BERICHTE UND MITTEILUNGEN

DISTRIBUTIONS OF RURAL CENTERS NEAR CHENGDU IN SOUTHWEST CHINA

A comparison with G. W. SKINNER's central place model

With 2 figures and 2 tables

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Zusammenfassung: Das räumliche System ländlicher Zentren in der Nähe von Chengdu in Südwestchina – ein Vergleich mit G. W. SKINNERS zentralörtlichem Modell

In der Volksrepublik China wurde die zentralörtliche Theorie CHRISTALLERS erst in der jüngeren Vergangenheit nachhaltig rezipiert. Das Geographische Institut der Chinesischen Akademie der Wissenschaft initiierte in den 1980er Jahren ein Forschungsprojekt „Die Anwendung der zentralörtlichen Theorie in China", an dem Geographen aus ganz China beteiligt waren. In diesem Rahmen ist die vorliegende Studie entstanden, die 1987 ein Gebiet in Sichuan bearbeitete, das schon SKINNER 1949/50 untersucht und in seinem berühmten Aufsatz von 1964/65 als empirisches Beispiel für ein K = 4 System präsentiert hatte. Zur quantitativen Erfassung der Umlandbedeutung der ländlichen Zentren werden in der vorliegenden Arbeit nicht nur die periodischen Märkte und ihre Funktionen, sondern auch die von permanenten zentralen Einrichtungen verwendet. Die Gesamtbedeutung wird durch die Addition der Jahresumsatzzahlen dieser Funktionen bestimmt. Auf dieser Grundlage erfolgt die Festlegung einer dreistufigen Hierarchie. Die Ergänzungsgebiete der zwei obersten Stufen (Abb. 1) wurden nicht empirisch ermittelt, sondern durch die Anwendung eines modifizierten Verfahrens nach REILLY theoretisch konstruiert.

Das Bevölkerungswachstum und die starke Wirtschaftsentwicklung der letzten 15 Jahre haben eine Intensivierung des Marktgeschehens bewirkt. Während es früher nur drei Markttage pro Dekade gab, haben die höherrangigen Zentren bereits jeden zweiten Tag Markt, und der Trend geht offensichtlich dahin, daß aus den „periodischen" Märkten „tägliche" werden. Ein echter Vergleich der Karte von 1949/50 (Abb. 2) mit der von 1987 (Abb. 1) ist kaum möglich, weil SKINNERS Karte eine Reihe von gravierenden Fehlern enthält.

Introduction

The foundations of the now widely-recognized central place theory were established in 1933 by WALTER CHRISTALLER. It was during the 1970's that central place theory was introduced systematically to Chinese geography. In recent years, economic geographers in China have been focusing their attention on the applications of CHRISTALLER's theory to studies of intra- and inter-urban systems at the expense of studies of rural centers. By definition, a rural center is a service center which provides certain central functions to its surrounding rural area. This paper, which was integrated into the Academic Research Project: "Application of the Central Place Theory in China", sponsored by Shao Qingyu, tentatively studies the rural center system near Chengdu.

G. WILLIAM SKINNER adopted the central place theory to analyze the marketing mechanism in rural China and categorized marketing places into three classes. In order to verify CHRISTALLER's models, he particularly studied in 1949/50 a part of the periodic markets in Jintang, Zhongjiang counties and Qingbaijiang district (according to the present administrative regions in Sichuan province) and mapped their distribution which he thought complied with a K = 4 hierarchical system (SKINNER 1964/65, p. 22). In many countries (even in China) his research results have been widely cited in geographical textbooks concerning the application of the central place theory in the developing countries. My task was to revisit SKINNER's research area nearly 40 years later and to study the changes which have taken place.

Spatial distribution of rural centers

Jintang county is the main area of the study. In October, 1987, most of the field investigations were concentrated in Jintang county, whereas less field work was done in Zhongjiang county (to the East) and Qingbaijiang district (to the NW). All the calculations below are only concerned with the rural centers in Jintang county. Whereas SKINNER does not tell us, how he arrived at the hierarchy of the market places and the delimitation of their marketing areas in Jintang county, at least he does not give us any quantitative data, the following classification of its present-day 42 rural centers employs their nodalities. Nodality of a rural center is the total value of sales and services it offers. The formulation goes as follows:

$$Nt = R + S,$$

where: Nt = nodality of center t,
R = value of sales in center t,
S = value of services in center t.

Table 1: The hierarchiy and nodalities of the 42 rural centers in Jintang county, 1986
Hierarchie and Nodalitäten der 42 ländlichen Zentren im Kreis Jintang 1986

Level	Number	Names of rural centers					
Highest (A-level)	6	Zhaozhen 6988.3	Huaikou 3193.7	Tuqiao 1634.2	Zhugao 1433.0	Gaoban 882.3	Wufeng 835.7
Higher (B-level)	18	Fuxin 978.4	Guancang 730.3	Guangxin 662.4	Zhaojia 590.5	Sanhe 439.7	Yunhe 405.0
		Longsheng 363.6	Youxin 350.0	Qingjiang 310.8	Pingqiao 308.7	Baiguo 297.8	Shuanghe 260.3
		Zhuanlong 241.8	Shuangliu 237.9	Yunxiu 176.3	Anle 165.6	Shilong 139.0	Yangliu 124.3
Minor	18	Jinlong 264.4	Huangjia 136.2	Longwei 97.9	Da'an 97.5	Yuhe 95.3	Sanlie 90.5
		Qingming 81.4	Shifu 78.8	Daqiao 72.4	Xixian 71.8	Jinle 68.0	Yanjing 62.3
		Jiulong 60.6	Sanxing 55.8	Changle 55.6	Yuelai 39.4	Sifang 24.9	Xinhua 5.1

Note: Unit of measurement: ten thousand yuan

Table 1 shows the nodalities of the 42 rural centers in Jintang county. Two critical points are identified: N = 800 and N = 100. Rural centers whose nodality is above 800 are all towns (with 2,000 or more habitants). Almost all rural centers whose nodality is below 100 do not have a periodic market. According to these two points, the 42 rural centers are classified into three levels (see Table 1).

But there are exceptions. Although Fuxin has a nodality well above 800, it is categorized into the B-level group. Compared with the A-level centers, it has less cultural and financial functions and less hospital facilities. As for Jinlong and Huangjia, which are included in the minor group, their nodalities exceed 100. Apart from their less functions and less service facilities, explanation of their level degradation in the hierarchy requires taking into consideration the spatial inequality of economic development in this county. Putting Jinlong and Huangjia into their own locales and contrasting them with their neighbouring centers, we can confidently categorize them into the minor group. Compared with Fuxin and Sanhe whose nodalities are 978.4 and 439.7 respectively, that of Jinlong (264.4) is much smaller. Similarly, Huangjia's nodality (136.2) is trivial in the comparison with those of Huaikou (3193.7) and Sanhe (439.7).

By taking the hierarchy system developed above as a reference point, levels of rural centers in the area outside Jintang county are identified. Qingquanzhen in Qingbaijiang district is a town, which has a larger population (6599) than does Wufeng (with the third largest population (5995) in Jintang county). Market trading in Qingquanzhen is prosperous and the volume of it exceeded 4.50 million yuan in 1986. So Qingquanzhen is identified as an A-level center. The volume of market trading in Xinlong, Zhongjiang county, was 3.53 million yuan in 1984, greater than that of Wufengzhen in 1986 (3.40 million yuan); the volume of trading in Yongmen, Zhongjiang county, was more than 6.00 million yuan in 1984, close to that of Huaikouzhen in 1986 (6.59 million yuan). Therefore, Xinlong and Yongmen are also recognized as A-level centers. In this way of comparison, B-level centers in the surrounding area are identified (see Fig. 1). More detailed information on the population, sales and services of the 26 main rural centers of Jintang county is presented in Table 2.

The complementary regions of the rural centers were not realized by empirical research but calculated according to Reilly's formula:

$$Bij = Dij/(1 + Pj/Pi),$$

where Bij is the predicted distance from center i to the boundary between its complementary region and that of center j. Dij is the distance from center i to center j. Pi is the population of center i and Pj the population of center j. But Reilly's model is too simple, for it uses straight-line distance and crude population totals. Therefore, road distance between, and nodalities of, center i and j were used in the study to represent Dij and Pi and Pj respectively. But for the centers in Jintang county's surrounding area without nodalities, population totals are still used. In this way the complementary regions (equivalents to marketing areas suggested by Skinner) of A- and B-level centers in the area of study were delimited (the minor centers are excluded because most of them do not

Table 2: Selected characteristics of 26 rural centers in Jintang county, 1986
Ausgewählte Merkmale für 26 ländliche Zentren im Kreis Jintang 1986

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
Zhaozhen	34979	1651.0	150.0	5187.3	313	70	32.46	5630	269	283
Huaikou	10477	659.0	122.8	2411.9	370	44	4.66	4562	177	198
Wufeng	5995	340.0	112.5	383.2	201	17	2.58	1352	21	43
Gaoban	2620	322.4	94.3	465.8	166	21	1.01	1427	34	27
Zhugao	3075	461.1	109.9	862.0	191	26	1.10	1700	65	40
Tuqiao	2003	499.2	95.0	1040.0	246	23	2.12	1197	33	43
Zhaojia	1629	272.0	62.4	256.1	64	11	0.99	1720	17	40
Fuxin	2272	269.0	64.2	645.2	126	17	0.32	1369	33	27
Guancang	1144	352.0	87.6	290.7	70	6	1.24	1328	13	15
Guangxin	948	260.9	105.4	296.1	84	7	0.78	1355	11	10
Qingjiang	1421	44.0	90.3	176.5	45	7	0.84	1197	18	27
Sanhe	597	111.4	80.5	247.8	43	6	0.48	1180	8	12
Youxin	517	105.0	65.0	180.0	26	7	0.61	1183	7	15
Baiguo	1027	57.0	73.0	167.7	40	6	0.49	1025	7	20
Yunhe	972	142.6	49.9	212.5	71	7	0.59	1066	14	10
Yangliu	578	8.8	38.4	77.1	23	5	0.29	1045	7	0
Zhuanlong	840	78.3	37.4	126.1	30	6	0.36	855	10	0
Anle	265	0.0	39.3	126.3	9	6	0.14	761	9	6
Shuanghe	277	0.0	14.8	245.4	11	5	0.40	836	7	0
Longsheng	454	182.6	57.8	123.2	40	5	0.53	955	10	15
Shuangliu	421	57.5	44.5	136.0	29	5	0.39	859	7	14
Pingqiao	891	99.6	55.8	153.4	37	5	0.91	967	9	10
Yunxiu	801	35.2	35.4	105.7	22	5	0.71	775	12	12
Shilong	240	0.0	23.4	115.6	18	3	0.02	925	10	12
Jinlong	1374	15.0	42.6	206.8	46	6	0.69	1178	11	12
Huangjia	938	0.0	42.0	94.2	14	6	0.93	1202	10	12

Note: The ten variables are: X_1 = population size, X_2 = annual volume of market trading, X_3 = annual value of private firms' retailing and services, X_4 = annual value of national and collective firms' retailing and services, X_5 = staff employment of supply cooperatives, X_6 = staff employment of agricultural banks and credit cooperatives, X_7 = annual value of cultural and recreational services, X_8 = total number of primary and secondary school students, X_9 = total number of physicians, X_{10} = total number of hospital beds
Unit of measurement in columns X_2, X_3, X_4, and X_7: ten thousand yuan

have a periodic market). By modifying the above calculation results according to the actual conditions in the area of study, Fig. 1, which shows the complementary regions of A- and B-level rural centers, is developed.

From Fig. 1, we will easily find that the distribution of rural centers in Qingquanzhen and Zhaozhen areas approximates to the K = 3 system, i. e. a B-level center is dependent on three A-level centers; that the distribution of rural centers in Wufengzhen, Huaikouzhen, Xinlong and Yongmen areas closely complies with the K = 4 system, i. e. a B-level center is located at about the mid-point of the road connecting two neighbouring A-level centers; that the distribution of rural centers in Gaoban, Zhugao, Tuqiao areas is the result of both the administrative and the traffic principles, i. e. most of the B-level centers are within their respective A-level complementary regions.

How should we explain these three different distributions? Essentially, they owe their differences to the disparities of regional economic development. Qingquanzhen and Zhaozhen areas are at the brim of Chengdu Plain, connecting most frequently with Chengdu, the capital of Sichuan province. They have the highest level of economic development in the area of study. People in these areas are considered to behave economically rational, so the distribution of the centers approximates to the K = 3 hierarchical system controlled by the marketing principle. The remaining part of Fig. 1 is located in mountain and hill areas, whose less-developed economies make the distributions of their rural centers primarily comply with the traffic and the administrative principles. In the center of Fig. 1 is a part of Longquan range, where constructing a road is very difficult, so the traffic principle dominates the distribution of rural centers in this area. In Gaoban, Zhugao and Tuqiao hill areas, the construction of a road is easier than in Longquan range and then traffic principle becomes less constraining while the conveniences of administration become more important in establishing the system of rural centers.

From the above analyses, we can infer that CHRISTALLER's theory is applicable in China despite some

deviations from it in reality. The central place theory can help us study and plan rural center systems rationally and effectively.

Temporal spacing of rural centers

Periodic markets are prevalent in Southwest China. In the area of study all A-level and most B-level rural centers, together with four minor centers and a village, have periodic markets. People living around a periodic market go there to buy and sell on market days. Periodic markets do not operate except on market days which come at intervals of two, three, four and five days. The scheduling systems of rural centers in the area of study are based on the 'decade' (ten days) cycle. Three marketing systems are identified: two-per-decade, three-per-decade and every-other-day schedules. To a great extent, the marketing schedule a rural center adopts reflects its role in the rural center hierarchy. All A-level rural centers in the area of study adopt every-other-day market schedules, with the shortest interval between market days. Most B-level centers carry out three-per-decade schedules, some even adopt every-other-day schedules. Only one B-level center (Gangbai) chooses a two-per-decade schedule. As shown in Fig. 1, the three-per-decade schedules are 1-4-7, 2-5-8 and 3-6-9, whereas the every-other-day schedules are 1-3-5-7-9 and 2-4-6-8-10. Only one kind of the two-per-decade market schedule, 5-10, appears in Fig. 1.

The distribution of schedules among different rural centers is based primarily on the following two principles: (1) each market shares the same schedule with as few of its neighbours as possible, so that competition between adjacent markets can be reduced as much as possible. (2) the aim is to minimize conflict between the market schedule of a lower-level rural center and the schedules of the higher-level centers toward which it is oriented, so that people within the complementary region of the lower-level center have time to go to the nearest higher-level center to buy or receive the higher-order goods and services (see Fig. 1). Another factor affecting the distribution is administrative regulations. The distribution of marketing schedules in a county is planned and carried out by its Industrial and Commercial Bureau (ICAB). Each ICAB uses the above two principles within its own territory. This gives a possibility of the existence of conflicts between the schedules of neighbouring centers in the boundary area of two adjacent counties. For example, Baixiang in Zhongjiang county shares the same marketing schedule (2-4-6-8-10) with its adjacent center, Fuxin, in Jintang county; the same problem occurs between Renhe, in Qingbaijiang district, and Huaikouzhen, in Jintang county. As the economy in the area of study improved, there are so many people who go to the markets that the commercial and transport facilities of most centers cannot meet the demand. In order to solve this problem, the ICAB of Jintang county gives five major centers (Zhaozhen, Huaikouzhen, Gaoban, Zhugao and Tuqiao) the same every-other-day schedule (i. e. 2-4-6-8-10) to minimize the number of people who go to each of them.

A comparison with G. W. Skinner's representation of Jintang county's periodic market system in 1949/50

In the beginning it must be stressed, that a genuine comparison between Skinner's map of 1949/50 and mine of 1987 is not possible, because he mapped periodic markets whereas I constructed rural centers, which are only partially equal to the latter. In order to create a hierarchy of periodic markets one uses the average number of visitors and stands and turnover on a market day, whereas the calculation of nodality uses the total value of sales and services, per annum, of permanent institutions like retail shops, hospitals, cinemas, hotels, restaurants, tea-houses, repairers etc. plus the annual sum of sales and services on the periodic markets, if there is one. Fig. 1 shows, that one village and four minor rural centers have a periodic market, whereas several B-rural centers have none. The latter are located too close to A-level centers, that may explain the absence of periodic markets.

The pattern in Fig. 2 is spatially more regular, closer to Christaller's hexagonal model than in Fig. 1. Periodic markets in Fig. 2 are integrated into a K = 4 hierarchical system only, but generally speaking, in Fig. 1 some of the rural centers are arranged according to a K = 3 hierarchy, some to a K = 7 system, the others to a K = 4 distribution. Skinner neglected the spatial continuum of central places. The area for his study was too small. He did not consider the spatial relationships between markets just inside and those just outside the boundary.

Skinner's map of 1949 has some deplorable mistakes. He misplaced the standard market Ts'ai-tzu-pa (now called Longwei), which is located at about the mid-point between Zhaozhen and Yuelai, not between Zhaozhen and Xinlong as shown by him. The table of market distribution of Jintang county in 1921 tells us, that Ts'ai-tzu-pa opened its market in 1911 and that it had a schedule of 4-7-10 in 1921. In the same table of 1954 it already had lost its market. So the large standard marketing area of Longwei, which Skinner put on his map between Zhaozhen and Xinlong, never existed there!

Another case is San-huang-miao (now named Yuelai). Its market was started in 1875. Its name was still in the table of market distribution of Jintang county in 1921, but already then no market days were given. In the table of 1954 its name has been deleeted. So when Skinner put Yuelai on the map

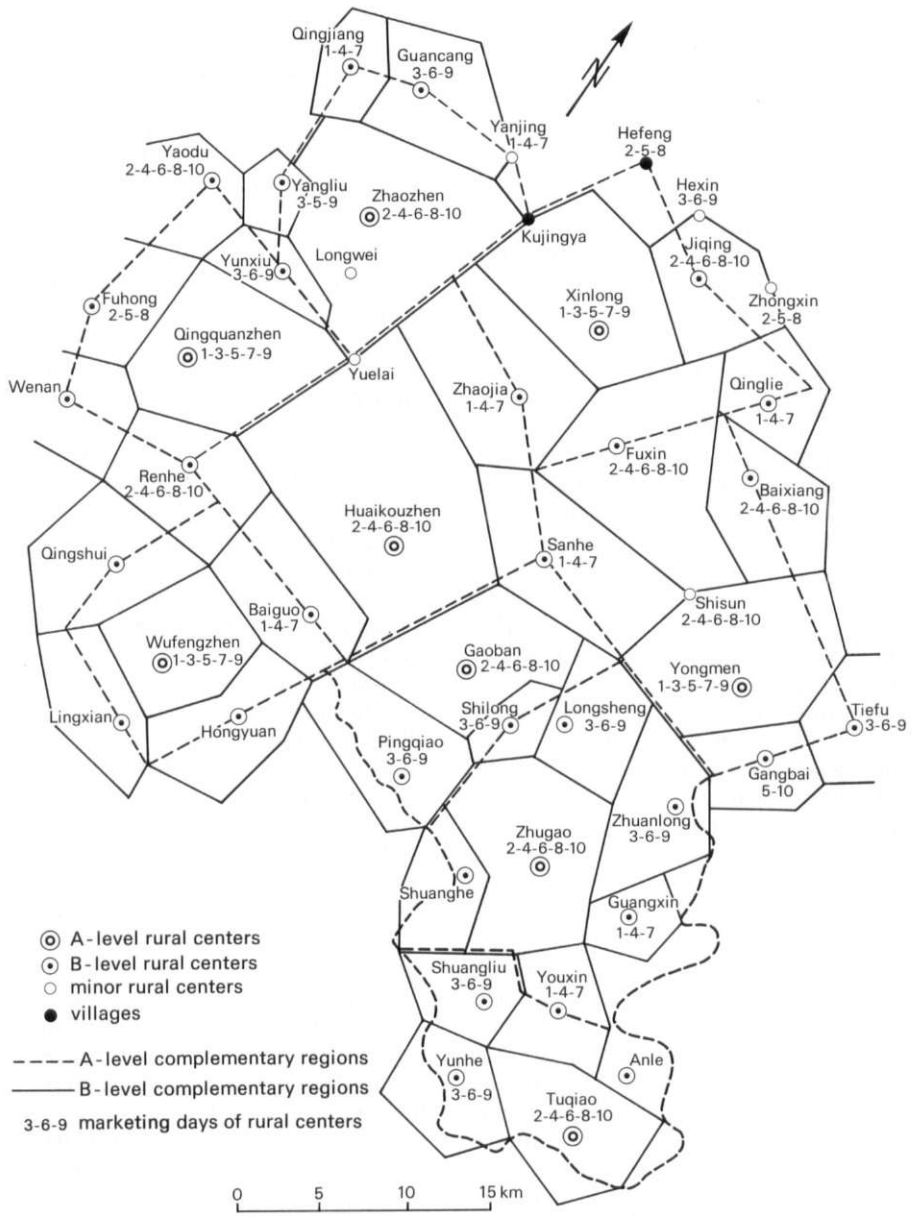

Fig. 1: Distribution of rural centers in Jintang county and part of Qingbaijiang district and Zhongjiang county, 1987
Räumliche Verteilung der ländlichen Zentren im Kreis Jintang und Teilen des Qingbaijiang Distriktes und des Kreises Zhongjiang im Jahre 1987

for 1949, there was actually no periodic market anymore and therefore he was not able to give market days for that place.

Another riddle is Jiqing, which lies 7 km NNE of Xinlong and has today a schedule of 2-4-6-8-10. The tables of market distribution of Zhongjiang county for this century prove, that Jiqing always had a market, also in 1949, but SKINNER omitted it on his map. A comparison of the spatial distribution of central places and their complementary areas in 1949 and 1987 is therefore impeded by the many mistakes on SKINNER's map. If one wants to be malicious, one would utter the suspicion that he deliberately cheated in order to verify by all means the empirical existence of a K = 4 system in China.

The area investigated has experienced great social, cultural and economic changes such as the improvement of economic conditions and transportation and

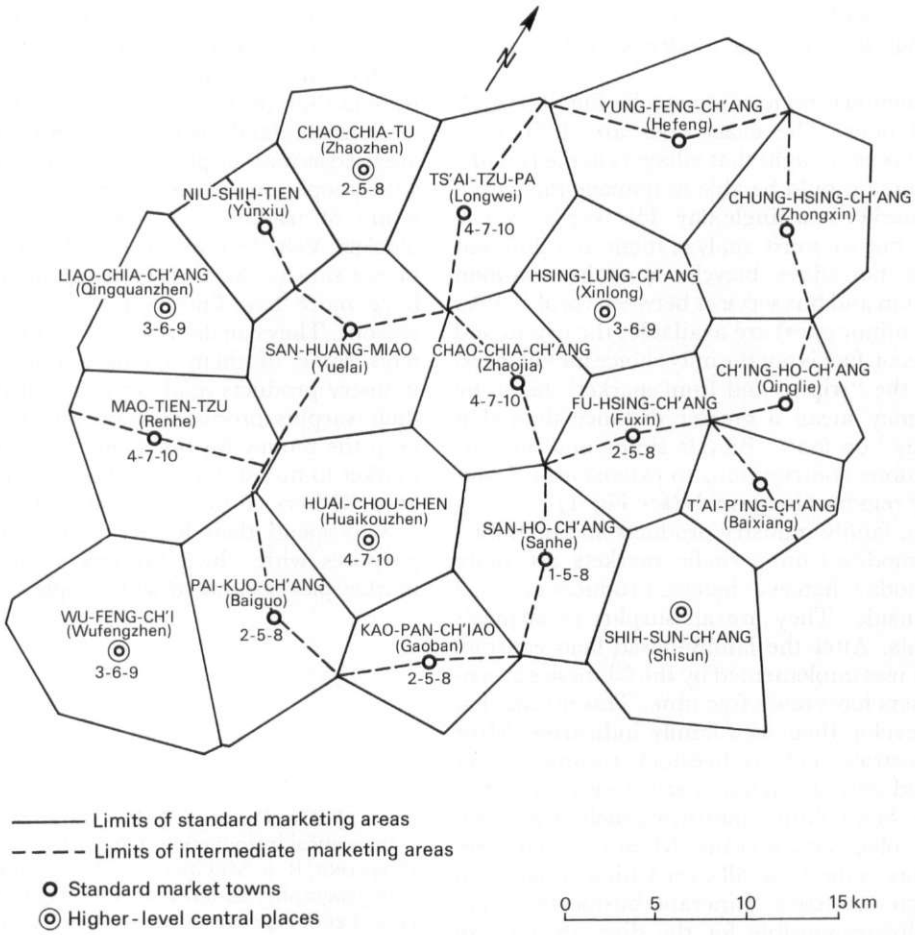

Fig. 2: Distribution of periodic markets in part of Jintang and Zhongjiang counties and in Qingbaijiang district, 1949/50, according to G. W. SKINNER (1964/65)
New spellings and/or new names of geographical places are given in paranthesis
Räumliche Verteilung der periodischen Märkte in Teilen der Kreise Jintang und Zhongjiang und im Qingbaijiang Distrikt im Jahre 1949/50 nach G. W. SKINNER (1964/65)

increases in population for the past 40 years. The boundaries of the complementary regions of its rural centers reflect these above mentioned changes.

Some rural centers such as Yangliu, Hexin and Yanjing, which did not operate as periodic markets in the 1950, now have become periodic markets (compare Fig. 1 with Fig. 2). Meanwhile, the spacing of marketing days as shown in Fig. 1 is shorter than that in Fig. 2 (in fact, it can be observed that in some rural centers marketing on non-marketing days is as prosperous as that on the marketing days). As EDWARD L. ULLMAN noted, periodic markets are excellent examples of a space-time substitution. In other words, markets close together in distance must be spaced in time, and vice versa. Therefore, when trading and commerce in a given area have been increased, the need for more exchange may be met in any number of the following three ways: (1) develop new periodic markets, (2) increase the number of marketing days for the established periodic markets, (3) prolong durations of trading on marketing days. Improvement of economic conditions and increase in population density in the area of study for the past few decades have largely enhanced the total areal purchasing power, this in turn has intensified the demand for trading. To meet this demand, all of the above three ways have been used. First, some new rural centers have become periodic markets. When commercial facilities can no longer be increased spatially, shortening the intervals between marketing days and prolonging durations of trading on marketing days become necessary and important. In fact, trading on marketing days, especially in A-level centers, starts in the early morning and finishes in the late afternoon.

Peak hours of trading are normally from 11 a. m. to 2 p. m., but they have a tendency to be further prolonged.

Complementary regions shown in Fig. 1 are all generalized ones. The exact ones are difficult to delimit. SKINNER thought that villagers at the rim of a marketing area should be able to manage the trip to and from market in a single day. His words are still true today, but we must analyze them in a different way. Since nowadays bicycles are the common transportation and bus services between rural centers (except the minor ones) are available, the trip to and from market on foot is not the only choice for villagers. Therefore, the "trip to and from market" taken by a villager may mean a greater distance than that measured by "on foot". Bicycle riding and bus services have done contributions to extensions of complementary regions along roads (see Fig. 1).

Produces, family industry products and manufactured commodities on periodic markets are more diversified today than ever before. Produces are local or from outside. They are all surplus to farmer's requirements. After the family-based land contraction system was implemented by the Chinese government, farmers have more free time. This means that they can develop their own family industries. Must family industries such as livestock raising, flower planting and various orchards are closely related to agriculture. Some family industries such as bamboo weaving involve certain crafts. Manufactured commodities may come from all over China, some even from foreign countries. Itinerant businessmen are also partially responsible for the diversification of goods on markets. Itinerant pedlars bustling between markets just to attain the survival threshold can no longer be found. Instead, mobile traders today use a number of adjacent markets just in order to profit from the price differentials. For example, a mobile trader may get up very early (probably 3 a. m.) and ride a bicycle or a motorcycle to a market, which may be 50–70 km away from his home, to buy earlier harvested produces (such as cayenne pepper, vegetable) and manufactured goods which are not found in his home market. On the same day or on the following day, these produces and goods will appear at his home market at a higher price. Buyers can also take advantage of these activities because they can eat produces that have not yet been harvested locally and enjoy new manufactured goods.

One can see much more people on markets at present than in the 1950s and the 1960s. In general, sections of inland roads passing through rural centers are used as market-places. They are always congested with people on marketing days, especially in peak hours of trading, and passing vehicles are then blocked. Vehicles have to move through these market-places slowly. As already mentioned, farmers now have more free time, especially in slack farming seasons. They can do whatever they want. On market days some of them go to market to sell family industry products made in their leisure time and/or their surplus produces, then buy needed goods or keep the money for other purposes. Some go to the market to buy needed articles using the money they keep. Others go to market either to meet friends or just to spend their leisure time. These diversified purposes with which farmers go to market make market-places jammed with people.

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