью населения и местом, занятом населёнными местностьями в их иерархии на определённой территории, применяется автором настоящей статьи на примере населённых пунктов Румынии, для того, чтобы проверить ряд гипотез процесса градостроительства. С этой целью статистически проанализированы и оценены несколько вариантов целью статистически проанализированы и оценены несколько вариантов развития сети населёных пунктов до 2000 года.

10. III. 1978.