City-size distribution in the Austrian-Hungarian monarchy 1857-1910: a rank-size approach

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CITY-SIZE DISTRIBUTION IN THE AUSTRIAN-HUNGARIAN MONARCHY 1857-1910: A RANK-SIZE APPROACH

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Abstract: In applying the method of rank size analysis to the study of inter-urban-system of the former Austrian-Hungarian monarchy, one does not only fill a gap in empirical research, but also realizes a transfer of the above mentioned methodological paradigm to the social and economic history. Part one of the following essay deals with the methodological tool, its history and its limitations. Part two contains the demonstration of the method as well as some outlines for scientific interpretation.

1. INTRODUCTION

Research on the rank-size-distributions are favourite subjects of geographers, economists and regional scientists. "Terrae incognitae" for city-size-distribution research in Europe, North-America and the third world have become rare. Historians hardly ever have taken up this topic. This paper serves the following purposes:

1. to outline of the possibilities and limitations of the method of rank-size-distribution-analysis;

2. to demonstrate an application of the rank-size-distribution to the Austrian-Hungarian-monarchy.

Special emphasis will be given to:

a) the dichotomy of the Austrian and Hungarian part of the monarchy after the "Ausgleich 1867" (which guaranteed Hungary a stronger autonomy) as reflected in the urban system;

b) effects of the changes of the technological and social infrastructure, as well as of the administrative structure and the industrial development on the urban system of the "Kronländer" (such as Bohemia, Moravia, Silesia, Galicia etc.).

The reason for the popularity of rank-size distribution analysis lies in the comparatively easily available data (neglecting all problems with the definition of cities) in the computational ease and finally in the regularity of the rank-size-distribution. This poses the intellectual challenge of combining analytical-economic theories or historical-hermeneutic theories with the results of rank-size distribution analysis. Social-scientific journals, especially geographical ones reflect the popularity of this topic which first appeared in the beginning of this century. Since then the objec-

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tives of such analysis of city size distributions shifted from simple description and formal illustration of those distributions to explanations of regularities and the temporal development of rank-size patterns.

2. CITY-SIZE DISTRIBUTION AND A LITERATURE REVIEW

2.1 The rank-size-rule as a general instrument of scientific description

A preliminary statement: The relationship between the number and the size of specific elements is used in different disciplines as a first descriptive instrument. Here I refer to biology and national-economy. Therefore one can draw the evident conclusion that the rank-size-rule relating to the population of cities is not an instrument of description particular to spatial relations but a non spatial descriptive index.

Early attempts of research on the distribution of urban population date back more than 70 years. In 1910 AUERBACH (1913) recognized, that the product of rank and size of a city is a constant. He furthermore assumed, that this regularity would be equally true for other phenomena. His general formulation was: "Wenn man n-Individuen nach einer bestimmten Eigenschaft in absteigender Folge ordnet und dabei entweder bei der Rangnummer n_1, oder bei n_2 oder allgemein bei der Rangnummer nx aufhört, wobei dann jene Eigenschaft zuletzt auf den Wert p1, p2, px herabgesunken ist, so besteht zwischen nx und px ein bestimmtes Gesetz. ... nx * px = constant" (AUERBACH 1913, S. 76). His explanatory approach did, however, not hold what it seemed to promise at the beginning.

LOTKA (1924) modified the equation of AUERBACH by introducing an exponent q which scaled the effect of the variable nx. Furthermore LOTKA transformed the equation in a logarithmical form.

Since 1924 theoretical biology also described the principal of the allometrical growth. This principal means that the relative speed of growth of a specific part y in relation to the speed of growth of another part or of the speed of the whole organism x is constant (see: BERTALANFFY, 1942, S. 275).

ZIPF (1914 and 1949) popularized the analysis of sorted frequency-distributions by using the examples of cities, which were characterized by their populations. His observations correspond to the ideas described above: The population of a city p_i can be represented as a quotient of population of the largest city diveded through the rank of city i. Locating the cities in a double-logarithic coordinate-system, where the axes are defined as rank and population, cities are expected to lie on a straight line when the ZIPF's rank-size-rule is valid. This distribution can be described by the following formula:

$$\log p_i = \log p_1 - q \log r_i$$

ZIPF discovered the rank-size-rule while investigating the US-cities during 1790-1950. The fascinating simplicity of this rank-size-rule lead to it being used as a general instrument without asking for the implications of this model. The impact of the specificity of the US-american urban development have never been discussed. And their is also a lack of discussion about the adequacy of the linear-modeling assumption between the relation of rank and size which is non-linear very often.

2.2 The elements of the rank-size-distribution

The rank-size-rule is based on the following - disputable - assumptions. Now, they will be discussed seperately:

(1) Size and definition of the urban system

The rank-size-rule is derived from the urban system of a state seen as a whole. In the existing literature the state-urban system has not been disaggregated into smaller components, and it has not been discussed either which particular rank-size-distribution results such a disaggregation would yield.

As a consequences of what I mentioned just now the numerous cross-cultural comparisons have not taken into account potential effects of varying size of the urban system. They did not discuss the possibility that system size could have an impact on rank-size-distribution pattern, and did not compare small-, intermediate-, or large states with respect to the rank-size-distribution of their cities.

(2) Types of distribution

Subsequently of a flood of investigation of urban systems some other types of rank-size-distribution were found:

- rank-size-rule distribution (ZIPF)
- primacy distribution
- oligarchic distribution
- counter-primacy-distribution

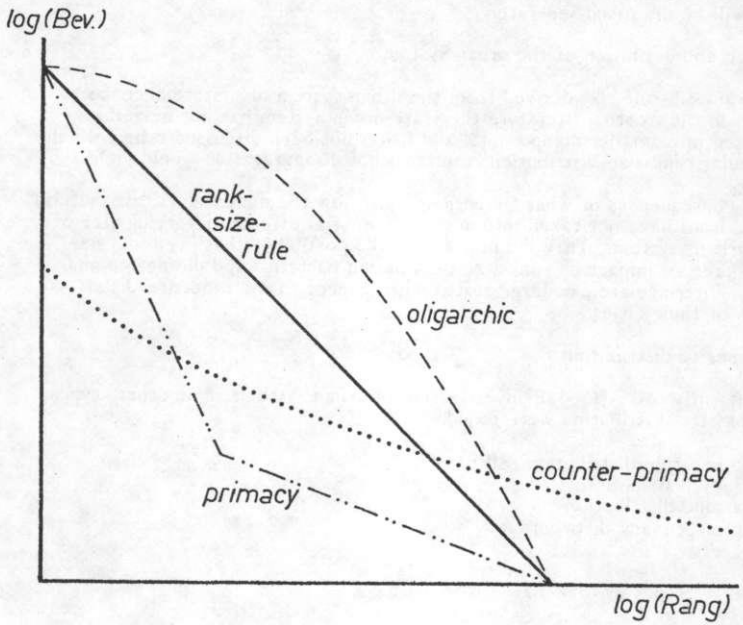
Figure 1: Types of rank-size-distribution

Primacy distribution:

The deviation of the largest city as a "outlier" from the rank-size-rule was described by JEFFERSON as the concept of the primate city. JEFFERSON investigated city-size-distribution with largest cities having population sizes high above the population of the next largest city in the system. The primate city distribution thus does not fit the rank-size-rule, because the population size of the next lower level city is far smaller than can be expected from rank-size-rule, namely $p_2 = p_1/2$ $\frac{p_1}{2}$

The operationalization of the primate distribution turned out to be difficult. The degree of primacy is expressed by the so called "primacy index". Differences in this delimination in various literature are shown in table 1 of the appendix.

Figure 1: TYPES OF RANK-SIZE-DISTRIBUTION



Oligarchic distribution:

Several large cities with similar population sizes dominate a disproportionate small number of medium-size cities (convex and s-shaped curve).

Counter primacy distribution:

A distribution with no primate city, but rather a disproportionally large size of intermediate rank cities, resulting in a concave shape of the distribution.

Generally one had to mention that a standardized definition of rank-size-distributions by means of indices does not exist.

(3) Lower limit of the settlement system

The question of the lower limit of the city-size-distribution is important because its leads to the problem of selecting only a small part of the whole settlement system.

MALECZKI's (1979) work, a systematic study of the effect of different threshold values should be mentioned here. He writes:

> "The description of the rank-size-structure of an urban system is not as straightforward as previous research would suggest. This structure depends largely on the definition of the system, as implied by the threshold size of cities included in the system." (MALECZKI, 1979, p. 50).

(4) Defining the area of the city

Frequently the problem arises because the administrative boundaries of a city do not coincide with the boundaries indicated by settlement structure. The process of suburbanization lead to the transformation of cities into urban agglomerations, which prove even more difficult to delimit in an internationally standardized way. All existing studies therefore de facto compare urban cores only. Using the example of the differing strategies Vienna and Prag used for incorporating adjacent communities during the 19th century this study shows the difference between the boundary of the agglomeration and the boundary of the administrative unit.

(5) Interpretation of rank-size-distribution-chains

There are few concepts in the literature for interpreting the distances between rank-size-distribution-chains and their changes in a time series analysis (the intercept and the slope of the regression line).

Basically in changes of the slope an increase of steepness indicates - in the case of a rank-size-rule-distribution - urban growth in the upper ranks of the urban system, whereas a flattening of the regression line signifies that smaller cities gain in the growth of urban population. In the case of a primacy distribution an increase of steepness can also be interpreted as an urban growth of all middle-rank-cities.

(6) The existance of a developmental model of city sizes

The appearance of a primate city as well as the rank-size-rule-distribution are usually connected with certain stages in the economic development of a state. One assumes that highly industrialized states will exhibit rank-size-rule-distribution, while countries in the initial stage of industrialization will tend to show a primate distribution. BERRY (1961) showed a model of the development of city-size-distributions.

Figure 2: A developmental model city size-distribution (BERRY, 1961, p. 583)

BERRY pointed out that the starting point of his model is the primacy distribution, characterized as the simplest type of city-size-distribution.

> "Thus, primate cities are either orthogenetic political and administrative capitals, heterogenetic capitals of the emerging nations, or empire capitals" (p. 582). "Primacy characterizes small countries with simple subsistence economies (Thailand), or is associated with the presence of an empire capital (Portugal)".

The city-size-distribution will eventually lead to a rank-size-rule-distribution. The major assumption based on three hypothesis:

> "... fewer forces (leading more to a primacy distribution) will affect the urban structure of a country

(a) the smaller is that country
(b) the shorter is the history of urbanization in the country and
(c) the simpler is the economic and political life of the country and the lower its degree of economic development." (BERRY, p. 584).

BERRY's general conclusion represent some progress to compare urban-systems. But he failed in many cases. Regarding to the critic of RAPAPORT and SHEPPARD - (rank-size-distributions may well be the result of some multi-functional processes, but one will never be able to deduce specific economic processes from a konwledge of city-size-distribution) -, however, it is not clear if a developmental model of city-size-distribution is a sucessful topic.

2.3 Patterns of interpretations

It is intrinsic to scientific methods to ask for explanations for the occurrence of typical rank-size-distributions. Numerous and various answers fill the scientific literature. In principle the rank-size-rule is a simple, mainly descriptive instrument of analysis. In the interpretation of its results, various different strategies can be adopted:

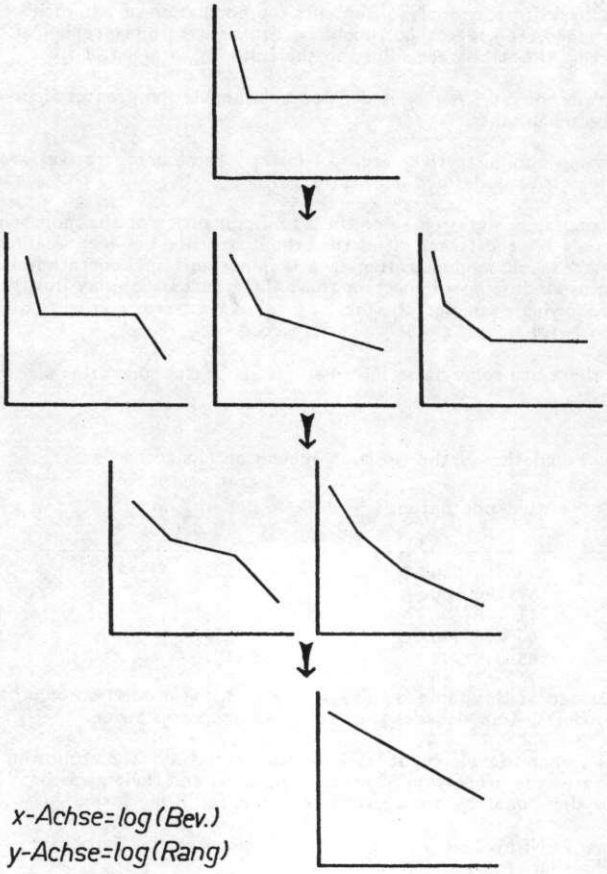
(1) Rank-size-distributions are the result of a random process. The assumptions are that at a distinct point in time all cities start with a randomly distributed population and exhibit a proportional increase of population (compared to the original population) until the next time unit. For infinitively small or frequent time steps the central limit theorem will hold and lead to a lognormal city-size-distribution.

(2) The rank-size-distribution is the result of a historical process and can therefore not be explained by a general theory. The concrete development of a city-system can be explained, with regard to the individual circumstances and the history of the respective system.

(3) Rank-size-distributions are the result of a central-place-distribution. Hierarchies of cities can be ranked according to the specific centrality of their urban functions (market, traffic, administration) and will give rise to a distributional pattern similar between centres and peripheries.

It is not the aim of this essay to analyse the different patterns of interpretation. This leads to basic questions concerning urban history and geography but it seems, that the interpretation of the rank-size-distribution in context to the central-place-theory has the largest value (see: BEGUIN, 1983, p. 749-758).

Figure 2: A DEVELOPMENTAL MODEL OF CITY-SIZE-DISTRIBUTION



3. ANALYSIS

3.1 Rank-size-distribution

The database for this analysis contents the population of 230 cities from 6 censuses (1857,1869,1880,1890,1900 and 1910). Three, more technical problems of collecting the data were solved in the following pragmatic way:

(1) Definition of city: A city is defined by a population greater than 10 000 inhabitants.

(2) Changing administrative areas of cities: The administrative area of greater cities is defined per status 1910.

(3) Changing agglomeration: For the 25 biggest cities of the monarchy (and it is only for the larger cities that the difference between administrative area and agglomeration area is important) agglomeration data are being used. Just how important these differences are, may illustrated by the following example: Prague: 223 741 (Census 1910), 595 702 (Agglomeration 1910).

At first there are some basic informations about the population size for the monarchy:

Table 1: Population of the Austrian-Hungarian Monarchy

Time	entire population	% urban pop (> 10 000)	n of cases
1869	35 815 000	10.4	115
1880	37 786 000	13.0	152
1890	41 786 102	15.5	174
1900	45 273 340	17.8	199
1910	49 316 744	19.9	229

One message of this table is the strong increasing proportion of urban population. During four decades the proportion increases twice.

Regional urban development is very differentiated. The following table demonstrates the proportion of urban population and their growth. The Kronländer of the monarchy are aggregated in the following form:

ALPENLÄNDER: Lower-Austria, Upper-Austria, Tyrol, Salzburg, Styria, Carinthia

SUDETENLÄNDER: Bohemia, Moravia, Silesia

KARPATHENLÄNDER: Galicia, Bukowina

KÜSTENLÄNDER: Triest, Krain, Istrien, Görz

These four regions constitute Cisleithanien. The other part of the monarchy (Hungary, Kroatien and Slawonien) is called Transleithanien.

Table 2: Urban population of regions of the Austrian-Hungarian Monarchy

Time	Alpenländer		Sudetenländer		Karpathenländer		Transleithanien	
	%	index	%	index	%	index	%	index
1857	16.2	—	5.7	--	4.5	--	--	—
1869	21.2	100.0	6.8	100.0	5.8	100.0	10.5	100.0
1880	25.0	128.9	10.7	168.6	7.9	148.1	12.1	116.9
1890	29.7	165.2	13.8	229.1	8.9	186.9	14.0	150.8
1900	34.1	208.6	16.6	298.9	10.4	241.2	15.9	188.1
1910	37.0	250.3	18.7	362.9	12.7	322.7	17.4	223.7

The urban development in the Sudentländer is the highest, comparing with the other Kronländer , continued by the Karpathenländer and the Alpenländer. The weak increase of urban growth in Transleithanien will be discussed later.

The rank-size-distribution offers the characteristic graph of a primacy-distribution. One large city (Vienna) dominates the hierarchy of the other cities. But in fact the primacy tendency decreases during the founder-period. Budapest and Prague growing faster then Vienna. The entire settlement structure seems to be very stable. The calculation of correlations between the ranks of cities at different time periods also clearly indicates the stable structure. No correlation coefficient is smaller then 0.935 (1857-1869: 0.955, 1869-1880: 0.935, 1880-1890: 0.952, 1890-1900: 0.967, 1900-1910: 0.976).

Figure 3: Rank-Size-Distribution 1857-1910

The following table shows the parameters of the rank-size-distributin of the Austrian-Hungarian monarchy for 1857 until 1910.

Table 3: Regression-parameters of the rank-size distribution (Primary Index p1 = proportion first city to the second; P2 = proportion first city to sum of the next four cities)

Date	Intercept	Slope	R	Primacy Index P_1	Primacy Index P_2
1910	5.841	-.767	-.991	2.18	1.23
1900	5.744	-.752	-.991	2.24	1.37
1890	5.609	-.714	-.987	2.66	1.36
1880	5.476	-.677	-.985	3.01	1.24
1869	5.406	-.678	-.984	3.25	1 13
1857	5.304	-.655	-.978	3.20	1 11

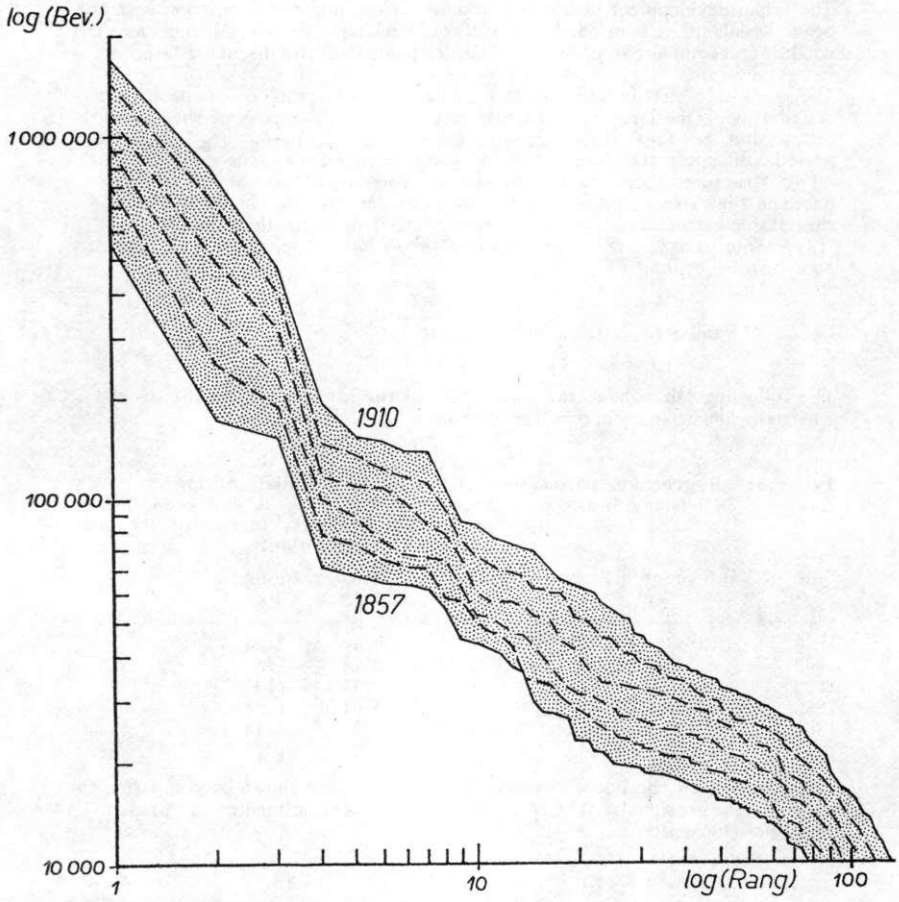
The adequacy of the linear regression approach can be shown by comparing the sum of the residuals. The non linear regression is defined as a single negative exponential curve:

Example 1910:

non linear regression:
POP(i) = 6.1 exp. (-.i7*RANK(i)) mean square of residuals: $\hat{\sigma}^2$ 0.00181

linear regression:
POP(i) = 5.8 -0.77 * RANK(i) mean square of residuals: 0.00153

Figure 3: RANK-SIZE-DISTRIBUTION 1857-1910



The "zero-hypothesis" is the equal growth of all cities, expressed in an increase of the interception and a constant slope. But this hypothesis cannot be accepted and it is not possible to formulate an alternative hypothesis only by analysing the regression parameters because this could be misleading. "For example, the intercept and slope of the rank-size-distribution may change because larger cities are growing relatively faster than smaller ones the slope may increase over time because of increases in the populations of larger cities alone or declines in the populations of smaller cities and the intercept may change because of uniform growth in the entire system of cities." (STRICKLAND, 1984, p. 43). The problem of interpretation rank-size-distribution-chains was mentioned earlier in section 2.2. In the case of table 3 the increasing slope is caused by the growth of medium and large cities and not in the same proportional way by the growth of the primate city Vienna. Differentiating urban growth according to categories of city size, one can show the following regularities.

(1) The variance of growth rates decreases with increasing city size. Large cities exhibit a more homogeneous development than small cities do.

(2) The growth rates of large cities decrease towards the end of the century, smaller cities show persistant patterns of dynamic growth.

(3) The increasing urbanization during the founders period captures increasingly deeper layers of urban structures as to their instability and redistribution effects. This is expressed by the increase of changes in the lower ranks of cities.

Figure 4: Transition of cities

(4) Patterns of growth

The pattern of growth on the urban-system is more dependent on the various effects of size and only particular from a west-east process of urbanization. A cluster-analysis of the 5 growth-rates of all cities exhibits as the main result three different clusters which can be described as follows:

- all capitals (Vienna, Prague, Budapest) and all greater cities of the monarchy (Lemberg, Krakau, Agram, Fiume, ...) with a strong growth-period in the Hochgrlinderzeit.

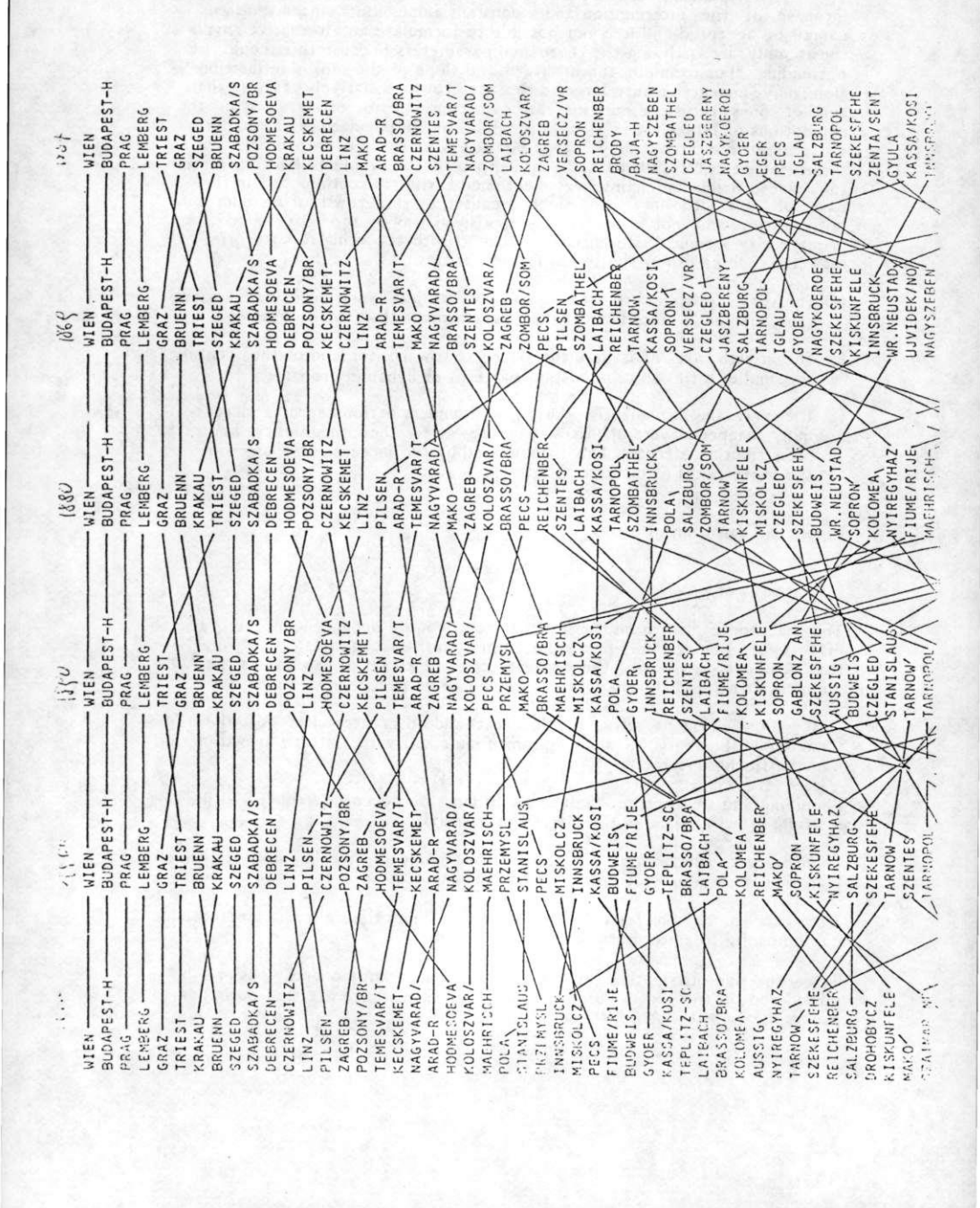
- medium and small cities (Salzburg, Brünn, Debrecen, Trient ...) with a strong growth-period in the late founderperiod.

- and cities, which were not affected by some economic impulses and which are hence showing only a stagnant development.

What are the reasons for this development? Which theoretical construction can be useful for interpretation such phenomena?

The rank-size-distribution in the Austrian-Hungarian monarchy has to be considered in the context of three main processes which are the basic assumption of CHRISTALLER's central place theory:

Figure 4: TRANSITION OF CITIES



(1) the administrative political development of the monarchy in the 19th century, which can be characterized by the dichotomy between Cis- and Transleithanien

(2) the advancement of traffic-infrastructure and the resulting changes in the accessibility of areas within the urban system.

(3) the spread of industrialization.

The effects of these processes on the urban system can be shown by disaggregation the data.

3.1.1 The effect of desaggregation

3.I.I.I The dichotomy of Cis- and Transleithanien

The example of the effect of the administrative-political development:

While other European nations realized their imperialistic intentions in Africa and South-East-Asia, Austria concentrated on solving its interior problems. These were characterized by difficulties that become more marked in the course of the 19th century due to exterior defeats (e.g.: Königgrätz 1866) and the rising nationalism of the various nationalities encorporated in the Austrian-Hungarian monarchy. In 1867, the "Ausgleich" with Hungary was signed which separated the administration of the two states while maintaining a joint exterior-, finance-, and defense policy, as well as a common empire under of Franz Josef I. The lack of concessions to other national groups lead to a deepening of the national and social conflicts in the 2nd half of the 19th century.

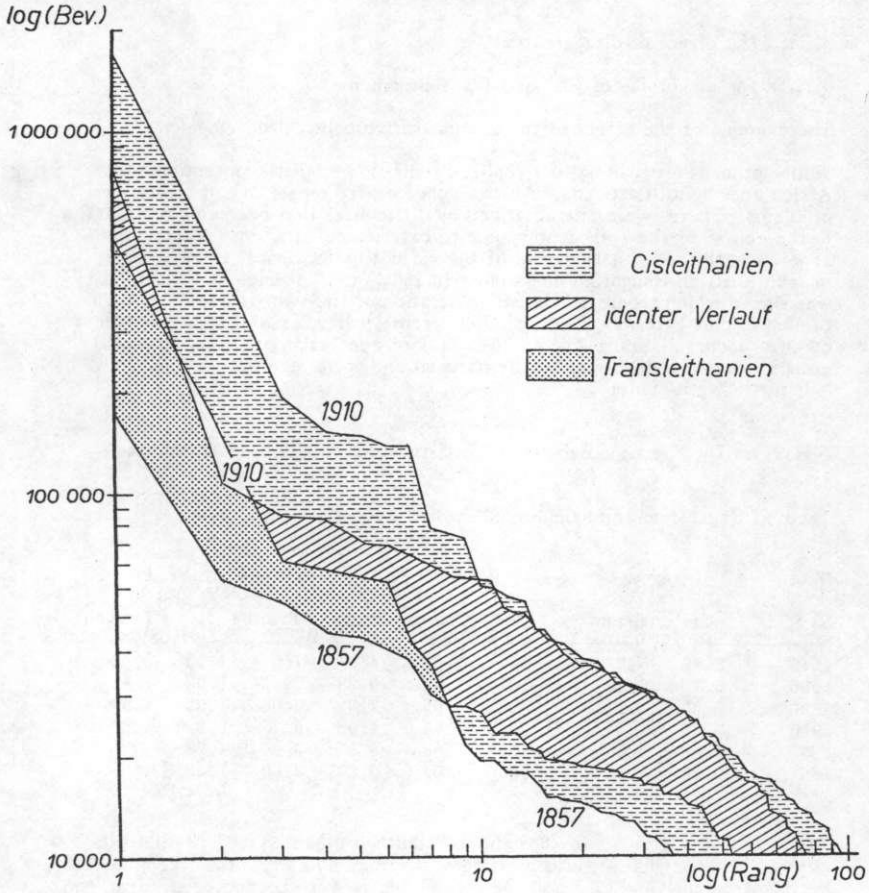
Figure 5: The superimposed rank-size-distribution of Cis- and Transleithan

Table 4: Regression and Primacy index of the rank-size-distribution

Date	Intercept		Slope		Primacy Index 1)			
					PI		P2	
	Cis leithanien	Trans-	Cis leithanien	Trans-	Cis, lei thanien	Trans -	Cis leithanien	Trans-
1910	5.78	5.37	-.87	-.61	4.01	7.91	1.90	0.93
1900	5.70	5.28	-.87	-.58	3.99	7.52	1.93	1.22
1890	5.60	5.17	-.85	-.55	4.09	6.06	1.92	1.58
1880	5.44	5.05	-.80	-.51	4.58	5.10	2.07	1.91
1869	5.39	5.02	-.85	-.52	4.35	3.86	1.98	2.36
1857	5.30	4.95	-.85	-.51	3.63	3.00	1.58	2.43

After the "Ausgleich" in 1867 the Transleithan urban system exhibits a strong development towards a primacy structure. In 1873 the "königliche Freistadt" Buda and Pest and the city of Obuda were connected to form the new capital and residence Budapest, which functioned as a symbol of patriotic vanity (Symbol der nationalen Eitelkeit). Incited by the competition to Vienna, Budapest could catch up on the standards of European centres only by neglecting the development of the rest of the country in many respects. Exhausting the state's financial resources, this development had a twofold

Figure 5: THE SUIPERIMPOSED RANK-SIZE DISTRIBUTION CIS- AND TRANSLEITHANIEN



negative effect on the smaller towns: first, it rendered impossible an appropriate promotion of other towns, and second, it brought about a loss of inhabitants of other towns as a consequence of a marked migration flow to Budapest (DEAK, 1979, 124).

Compared to Cisleithanien the structure of the Hungarian urban system reveals a significantly higher proportion of small-, and intermediate size cities (between 20 and 40 000 inhabitants) and a smaller number of large cities with more than 80 000 inhabitants and small cities with less than 20 000. This trend has increased during the period of research and can still today be regarded as a characteristic for the Hungarian urban system. "The curtailed curve of Hungary indicates a lack of small towns and an overproportional share of medium-size towns, the latter being much less representative for Austria" (LICHTENBERGER, 1982, p. 264).

The development of the urban system after 1867 is marked by the preference of the central region highlighted by the example of Budapest and also of the areas along railway linkages. Here the Budapest-Rijeka line deserves special consideration, since it set growth-impulses for a large number of cities (e.g.: Szombathely, Kasposvar, Nagykanisza). In the mountainous regions of the north the development of settlements stagnated.

3.1.1.2 Disaggregation of Cisleithanien

Further disaggregation of Cisleithanien brings about the following groups of Kronländer which were defined as the traditional geographical units:

- Alpenländer
- Sudetentländer
- Karpatenländer
- Küstenländer

This regionalization demonstrates the effects of different innovation of industrialization and accessibility.

There is a common agreement of the fact that the improvement of technical infrastructure that went along with the industrial development of the 19th century brought about a significant restructuring of space. Traditional location factors loose their importance, new locations develop. The efficient transportation network is crucial for promoting further division of labor with respect to space, where the distance between production and consumption can now increase even further. In addition, the very construction of the transportation network itself (e.g.: railwaysystem) induces industrialization.

But the development of the Austrian-Hungarian railwaysystem was characterized by some pecularities. I want to point out two aspects:

- During the first period of construction, the railwaysystem was private (except from 1841 to 1854). Hence the regional development of the railway was layed out according to considerations of profit-making. Profit could only be made however when goods were brought into the centers of high density on a large scale (e.g. Vienna).

- After 1880 the railwaysystem have become an centraliste instrument to balance regional and nationalistic disparities as well as military interests (BACHINGER, 1973, p. 321). As a consequence, further development of

the railwaysystem did no longer focus on Vienna and the industrialized areas but on the east and south respectively.

Nonetheless the predominant accessibility of the North and that of the area around the capital became evident before the World War I (see Appendix Table 2).

Figure 6: The rank-size distribution

The above figure shows the pattern of urban development split up into regional units. The interesting features here are:

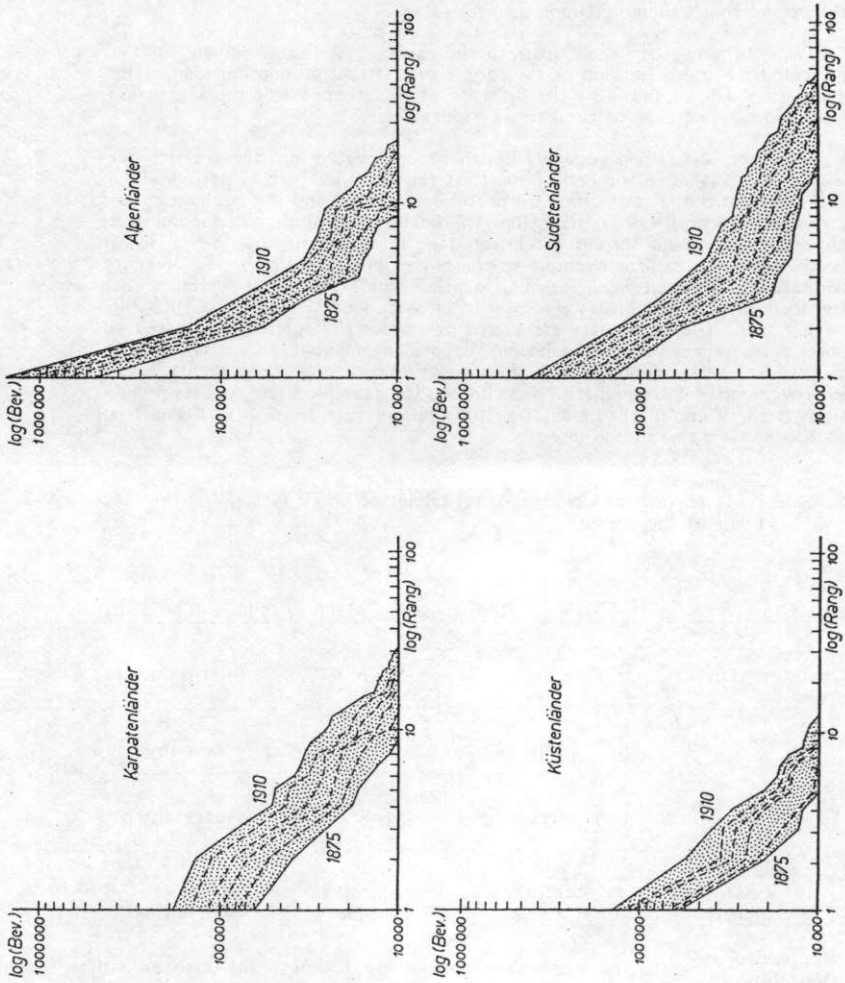
The Alpenländer are characterized by a primacy city-size-distribution which shows a weak increasing tendency (Primacy Index 1869: 10.8, 1910: 12.3). In the Hinterland of Vienna only small cities are growing (effects of dislocation of industries). In the eastern parts there are no relevant medium-size cities. The western parts show a strong increasing development of small towns especially caused by the expanding tourism (e.g. Bad-Gastein, Bad Ischl etc.) Vorarlberg^ cities (all sizes) expand with the industrialization. The south of the Alpenländer shows a different picture: Urban growth of central places, as well as of smaller towns with tourism and of industrialized areas, decline in rural communities.

The Sudetenänder exhibits a primacy-distribution too. But the proportion first to second largest city being stable. The urban growth reached their peak between 1869 and 1880 with 2.1 % growth-rate every year. Smaller towns (less than 40 000 inhabitants) are growing, medium-size cities up to 100 000 stagnate.

In the Karpatenländer a counter-primacy-distribution is characterized by the absence of a primate city and large proportion of small towns. The proportion of the ist to 2nd city being stable. The city-size-distribution can be described by a strong decrease of rural population, which is the source of oversea-migration and long-distance migration (to Vienna) and an increase of particularly small towns up to 20 000 inhabitants.

The Küstenländer show also a primacy-distribution with Triest on the top. The Primacy-Index is decreasing (from 4.2 1869 to 2.7 1910), the lower tail of the distribution is growing. The increasing importance of the harbours for military and trade capacity (Triest, Pola) and the glamour of smaller towns like Abbazia caused this development.

Figure 6: THE RANK-SIZE-DISTRIBUTION 1857-1910



.. SUMMARY AND CONCLUSION

The, partly very significant, primacy distribution of the Alpen-, and Sudetenländer and of the Küstenländer in the south of the monarchy is in contrast to the agrarian Karpathenländer which show a counter-primacy settlement structure resulting from several respective centres of similar size (Lemberg, Krakau, Czernowitz). The "over-aH"-development until 1870 is marked by a disproportional population increase in large cities, which at that stage reach their maximum growth rates.

From 1880 onwards, the growth of the capital city slows down, and the intermediate rank section of the rank-size-distribution continues to gain population. This is shown by the increase of the steepness of the regression line, and the decrease of the Primacy Index.

Medium-size cities progressively became incorporated into the traffic network. This is due to the end of the first railway construction period which had favoured the largest cities (in particular Vienna) and the beginning of a new stage in railway construction. The better accessibility of medium size cities, their labour surplus and lower wage level combined with the lower costs of living lead for example to the movement of Vienna's silk industry to Moravia. Similar tendencies of delocation from Vienna can be found in the furniture producing industry and textile industry (see MATIS, BACHINGER, 1972, 227). The secondary effects of new industrial settlement (increased purchasing power of the population, expansion of public and private services) may furthermore explain the immigration of population and the rank-improvement of intermediate cites. Pilsen, for example increased its population from 14 000 in 1857 (rank 64) to 81 000 in 1910 (rank 14), Brünn from 60 000 in 1857 to 150 000 in 1910.

Scheme 1: Overview on developmental trends of urban system in the second half of the century

	1848 1857	1869 1880	1890 1900 1910
innercity construction period	Früh	Hoch	Spätgründerzeit
Stages of Industrialization	imitation	restructuring	efficiency
Urban growth rates	increasing	peak	decreasing
dominant city-size of growth	capitals	capitals+ medium	medium+ small cities
Rank-size-distribution	primacy - decreasing toward rank-size-rule-distribution		

Concluding .the essay, I want to point out four directions for further research:

(1) Research on the effects of disaggregation: This paper showed that the rank-size-distribution of the Austrian-Hungarian monarchy and the Rank-size distribution of the two disaggregational levels differ significantly - but the primacy tendency was dominant. A centralists system such as the Austrian-Hungarian monarchy appears to produce a centralistic urban system and urban system clearly distinct from those of federal states such as Switzerland. The major forces active in this spatial reproduction-process are the administrative organization of the state and the state planned construction of technical infrastructure. Quite like the ostentatious architecture of baroque the capitals symbolized power and manifested national autonomy.

(2) Research that considers the urban function as explanatory concepts. The market-, transportation-, and administration functions (after CHRISTALLER) seem to be valuable concepts for the interpretation of rank-size-distributions and their changes in time. This paper showed that the central place concept provided valuable interpretations for understanding rank-size distribution structure.

(3) The problem of incorporating distance and accessibility as a measure for hierarchical structure is yet to be solved. Weighting the ranks of cities according to their distance or the size of their Hinterland could increase the descriptive value of the instrument.

(4) Research on the reformulation of the rank-size-rule: The rank-size distribution proves to be a valuable descriptive instrument for analysing the settlement structure of an urban system. It turns out that further consideration of the functional characteristics of cities could bring valuable insights. The same holds for the spatial and temporal disaggregation of the urban system.

At last some critical aspects of using rank-size-distribution models: The method is - I pointed it out - a handy descriptive instruments to characterize and compare urban-systems at a gross and not very sophisticated level. It is useful to start some detailed discussion about underlying structures. But without this detailed discussion applications of this method are not serious.

APPENDIX

Table 1: Operationalization of the Term "primacy" (see SHAPPARD)

JEFFERSON (1939):	$\frac{Pi}{P_2}$
ZIPF (1949):	Rank-Size -Rule
BERRY (1961):	visuell
MEHTA (1964)	!i / ZPi
MC.GREEVY (1971)	Fit to a log-normal distribution
EL SHAKS (1972)	$P - \frac{1}{n-1} * \Sigma \frac{1}{n-i} * P_i Z (Pi - Pj)$

An alternativ approach to identify "primacy" was developed by SHEPPARD who compared the population of every adjacent city and not only of the first to the second one.

$$I = \frac{1}{n-2} \sum_{i-1}^{n-2} \frac{\log P_1 - \log P_{i+1}}{\log P_{i+1} - \log P_{i+2}} * \frac{\log (i+2) - \log (i+1)}{\log (i+1) - \log (i)}$$

Table 2: Share of the Kronländer of the railwaysystem (see: BACHINGER, p. 301)

	Length of tracks per km²
Bohemia	130
Silesia	130
Lower Austria	125
Moravia	95
Upper Austria	91
:	
:	
Hungary	66
:	
Dalmatia	18

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