A Hierarchical Regional Space Model for Contemporary China

- ANALYZING THE URBAN HIERARCHY

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Central place analysis is the first step in the construction of the model of Hierarchical Regional Space and is a prerequisite for the subsequent calculation of an elaborate urbanization index (URC) and a regional systems index (RSI). Regional systems theory conceptualizes towns and cities as the nodes of local or regional social and economic systems that are nested in a more or less integrated hierarchy. In our central place analysis of China, we assign all cities and towns to one of eight hierarchical levels; the hinterlands of these central places, in turn, constitute a systems hierarchy culminating in macroregional economies-cum-societies.

Measuring Municipal Centrality

John Marshall's 1989 book *The Structure of Urban Systems* reviews the precepts of Christallerian central place theory and offers operational procedures to apply the theory to real urban systems. An initial step in operationalizing a central place analysis is to develop some measure of the centrality of a settlement. The simplest such measure of a town's importance is the size of its population. This measure can be improved upon by also considering an urban center's role in providing services to external customers. In fact, a key premise of central place theory is that certain services, or central functions, most efficiently serve markets of a certain minimal size and are therefore likely to be found at certain levels in an urban hierarchy. Goods and services available at local cities (but not at lower-order towns) will normally also be available in central places at all higher levels of the hierarchy; thus particular central functions are "incremental" as one moves up the urban hierarchy. Research in Europe and North America has therefore focused on tabulating entries in business and commercial directories to identify central functions provided in each settlement. Using this method, central functions are assigned a certain weight, and a weighted tally of functions is used to measure the centrality of each settlement (Marshall, 1989, 178-184). (In collaboration with the French historian Ted Margadant, Skinner is currently pursuing this course of research in an analysis of 19th century France.)

The approach we have adopted in this study of contemporary China makes use of the ChinaT data file, which includes socioeconomic data for over 450 central cities of designated *shi* (municipalities) from the *Zhongguo chengshi tongji nianjian* (China Urban

Statistics Yearbook, 1991). To represent the services or central functions provided by these cities, we selected eleven diverse but highly intercorrelated variables:

    Total bank loans outstanding at year end
    Number of medical doctors
    Number of health care agencies
    Gross value of tertiary industry
    Output value of the printing industry
    Total commodity sales
    Number of teachers in secondary schools and higher
    Total holdings (volumes) of public libraries
    Annual gross receipts of Posts and Telecommunications
    Output value of the food processing industry
    Total annual freight by land, sea, and air

These components were weighted to construct a standardized index of municipal centrality.

For the remaining towns in the ChinaT file, we relied on the available data on population in various categories reported in the 1990 census. We calculated the approximate non-agricultural urban population to represent the centrality of these smaller settlements.

Delimiting the Hinterlands of Metropolises and Regional Cities

We must recognize from the outset that China is on quite a different scale from a Japan, or Thailand or Iran or France. Throughout the last century it has been more or less ten times as populous as these standard-sized countries, and its internal differentiation has been and is correspondingly sharper. By the beginning of this century, Tokyo, Bangkok,. Teheran, and Paris each served as the central metropolis of a single, integrated urban hierarchy. The same could not and still cannot be said of China. China's urban system as a whole is decentralized, enhancing the salience of its regional systems of cities. Just as France, Germany and Italy each boasts a semi-autonomous, hierarchical system of cities, even though they are interrelated within a more inclusive Western European system, so the Lower Yangzi, Upper Yangzi, Lingnan and the other regional urban systems of China must be recognized as semi-autonomous despite their integration into a national Chinese economy. In the sense that Paris is <u>the</u> metropolis of France, Shanghai is <u>the</u> metropolis of the Lower Yangzi. But at the next level up, no city or pair of cities predominates. China's urban system, like Europe's, is decentralized (Skinner 1999). Thus, in China we find nine apex metropolises, and central place analysis begins by identifying these metropolises and analyzing their dependent city systems separately. As Marshall points

out, "a city's degree of primacy depends on the extent of the area to which the analysis is applied" (p.348). From this insight is derived the top-down method of identifying the appropriate hinterland areas of cities at each level in the urban hierarchy.

It should not be imagined that one can assign central places to level in the hierarchy by listing all the cities and towns in order of absolute centrality index and making cutpoints at breaks in the data. As Marshall reminds us, an ordered listing of either population sizes or centrality index values for cities in large countries produces a continuum of values, with no readily discernable, hierarchical discontinuities. This follows from the fact that absolute levels of centrality vary across systems at the same level. Within any one regional city system the index figures for all dependent greater cities will be distinctly smaller than that of the regional city. But when the index figures for all regional and greater cities are aggregated to the macroregional level (and a fortiori to the national level), the discontinuities of each system are masked.

Differentiation in absolute centrality across systems is theoretically expected. On the usual case, the number of firms or agencies providing a given urban function that is incremental at, say, the central town level, declines as one moves from core to periphery, perahps 5-6 shoe stores or clinics on average in central towns in the inner core as against one in central towns in the far periphery. Theory also predicts an upward shift of certain functions to the next higher level in peripherally situated local systems (Skinner 1977, Appendix). Combining the logic of central place theory and regional systems theory, we hypothesize that the mean centrality of regional cities will decline as one moves from the core to the periphery of a high-order regional system. We find this to be generally the case, at least insofar as city size indexes centrality, as shown for the Lower Yangzi macroregion in Table 2.1. In comparison with regional city systems in the core, those in the periphery tend to be larger in area, smaller in population, and exhibit lower centrality values, not only for the regional cities themselves but also for central places at each lower level of the urban hierarchy (Skinner 1977, 293-96 and Appendix). These systematic differences underline the importance of pursuing the central place analysis from the top down for each regional city system separately.

A central place analysis requires not only a centrality index value for each city and town but also a working map that positions each central place in relation to the transport network and physiographic features. Accordingly, we prepared an array of large sized maps, showing all mapped central places, the transport network, and other physiographic features. The central cities of municipalities were labeled with their respective centrality

Level in the urban hierarchy	1 Inner Core	2	3 Outer Core	4-5 Near Periphery	6-7 Far Periphery
Apex metropolis	7,352,640	-	-	-	-
Central metropolises	-	1,493,320	-	-	-
Regional metropolises	753,210	538,540	430,002	583,070	
Regional cities	-	224,360	204,470	200,710	166,150
Greater cities	89,350	48,360	41,050	39,750	35,240
Local cities	16,360	12,710	8,820	9,420	9,460
Central towns	4,230	3,560	3,200	3,120	2,600

Table 2.1 Mean size of central places by level in the urban hierarchy and by zone in the core-periphery structure, Lower Yangzi macroregion, 1990.

index values, and *zhen* towns were labeled with their non-agricultural urban populations. Roads, railroads, and navigable waterways were depicted according to their relative transportation costs.

Skinner then proceeded with the central place analysis, following, insofar as possible, the procedures advocated by Marshall (1989: 219-260). The first examination determined which cities in the entire country served as metropolises, and roughly delineated which dependent, lower-order cities belonged within each metropolitan system. Subsequent examinations identified regional cities and the dependent central places within each regional city system. Carrying this procedure down to the level of greater cities and so on improved the precision with which lower-order cities could be assigned to systems at the higher levels. As expected from central place theory, certain towns were found to sit "Janus-faced" astride the boundary of two (or three) city systems at the next higher level of the hierarchy. In other cases, we delineated a city system boundary between two towns that appear to be oriented towards different higher-order cities.

Reference to roads, rivers, and other landscape features increased our confidence that the city system boundaries approximate actual economic behavior. Historically, macroregional systems developed within river basins, building up social and economic ties along natural transportation corridors (Skinner 1977, 1994). Thus in many cases we expect that regional systems boundaries should follow the topographical features that

define river basins. However, in delineating system boundaries, we gave precedence to the transport grid. After assigning segments of the transport route to particular regional city systems, the RCS boundaries were drawn on the assumption that the catchment area of roads or navigable rivers in adjacent systems would normally extend to the crest of mountains or hills between them.

The configuration of settlements in relation to the transport network is critical in our delineation of regional system boundaries at the scale of metropolitan and regional city systems. These boundaries should lie along the line that is "most remote" from two regional cores. In terms of the gravity models often used in spatial analysis, this is the line of equal attraction to the competing cities. Since we conceptualize these systems as hierarchically nested, this line does not necessarily fall at an equal surface distance from the cores, or even at an equal cost distance, but reflect the orientation of central places to nodes at the next higher level of the urban hierarchy. We find that this orientation, reinforced by the physical landscape, generally has a high degree of stability through modern history. In certain cases, the configuration of administrative boundaries have apparently prompted local governments to build road and rail spurs across physiographic barriers, effectively incorporating new areas that had been part of neighboring systems. It goes without saying that our regional system boundaries for 1990 reflect these modern changes to the regional landscape. Each of the three wall maps shows the limits of all regional city systems within the respective macroregion.

Assigning Levels in the Urban Hierarchy

To return to Marshall's (1989) procedures, for each city immediately below that of metropolises, we delimit its approximate hinterland. Then, within that dependent territory, we identify a lower tier of central places that in turn serve as nodes for their own hinterlands at the next lower level. In the end, all 12,000 mapped central places were assigned to one or another of eight levels in the urban hierarchy. We call this categorical variable Level in the Urban Hierarchy (LUH). Table 2.2 shows for China Proper (i.e., excluding the Inner Asian regions) the number of central places at each level of the urban hierarchy down to central towns. The table also shows the mean size (non-agricultural population) of cities and towns at each level; it should not be forgotten, however, that, for reasons spelled out above, the range in city size is wide at every level. The column at far right shows the number of regional systems at each level. In theory there will be as many regional city systems as there are regional cities <u>and</u> metropolises on the landscape, for every metropolis also serves as the center of a regional city system.

5

Level in the urban hierarchy	Average size (non-agric. population)	Number of central places	Number of regional systems
Apex metropolises	3,937,700	9	9
Central metropolises	1,277,620	17	26
Regional metropolises	576,990	48	74
Regional cities	175,360	202	278
Greater cities	39,890	1,225	1,501
Local cities	10,480	2,634*	3,535*
Central towns	2,830	3,923*	7,458*

*undercounts, modest for local cities, serious for central towns.

Table 2.2   Number and mean size of central places by level in the urban hierarchy, China Proper only, 1990. [Also: the estimated number of regional systems at each level]

Thus one adds the cumulative number of metropolises (74, also the number of regional metropolitan systems) to the number of regional cities (202) to arrive at the number of regional city systems (278). And so on, up and down the hierarchy.

We take 1500 as a fairly reliable figure for the number of greater city systems in China Proper. However, it is clear that our dataset excludes some local cities and many market towns, the number increasing at each lower level. The reason, of course, is that our dataset for low-order central places is limited to central places that had (by 1990) been officially designated as *zhen*. These designations are based not only on the size of the town's nonagricultural population, and not only on indicators of a town's centrality. Local politics plays a role, and in any case the criteria for according *zhen* status to a town vary from one province to another. Thus, in certain jurisdictions some local cities did not make the cut. Our datafile includes over 4,000 *zhen* towns that we classified as market towns below the central town level, but this number is clearly but a fraction of the true total. The likely order of magnitude is 3,750 central towns (yielding 5,250 central town systems), 13,000 intermediate market towns (yielding 18,400 intermediate marketing systems, and 46,000 standard markets (yielding 65,000 standard marketing systems). Because our map sources systematically exclude such small market towns except in remote regions, we do not pursue this analysis below the level of central towns. (An analysis of periodic marketing in Shandong, which Skinner is pursuing in collaboration

Level in the urban hierarchy	Number of central places	Household size (means)	Sex ratio (means)
Metropolises	7	3.71	110.6
Regional cities	22	3.79	111.7
Greater cities	122	3.87	120.1
Local cities	274	3.98	130.0
Central towns	193	4.45	150.6
Market towns	341	4.64	191.3

Table 2.3   Mean household size and mean sex ratio of central places, by level in the urban hierarchy, Northwest China macroregion, 1990.

with geographer Zhu Hongxing and agricultural economist Scott Rozelle, aims, inter alia, to extend the central place analysis all the way down.

We naturally expect cities and towns to be differentiated according to level in the urban hierarchy. Let me illustrate with two variables included in our ChinaT datafile. In general the sex ratio of central places is inversely related to the regional level of urbanization, relatively balanced in highly urbanized macroregions, relatively male-heavy in regions with low levels of urbanization. In addition, the sex ratio of city populations tends to increase (i.e., become increasingly male) as one moves down the urban hierarchy. This progression happens to be perfectly regular in case of Northwest China, as shown in Table 2.3, but a similar albeit less monotonic trend obtains everywhere. We may also note a tendency for urban household size to increase as one moves down the hierarchy, as also illustrated in Table 2.3. Interestingly enough, analyses now being pursued with ChinaS, the 1% sample data file, suggest that this progression is largely due to differences in offspring set size within conjugal units, rather than to family complexity (i.e., the number of conjugal units in the family).

The LUH variable provided by central place analysis makes possible a detailed, comparative investigation of regional urbanization, which we have not yet pursued. The LUH coding has already been added to the household records in ChinaS, the 1% sample datafile, which move opens up a variety of multivariate research designed to explain variation at the household level in population processes, educational attainment, occupation, and social inequality. The next paper describes how the outcome of our central place analysis, Level in the Urban Hierarchy, is used in conjunction with

residential data to position county-level units along an urban-rural continuum.

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