Is disurbanisation foreseeable in Japan? — a comparison between US and Japanese urbanisation processes[1]

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The 'urban problem' has two primary facets: rapid concentration of population into major urban centres; and population decline in large metropolitan areas. The former problem, urban concentration, accords with our traditional knowledge about the phenomenon of urbanisation and still characterises most developing countries. On the other hand, the problem of metropolitan decline has increasingly attracted the attention of scholars and policy makers whose interests centre around urban issues especially in the industrialised nations.[2]

A new hypothetical framework for understanding the spatial cycles of metropolitan areas and for synthesising the two apparently contrary types of urban change into one comprehensively consistent theoretical paradigm was outlined in the previous chapter[†] and tested empirically with data on the growth and decline of European metropolitan areas. The general concept of a metropolitan area includes a central city and the suburbs, comprising juxtaposed spatial entities, with which it is functionally integrated in economic and social spheres. The spatial cycle hypothesis argues that the life cycle of metropolitan areas recurrently follows four successive metamorphic stages – urbanisation, suburbanisation, disurbanisation, and re-urbanisation – with each composed of two sub-stages depending on the relative balance of population change between central city and suburbs (Table 1). The second type of urban problem alluded to – decline at metropolitan level – corresponds to the disurbanisation stage in the conceptual scheme of spatial cycles.

This paper is reprinted from Spatial Cycles, Van den Berg, L., L.S. Burns and L.H.Klaassen (Eds.), Gower, Aldershort, England, 1987, with a minor revision. The author is associated with the Department of Economics at Gakushuin University. A part of research for this paper was supported by the Gakushuin Uninversity Research Institute of Economnics and Management as well as by the Grant-in-Aid for Scientific Research of the Ministry of Education, Science and Culture.

† Van den Berg, L. and L.H.Klaassen (1987), "The Contagiousness of Urban Decline," Spatial Cycles, Van den Berg, L., L.S.Burns and L.H.Klaassen (Eds.), Gower, Aldershort, England.

Table 1
Spatial cycle hypothesis

Stage	Sub-stage	Population change* Central City (X)	Suburbs (Y)	Relative change	Metropolitan area
Urbanisation	1	+	-	X > Y	+
	2	+	+	X > Y	
Suburbanisation	3	+	+	X < Y	+
	4	-	+	X < Y	
Disurbanisation	5	-	+	X < Y	-
	6	-	-	X < Y	
Reurbanisation	7	-	-	X > Y	-
	8	+	-	X > Y	

*Plus and minus signs indicate population increase and decrease respectively.

Source: Constructed from Klaassen, Bourdrez and Volmuller (1981).

This thus focuses our scientific curiosity about whether the Japanese urban system has entered an era of disurbanisation or, if not, whether it will in the foreseeable future. To search for an answer to this question, a comparative analysis between US and Japanese urbanisation processes will be carried out using the spatial cycle framework and the ROXY index (discussed in a later section). In this analysis, we use population data by Standard Metropolitan Statistical Areas for the USA, and by Functional Urban Cores for Japan. (Functional Urban Core (FUC) is the Japanese equivalent of SMSA; see Kawashima (1972) for the definition of FUC.)

Disurbanisation in the United States

Disurbanisation preceded by population decrease in central cities

In 1981, there were 323 Standard Metropolitan Statistical Areas (SMSAs) in the USA. Table 2 lists the data for 1940–80 population changes in each of the 30 largest SMSAs and their central cities. (No SMSA data are available for the 1940–50 period.)

We see from these data that, for the 30, only Pittsburgh lost population in the 1960s although the decrease amounted only to 0.2 per cent. Population decline spread, however, with the advent of the 1970s. Between 1970 and 1975, New York, the largest SMSA, lost about 400,000 persons, or a decrease of 4.1 per cent. Others losing population during the same five-year period were Cleveland (losing 4.7 per cent), Newark (2.8 per cent), St Louis (1.8 per cent), Seattle–Everett (1.3 per cent), Los Angeles–Long Beach (0.8 per cent), Philadelphia (0.4 per cent), Boston (0.3 per cent), Cincinnati (0.3 per cent), and Detroit (0.2 per cent). With Pittsburgh also losing population (3.3 per cent) during the 1970s, as it did in the 1960s, a total of 11 SMSAs experienced population loss in the first half of the 1970s.

The second half of that decade saw Los Angeles–Long Beach, Seattle–Everett, and Cincinnati regaining population with five-year growth rates of 7.0, 14.2, and 1.4 per cent respectively. The rest of the 11 metropolitan areas, however, continued to lose population. Furthermore, with Nassau–Suffolk and Milwaukee also losing population by 1.9 and 0.9 per cent respectively, a total of 10 SMSAs registered declines during the 1975–80 period.

The data for the entire 1970–80 period show that the population decreased in 9 SMSAs out of the 13 which lost population during either the first half or the second half of the decade, excluding Los Angeles–Long Beach, Seattle–Everett, Cincinnati, and Nassau–Suffolk. This fact together with the additional information provided in Table 7.2 for the earlier 1950–60 and 1960–70 decades demonstrates that a significant reversal of past trends took place during the 1970s. In more concrete terms, the US metropolitan system had reached the fully fledged phase of disurbanisation.

It is important to note that disurbanisation did not surge abruptly on the US urban system without any warning signs. Central city population change served as a key omen of its approach. Table 2 shows that 14 central cities lost population during the 1950s, 15 in the 1960s, and 20 in the 1970s.[3] Thirteen central cities declined continuously during the entire three-decade period, 1950–80, and eight of these were in the SMSAs which disurbanised during the 1970s.[4] In other words, central city loss generally preceded by up to 20 years decline in the SMSAs to which the central cities belonged. This observation agrees reasonably with the spatial cycle hypothesis by implying that population loss in the central cities of large SMSAs predicts the emergence of disurbanisation.

Table 2
Population changes in the US, 1940–80; 30 largest SMSAs and their central cities

SMSA	Rank (1980 SMSA Pop)	Spatial Unit	Population (1,000) 1960	1970	1975	1980	Population Growth Rate % 1960–70	1970–75	1975–80	1970–80	(Reference) PGR % 1940–50	1950–60
New York	1	SMSA	9,540	9,974	9,561	9,120	4.5	-4.1	-4.6	-8.6	–	A
		CC	7,782	7,896	7,482	7,072	1.5	-5.2	-5.5	-10.4	5.9	-1.4
Los Angeles–Long Beach	2	SMSA	6,039	7,042	6,987	7,478	16.6	-0.8	7.0	6.2	–	45.5
		CC	2,479	2,812	2,727	2,967	13.4	-3.0	8.8	5.5	31.0	25.8
Chicago	3	SMSA	6,221	6,977	7,015	7,104	12.2	0.5	1.3	1.8	–	20.1
		CC	3,550	3,369	3,099	3,005	-5.1	-8.0	-3.0	-10.8	6.6	-2.0
Philadelphia	4	SMSA	4,343	4,824	4,807	4,717	11.1	-0.4	-1.9	-2.2	–	18.3
		CC	2,003	1,949	1,816	1,688	-2.7	-6.8	-7.0	-13.4	7.3	-3.3
Detroit	5	SMSA	3,950	4,435	4,424	4,353	12.3	-0.2	-1.6	-1.8	–	A
		CC	1,670	1,514	1,335	1,203	-9.3	-11.8	-9.9	-20.5	14.0	-9.7
San Francisco–Oakland	6	SMSA	2,619	3,109	3,140	3,251	17.4	1.0	3.5	4.6	–	24.0
		CC	740	716	665	679	-3.2	-7.1	2.1	-5.2	20.1	-4.5
Washington	7	SMSA	2,097	2,910	3,022	3,061	38.8	3.8	1.3	5.2	–	A
		CC	764	757	712	638	-0.9	-5.9	-10.4	-15.7	21.0	-4.7
Dallas–Ft Worth	8	SMSA	1,738	2,378	2,527	2,975	36.8	6.3	17.7	25.1	–	A
		CC	680	844	813	904	24.1	-3.7	11.2	7.1	47.1	56.7
Houston	9	SMSA	1,430	1,999	2,286	2,905	39.8	14.4	27.1	45.3	–	A
		CC	939	1,234	1,357	1,595	31.6	10.0	17.5	29.3	54.8	57.4
Boston	10	SMSA	2,688	2,899	2,890	2,763	7.8	-0.3	-4.4	-4.7	–	A
		CC	697	641	637	563	-8.0	-0.6	-11.6	-12.2	3.9	-13.0
Nassau–Suffolk	11	SMSA	1,967	2,556	2,657	2,606	29.9	4.0	-1.9	2.0	–	–
		CC	n.a.	n.a.	n.a.	n.a.	–	–	–	–	–	–
St Louis	12	SMSA	2,144	2,411	2,367	2,356	12.5	-1.8	-0.5	-2.3	–	A
		CC	750	622	525	453	-17.1	-15.6	-13.7	-27.2	5.0	-12.5
Pittsburgh	13	SMSA	2,405	2,401	2,322	2,264	-0.2	-3.3	-2.5	-5.7	–	8.7
		CC	604	520	459	424	-13.9	-11.7	-7.6	-18.5	0.7	-10.8
Baltimore	14	SMSA	1,804	2,071	2,148	2,174	14.8	3.7	1.2	5.0	–	A
		CC	939	905	852	787	-3.6	-5.9	-7.6	-13.0	10.6	-1.2
Minneapolis–St Paul	15	SMSA	1,598	1,965	2,011	2,114	23.0	2.3	5.1	7.6	–	A
		CC	434	434	378	371	-10.1	-12.9	-1.9	-14.5	6.1	-7.5
Atlanta	16	SMSA	1,169	1,596	1,790	2,030	36.5	12.2	13.4	27.2	–	A
		CC	487	495	436	425	1.6	-11.9	-2.5	-14.1	9.6	47.1

Newark	17	SMSA	1,833	2,057	1,999	1,966	12.2	-2.8	-1.7	-4.4	—	A
		CC	405	382	340	329	-5.7	-11.0	-3.2	-13.9	2.1	-7.7
Anaheim–Santa Ana–Garden Grove	18	SMSA	704	1,421	1,700	1,933	101.8	19.6	13.7	36.0	—	225.6
		CC	104	166	194	219	59.6	16.9	12.9	31.9	36.4	593.3
Cleveland	19	SMSA	1,909	2,064	1,967	1,899	8.1	-4.7	-3.5	-8.0	—	A
		CC	876	751	639	574	-14.3	-14.9	-10.2	-23.6	4.2	-4.3
San Diego	20	SMSA	1,033	1,358	1,585	1,862	31.5	16.7	17.5	37.1	—	85.5
		CC	573	697	774	876	21.6	11.0	13.2	25.7	64.5	71.6
Miami	21	SMSA	935	1,268	1,439	1,626	35.6	13.5	13.0	28.2	—	88.9
		CC	292	335	365	347	14.7	9.0	-4.9	3.6	44.8	17.3
Denver–Boulder	22	SMSA	935	1,239	1,413	1,621	32.5	14.0	14.7	30.8	—	A
		CC	494	515	485	492	4.3	-5.8	1.4	-4.5	29.2	18.8
Seattle–Everett	23	SMSA	1,107	1,425	1,407	1,607	28.7	-1.3	14.2	12.8	—	31.1
		CC	557	531	487	494	-4.7	-8.3	1.4	-7.0	27.2	19.0
Tampa–St Petersburg	24	SMSA	809	1,089	1,348	1,569	34.6	23.8	16.4	44.1	—	A
		CC	275	278	280	272	1.1	0.7	-2.9	-2.2	15.7	120.0
Riverside–San Bernadino–Ontario	25	SMSA	810	1,141	1,226	1,558	40.9	7.4	27.1	36.5	—	A
		CC	84	140	151	171	66.7	7.9	13.2	22.1	34.3	78.7
Phoenix	26	SMSA	664	969	1,221	1,509	45.9	26.0	23.6	55.7	—	100.0
		CC	439	582	665	790	32.6	14.3	18.8	35.7	64.6	310.3
Cincinnati	27	SMSA	1,268	1,385	1,381	1,401	9.2	-0.3	1.4	1.2	—	24.0
		CC	503	453	413	385	-9.2	-8.8	-6.8	-15.0	10.5	0.2
Milwaukee	28	SMSA	1,279	1,404	1,409	1,397	9.8	0.4	-0.9	-0.5	—	A
		CC	741	717	666	636	-3.2	-7.1	-4.5	-11.3	8.5	16.3
Kansas City	29	SMSA	1,109	1,274	1,290	1,327	14.9	1.3	2.9	4.2	—	A
		CC	476	507	473	448	6.5	-6.7	-5.3	-11.6	14.5	4.2
San José	30	SMSA	642	1,065	1,174	1,295	65.9	10.2	10.3	21.6	—	A
		CC	204	460	556	629	125.5	20.9	13.1	36.7	39.7	214.7
Total		SMSA	66,819	78,706	80,513	83,841	17.8	2.3	4.1	6.5		
		CC*	30,589	31,222	29,781	29,436	2.1	-4.6	-1.2	-5.7		
Average (weighted)		SMSA	2,227	2,524	2,684	2,795	17.8	2.3	4.1	6.5		
		CC*	1,055	1,077	1,027	1,015	2.1	-4.6	-1.2	-5.7		
Average (simple)		SMSA	—	—	—	—	26.2	5.4	7.0	13.3		
		CC*	—	—	—	—	10.1	-2.8	-0.2	-2.3		
United States			179,323	203,302	215,465	226,546	13.37	5.98	5.14	11.4		

*Excluding the city of Nassau.

Sources: US Bureau of the Census (1965, pp. 17–20; 1966, pp. 17–21; 1972, pp. 21–3; 1977, pp. 19–24; 1980, pp. 12, 21–6; 1981, pp. 18–23).

Largest SMSAs grouped into three categories

We should not, at the same time, fail to notice that several large SMSAs gained population in the 1970s at a pace exceeding the average growth rate of national population, and their central cities followed suit. The Pheonix SMSA, which increased its population by over 50 per cent between 1970 and 1980, was a leading example. Other SMSAs that enjoyed relative growth were Houston, San Diego, Riverside–San Bernardino–Ontario, Anaheim–Santa Ana–Garden Grove, and San José.

A categorisation matrix provides a systematic overview of the current US situation involving both rapidly growing metropolitan areas, as well as the cases of disurbanisation already discussed. Table 3 shows various stages of urban change classified according to the population growth rates of central cities and metropolitan areas, instead of the absolute values of population change in central city and suburbs as adopted in the original spatial cycle scheme (Table 1).

Table 3
Categorisation matrix for large metropolitan areas

			Population growth rate of central city		
			Negative	Positive: Below national average	Positive: Above national average
Population growth rate of SMSA or FUC	Positive	Above national average	C	B	A
	Positive	Below national average	F	E	D
	Negative		G	H	I

Note: FUC = Functional Urban Core

In this matrix, the population growth rates of central city and metropolitan area are both divided into three classes. The first class consists of areas with growth rates exceeding the national average; the second includes those with rates below the national average but above zero; and the third is for rates below zero. The classification yields nine cells running from A through I, each of which corresponds to at least one sub-stage of the spatial cycle scheme shown in Table 1. Nevertheless, this correspondence is somewhat confusing due to the fact that the growth rate is applied in Table 3 as a measurement for population changes while in Table 1 the absolute value of population change is applied for the same purpose. To make the relationships between cells and sub-stages more straightforward, we now slightly modify the conceptual framework of the spatial cycle hypothesis, but without losing its essence. We will alter the scheme described in Table 1, and designated as type-α scheme in Figure 1(a), to the scheme designated type-β in Figure 1(b) where the horizontal and vertical axes represent the growth rates of central city and metropolitan area respectively. (The type-γ scheme is discussed later.) Figures 2(a) through 2(c) demonstrate the resultant relationships between nine cells of the categorisation matrix and eight sub-stages of the spatial cycle scheme of type-β.

Suppose for the sake of convenience that the SMSAs falling in cell A, B, or C of the categorisation matrix are called 'actively growing SMSAs'; those in D, E, or F, 'quasi-growing SMSAs' (in the sense that population continues to grow but the growth rate is below the national average); and those in G, H, or I, 'degenerating SMSAs'. This classification roughly identifies trends in metropolitan growth or decline on the basis of the apparent changes of the SMSA populations. We can then classify the 30 largest SMSAs according to the average annual growth rates of population for 1975–80 into the three categories reported in Table 4 by assuming that central city boundaries remained unchanged during the five-year growth period. (Notice that in Table 2 the central city boundaries are variable over time.)

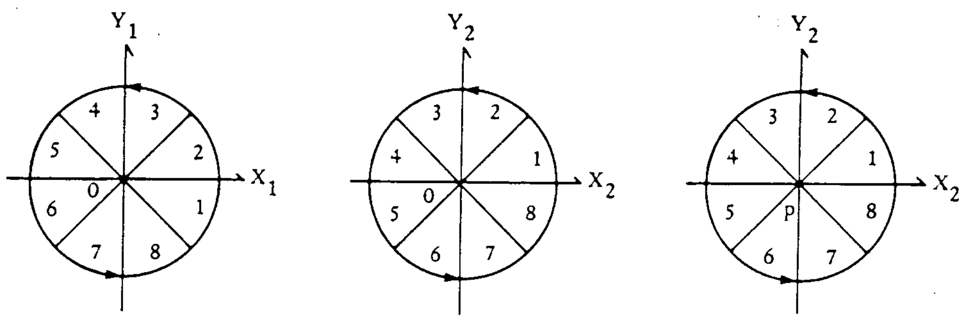
According to Table 4, 13 SMSAs grew at rates above the national average between 1975 and 1980. Eight of these belonged to Group A, two to Group B, and three to Group C. In light of the directional movement of spatial cycle flows depicted in Figure 2(c), the eight SMSAs in Group A (Houston, Riverside–San Bernardino–Ontario, Phoenix, Dallas–Ft Worth, San Diego, Anaheim–Santa Ana–Garden Grove, San Jose, and Los Angeles–Long Beach) are farthest from the disurbanisation stage in which the degenerating SMSAs in Group G are situated. Among the 13 actively growing SMSAs the three falling into Group C (Tampa–St Petersburg, Atlanta, and Miami) are closest to the disurbanisation stage.

As for quasi-growing SMSAs, we have zero, one, and six examples in Groups D, E, and F, respectively. As Figures 2(a) through 2(c) suggest, we cannot be quite sure to which cell – B of the second sub-stage or F of the third sub-stage – the San Francisco SMSA, in Group E at the second sub-stage, will most probably proceed in the next move. On the other hand, some of the five SMSAs belonging to Group F at the fourth sub-stage (Kansas City, Cincinnati, Washington D.C., Chicago, and Baltimore) are likely to disurbanise in the near future.

The 10 degenerating SMSAs (St Louis, Milwaukee, Detroit, Newark, Philadelphia, Nassau–Suffolk, Pittsburgh, Cleveland, Boston, and New York) all belong to Group G at the fifth sub-stage. There are no generating metropolitan areas in either Groups H or I. But the New York SMSA, which is closest to the sixth sub-stage,[5] seems to be taking the lead in approaching the reurbanisation stage among the 30 largest SMSAs. When New York will actually reurbanise, however, is perhaps a debatable question.

Characteristics of recent spatial changes

Drawing together the information provided in Tables 2 and 4, and accepting the basic concept of the spatial cycle hypothesis, the major



(a) Type-α scheme (b) Type-β scheme (c) Type-γ scheme

Notes

X_1 – population change in central city

Y_1 – population change in suburbs

X_2 – population growth rate of central city

Y_2 – population growth rate of metropolitan area

z – average growth rate of national total population

Coordinates of point P: (z,z)

Number in each fan-shaped segment: sub-stage number

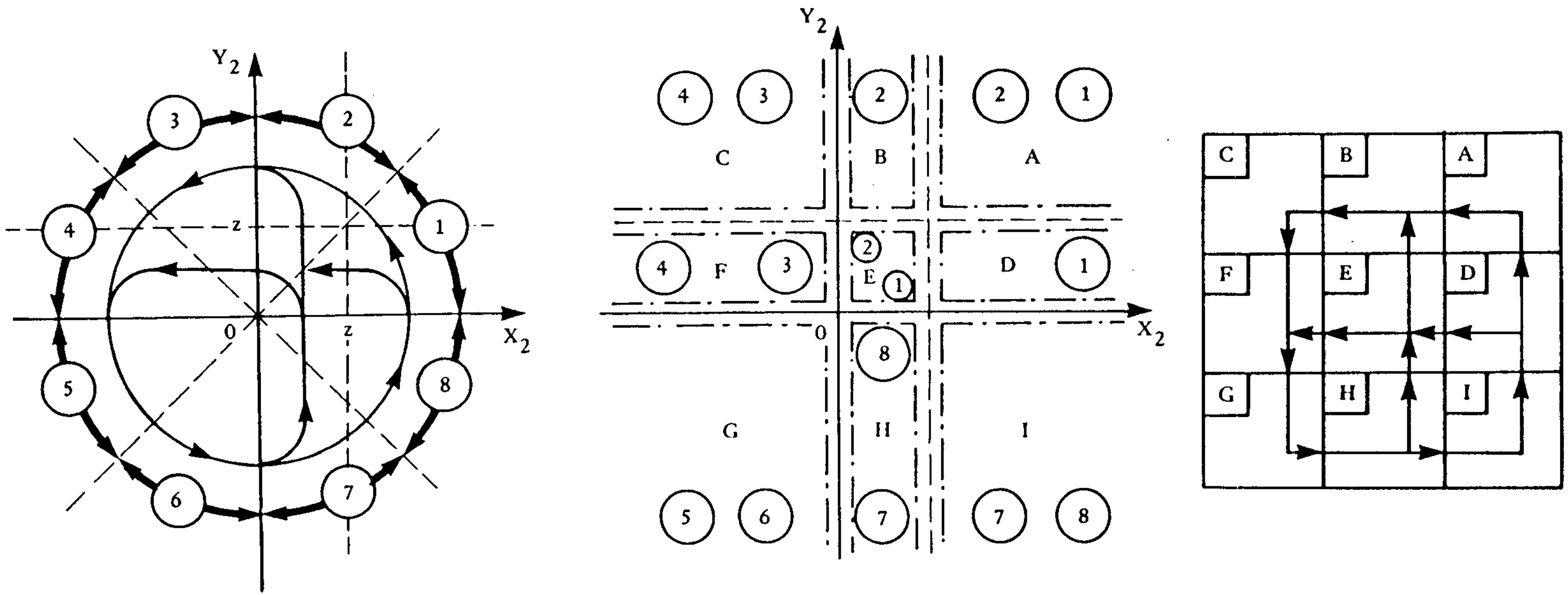
Urbanisation stage – sub-stages 1 and 2

Suburbanisation stage – sub-stages 3 and 4

Disurbanisation stage – sub-stages 5 and 6

Reurbanisation stage – sub-stages 7 and 8

Figure 1 Three types of spatial cycle schemes



(a) Sub-stages and main spatial cycles

(b) Cells and sub-stages

(c) Cells and main spatial cycles

Notes 1 Circled number indicates the sub-stage number
2 X_2-population growth rate of central city
Y_2-population growth rate of metropolitan area
z – average growth rate of national total population

Figure 2 Main spatial cycles of type-β scheme, its sub-stages and relationships between sub-stages and cells of categorisation matrix

Table 4
Three categories and nine groups of US SMSAs

SMSA	Annual PGR 1975–80 (%)		Sub-stage of spatial cycles	Annual PGR of SMSA (%)		Region
	SMSA	Central city		1960–70	1970–75	
Category 1						
Actively growing SMSAs						
Group A						
Houston	4.91	3.28	2	3.41	2.72	South
Riverside–San Bernardino–Ontario	4.91	2.52	2	3.49	1.45	West
Phoenix	4.33	3.50	2	3.85	4.73	West
Dallas–Ft Worth	3.32	2.14	2	3.18	1.22	South
San Diego	3.27	2.51	2	2.77	3.14	West
Anaheim–Santa Ana–Garden Grove	2.60	2.45	2	7.28	3.65	West
San Jose	1.98	2.50	1	5.19	1.97	West
Los Angeles–Long Beach	1.37	1.70	1	1.55	-0.16	West
Group B						
Denver–Boulder	2.78	0.29	2	2.86	2.66	West
Seattle–Everett	2.69	0.29	2	2.56	-0.25	West
Group C						
Tampa–St Petersburg	3.08	-0.57	3	3.02	4.36	South
Atlanta	2.55	-0.51	3	3.16	2.32	South
Miami	2.47	-1.01	3	3.09	2.56	South
Category 2						
Quasi-growing SMSAs						
Group D – null						
Group E						
San Francisco–Oakland	0.70	0.42	2	1.61	0.20	West
Group F						
Minneapolis–St Paul	1.00	-0.37	3	2.09	0.46	N.C.
Kansas City	0.57	-1.08	4	1.40	0.25	N.C.
Cincinnati	0.29	-1.39	4	0.89	-0.06	N.C.

Washington	0.26	-2.17	4	3.33	0.76	South
Chicago	0.25	-0.61	4	1.15	0.11	N.C.
Baltimore	0.24	-1.57	4	1.39	0.73	South
Category 3						
Degenerating SMSAs						
Group G						
St Louis	-0.09	-2.92	5	1.18	-0.37	N.C.
Milwaukee	-0.17	-0.92	5	0.94	0.07	N.C.
Detroit	-0.32	-2.06	5	1.16	-0.05	N.C.
Newark	-0.33	-0.66	5	1.16	-0.57	N.E.
Philadelphia	-0.38	-1.45	5	1.06	-0.07	N.E.
Nassau–Suffolk	-0.39	–	–	2.65	0.78	N.E.
Pittsburgh	-0.50	-1.57	5	-0.02	-0.67	N.E.
Cleveland	-0.70	-2.12	5	0.78	-0.96	N.C.
Boston	-0.89	-2.44	5	0.76	-0.06	N.E.
New York	-0.94	-1.12	5	0.45	-0.84	N.E.
Group H – null						
Group I – null						

Notes:

1 Sub-stages of spatial cycles are those appearing in type-β spatial cycle scheme described in Figure 1.
2 Groups A through I respectively correspond to cells A through I in Table 3.
3 PGR–Population Growth Rate; N.E. – Northeast; N.C. – North central.

features of the recent and possible future population changes in the 30 largest US SMSAs thus appear to be the following:

- The polarisation between metropolitan population growth and decline significantly widened as the urban system reached the full fledged phase of disurbanisation in the 1970s.
- With three pre-disurbanisation SMSAs[6] in Group C at the third sub-stage and six in Group F at the third and fourth sub-stages, the magnitude of the overall disurbanisation in the entire urban system will be continuously increased.
- All of the 13 actively growing SMSAs were located in either the South or the West, while the 10 degenerating SMSAs were in either the Northeast or the North Central regions. Moreover, all 9 pre-disurbanisation SMSAs were situated in either the North Central or the eastern part of the South. These facts indicate that the wave of population decline is permeating the South from the Northeast and the North Central regions along the South Atlantic area. Viewed more broadly, the population upsurge is sweeping from the combined Northeast–North Central region to the combined South-West regions, and travelling westward within the latter.[7]
- In terms of scale, eight out of the 10 SMSAs at the disurbanisation stage in the second half of the 1970s ranked among the nation's 20 largest metropolitan areas. If we add the five pre-disurbanisation SMSAs in Group F of the fourth sub-stage to the 10 degenerating SMSAs, then 10 of those 15 turn up among the largest. This provides persuasive evidence indeed that disurbanisation is currently concentrated in large SMSAs.

In short, the most salient characteristics of the pattern of population change revealed from our study of the 30 largest SMSAs are: the striking contrast between the population decline in the Northeast and the North Central and the population upsurge in the South and the West, with the artificial interpretation that the eastern portion of the South is considered as an extension of the combined Northeast–North Central region; and the intensive potential momentum of disurbanisation bursting into the largest metropolitan areas among those studied.

Relative disurbanisation in Japan

FUCs approaching decline, and rapidly growing FUCs

Population data for Japan's 86 Functional Urban Cores (FUCs), and for the central cities of the 30 largest, are shown by five-year intervals from 1960 to 1980 in Table 5. These tabulations are the basis for the population growth rates of the 30 largest FUCs and their central cities displayed in Table 6.

The data show that Tokyo's central city began to lose population as early as 1965–70. The rate of loss, 0.6 per cent for the five-year period, accelerated in each of the following intervals. The rates increased to 2.2 per cent and 3.4 per cent, respectively, during 1970–75 and 1975–80. In the meantime, although the population of the FUC rose by 57.2 per cent between 1960 and 1980, the five-year rates of growth dropped from 18.3 per cent in 1960–65 to 5.5 per cent in 1975–80.

The experience of Osaka, Japan's second largest FUC, ran roughly in parallel. Decline also began in the 1965–70 period with a 5.6 per cent drop in the central city's population followed by successive declines of 6.8 per cent in 1970–75 and 4.7 per cent in 1975–80. Although the FUC increased in population by 56 per cent between 1960 and 1980, its five-year growth rate dropped steadily from 21.1 per cent during 1960–65 to only 3.1 per cent in 1975–80.

In addition, the central city of Nagasaki started losing population (0.7 per cent) in the 1975–80 period while the growth rate of the FUC began to drop. Also, Kitakyushu FUC experienced net population loss in the 1960s, largely as the result of a decreasing suburban population. Accordingly, the central cities of three large FUCs (Tokyo, Osaka, and Nagasaki) lost population between 1975 and 1980.

Turning from the three FUCs approaching decline to those experiencing rapid population growth during 1975–80, we find that, of the 30 largest, Chiba grew most rapidly (13.6 per cent), followed in order by Toyota (with a five-year growth rate of 12.2 per cent for 1975–80), Sapporo (12.0 per cent), Fukuoka (11.5 per cent), and Kagoshima (10.2 per cent). Except for Fukuoka FUC, the population of their central cities also increased by upwards of 10 per cent in the same period.

Large FUCs grouped into three categories

From the data in Table 6 we can construct Table 7 to classify – in the same manner as we did in Table 4 for the 30 largest US

Table 5
Population of Functional Urban Cores, Japan (FUCs), 1960–1980

FUC and CC	Rank (1980 FUC population)	Population					Nr of localities
		1960	1965	1970	1975	1980	
Sapporo	7	887,535	1,101,329	1,310,693	1,558,739	1,745,345	5
CC	–	615,628	821,217	1,010,123	1,240,617	1,401,758	–
Hakodate	50	322,970	331,804	343,406	362,637	380,514	5
Asahikawa	55	239,636	271,930	297,189	320,526	352,620	1
Muroran	71	201,221	227,200	238,137	242,941	241,428	3
Kushiro	70	178,731	198,984	214,922	231,403	242,331	3
Obihiro	73	159,846	175,329	189,643	203,004	221,662	4
Aomori	61	253,952	264,921	279,294	303,055	327,298	3
Hirosaki	67	232,842	229,993	231,520	237,813	248,963	6
Hachinohe	62	253,474	264,767	281,838	297,473	312,343	7
Morioka	48	286,736	301,530	318,532	348,174	382,814	8
Sendai	10	860,509	922,607	1,019,991	1,160,920	1,271,318	21
CC	–	425,272	480,925	545,065	615,473	664,799	–
Ishinomaki	76	188,427	187,376	191,066	197,905	204,465	6
Akita	42	401,513	404,280	415,990	438,920	466,697	13
Yamagata	45	383,092	382,153	391,335	409,933	435,632	7
Fukushima	51	319,768	325,801	338,403	358,500	376,944	8
Aizuwakamatsu	82	175,162	171,115	167,605	168,710	174,616	6
Kouriyama	49	309,223	316,187	332,688	356,581	381,819	4
Mito	31	411,235	430,161	462,343	509,530	550,432	12
Hitachi	53	318,134	331,419	335,157	348,301	360,799	6
Utsunomiya	21	564,682	583,921	625,795	697,120	752,827	14
CC	–	239,007	265,696	301,231	344,417	377,748	–
Maebashi	54	279,557	297,136	318,747	341,323	360,252	6
Takasaki	43	353,262	368,552	391,387	424,747	451,370	10
Kiryu	80	159,393	164,427	171,730	179,798	183,934	4
Chiba	12	540,852	642,330	838,299	1,077;675	1,224,611	9
CC	–	258,357	339,850	482,133	659,344	746,428	–
Tokyo	1	13,388,959	15,844,973	18,005,894	19,955,814	21,049,507	121
CC	–	8,310,027	8,893,094	8,840,942	8,642,800	8,349,209	–
Yokohama	4	2,272,380	2,901,289	3,603,704	4,258,008	4,592,642	15
CC	–	1,375,510	1,788,915	2,238,264	2,621,648	2,773,822	–

Odawara	63	233,572	263,399	283,736	302,690	311,927	9
Niigata	18	657,650	684,250	713,690	762,831	815,390	14
CC	–	325,018	356,302	383,919	423,204	457,783	–
Nagaoka	69	212,790	218,177	224,121	233,008	242,976	4
Toyama	32	477,794	480,192	493,522	522,486	547,056	11
Takaoka	47	367,534	363,314	364,085	376,284	384,157	8
Kanazawa	24	482,871	507,897	540,268	600,819	647,139	13
CC	–	313,112	335,828	361,379	395,262	417,681	–
Fukui	33	485,114	493,737	499,568	526,470	546,360	15
Koufu	44	382,963	385,021	398,003	421,891	443,777	16
Nagano	40	404,489	413,282	429,191	460,582	484,568	11
Matsumoto	57	288,435	293,499	306,225	326,626	346,645	10
Gifu	13	805,117	886,222	959,945	1,043,477	1,103,051	23
CC	–	312,597	358,259	385,727	408,699	410,368	–
Shizuoka	14	793,848	860,971	927,563	993,432	1,031,374	8
CC	–	350,897	382,799	416,378	446,952	458,342	–
Hamamatsu	15	743,710	779,062	827,403	891,775	945,941	17
CC	–	357,098	392,632	432,221	468,886	490,827	–
Numazu	37	330,878	374,868	421,513	468,590	495,140	7
Fuji	58	244,499	265,534	294,619	326,039	340,703	4
Nagoya	3	3,642,667	4,201,059	4,714,576	5,180,943	5,430,025	64
CC	–	1,697,093	1,935,430	2,036,053	2,079,694	2,087,884	–
Toyohashi	30	403,935	439,617	473,409	520,769	554,283	8
CC	–	215,515	238,672	258,547	284,597	304,274	–
Toyota	29	311,142	364,410	445,073	525,850	590,135	5
CC	–	104,529	136,728	197,193	248,774	281,609	–
Tsu	52	310,101	317,047	329,540	351,405	367,414	10
Ise	79	174,001	177,547	178,606	183,663	186,481	7
Otsu	38	302,222	322,270	356,159	424,452	488,437	8
Kyoto	5	1,511,077	1,644,808	1,809,412	1,984,788	2,085,076	15
CC	–	1,284,818	1,365,007	1,419,165	1,461,050	1,472,993	–
Osaka	2	6,855,068	8,298,236	9,521,577	10,374,705	10,694,672	68
CC	–	3,011,563	3,156,222	2,980,487	2,778,975	2,648,158	–
Kobe	6	1,441,703	1,588,300	1,740,999	1,908,784	1,988,253	8
CC	–	1,113,977	1,216,640	1,288,937	1,360,530	1,367,392	–
Himeji	16	682,238	732,534	782,646	838,691	871,119	18
CC	–	334,520	373,653	408,353	436,099	446,255	–
Nara	46	209,160	238,931	289,195	352,723	404,259	5
Wakayama	28	491,841	534,381	572,343	601,362	617,128	11
CC	–	285,155	328,657	365,267	389,677	401,462	–
Tottori	75	204,752	200,044	199,035	204,715	213,535	11

FUC and CC	Rank (1980 FUC population)	Population					Nr of localities
		1960	1965	1970	1975	1980	
Yonago	74	189,769	189,817	192,831	203,758	216,709	10
Matsue	68	226,178	224,096	227,877	236,758	248,093	9
Okayama	20	583,686	605,213	647,614	719,828	765,680	15
CC*	–	306,757	338,693	375,106	513,452	545,737	–
Kurashiki	36	337,115	355,369	418,465	480,215	497,686	9
Hiroshima	11	732,365	861,374	994,560	1,166,010	1,258,864	12
CC*	–	431,336	504,245	541,998	852,607	899,394	–
Kure	60	321,224	329,580	335,273	342,540	337,427	10
Fukuyama	26	475,869	491,050	544,938	604,910	622,780	7
CC*	–	183,682	204,768	255,086	329,779	346,031	–
Shimonoseki	59	331,874	332,023	328,801	336,848	340,391	5
Ube	72	242,216	220,085	211,317	221,869	229,752	4
Yamaguchi	85	136,097	130,218	130,685	135,517	145,066	3
Iwakuni	81	168,067	175,221	174,427	181,402	182,936	5
Tokushima	35	447,679	449,893	458,535	484,487	510,425	13
Takamatsu	22	594,749	595,973	617,272	667,985	705,740	21
CC	–	243,538	257,716	274,367	298,997	316,662	–
Matsuyama	34	389,653	413,531	445,917	499,017	542,284	8
Imabari	78	176,467	176,809	181,583	192,296	197,397	7
Nyhama	77	197,286	194,550	193,238	200,679	203,468	3
Kochi	41	367,439	383,774	405,169	443,577	470,870	9
Kitakyushu	9	1,518,451	1,515,708	1,501,563	1,554,303	1,604,577	19
CC	–	986,401	1,042,388	1,042,321	1,058,067	1,065,084	–
Fukuoka	8	1,089,452	1,197,739	1,348,113	1,565,142	1,744,420	24
CC*	–	661,395	749,808	853,270	1,002,214	1,088,617	–
Omuta	65	345,890	325,751	297,188	290,578	290,772	6
Kurume	39	462,451	452,729	456,193	466,017	487,704	15
Saga	64	295,715	286,643	283,571	289,675	304,956	11
Nagasaki	27	506,565	523,700	545,435	592,092	617,302	8
CC*	–	380,983	405,479	421,114	450,195	447,091	–
Sasebo	66	297,099	273,533	272,294	275,668	277,479	3
Kumamoto	19	625,931	643,565	671,565	718,481	783,397	16
CC*	–	373,922	407,052	440,020	488,053	525,613	–
Yatsushiro	86	152,094	145,623	140,809	140,019	143,279	4
Oita	25	474,068	491,972	520,798	587,009	630,798	10
CC	–	207,151	226,417	260,584	320,236	360,484	–

Miyazaki	56	247,866	257,218	274,925	310,210	349,620	6
Miyakonojyo	84	148,052	143,481	138,538	142,667	155,712	3
Nobeoka	83	148,223	147,559	151,337	157,639	161,216	3
Kagoshima	23	490,734	515,900	543,018	601,595	663,069	11
CC	–	334,643	371,129	403,340	456,818	505,077	–
Naha	17	555,764	619,847	666,131	767,619	828,563	21
CC	–	223,047	257,177	276,380	295,091	295,801	–
All FUCs	–	60,670,350	67,639,667	74,731,360	82,275,810	86,988,636	1,024

Notes:

1 Figures for population as on 1 October.
2 FUC boundaries are as in 1970 and fixed over time.
3 CC stands for central city. The population of the central city is given for the 30 largest FUCs. The boundaries of central cities are as of 1980 and fixed over time. For central cities with *, population in 1960, 1965 and 1970 is given for the 1970 boundary of that city, and population in 1975 and 1980 is given for the 1980 boundary of that city.
4 Eighty-six FUCs cover 8,596,511 ha which is 23 per cent of the national territory. The total population residing in FUCs as a fraction of the national total population was 74.31 per cent in 1980.
5 The number of localities composing each FUC is as in October 1970.
6 Total population of the 30 largest FUCs was 44,985,418 (1960), 51,580,237 (1965), 58,034,287 (1970), 64,481,476 (1975), and 68,235,026 (1980).

Table 6
Population growth rates of the 30 largest Functional Urban Cores (FUCs) and their central cities (1960–1980)

FUC	Rank (1980 FUC population)	Spatial unit	Population growth rate 1960–65	1965–70	1970–75	1975–80	1975–80 (annual)	Rank among 30 FUCs 1975–80 PGR	1980 Pop.
Tokyo	1	FUC	18.3	13.6	10.8	5.5	1.07	5	1
		CC	7.0	-0.6	-2.2	-3.4	-0.69	–	–
Osaka	2	FUC	21.1	14.7	9.0	3.1	0.61	3	2
		CC	4.8	-5.6	-6.8	-4.7	-0.96	–	–
Nagoya	3	FUC	15.3	12.2	9.9	4.8	0.94	8	3
		CC	14.0	5.2	2.1	0.4	0.08	–	–
Yokohama	4	FUC	27.7	24.2	18.2	7.9	1.52	1	4
		CC	30.1	25.1	17.1	5.8	1.13	–	–
Kyoto	5	FUC	8.9	10.0	9.7	5.1	0.99	13	5
		CC	6.2	4.0	3.0	0.8	0.16	–	–
Kobe	6	FUC	10.2	9.6	9.6	4.2	0.82	10	6
		CC	9.2	5.9	5.6	0.5	0.10	–	–
Sapporo	7	FUC	24.1	19.0	18.9	12.0	2.29	2	8
		CC	33.4	23.0	22.8	13.0	2.47	–	–
Fukuoka	8	FUC	9.9	12.6	16.1	11.5	2.19	12	7
		CC*	13.4	13.8	17.5	8.6	1.67	–	–
Kitakyushu	9	FUC	-0.2	-0.9	3.5	3.2	0.64	30	9
		CC	5.7	0.0	1.5	0.7	0.13	–	–
Sendai	10	FUC	7.2	10.6	13.8	9.5	1.83	18	11
		CC	13.1	13.3	12.9	8.0	1.55	–	–
Hiroshima	11	FUC	17.6	15.5	17.2	8.0	1.54	6	10
		CC*	16.9	7.5	57.3	5.5	1.07	–	–
Chiba	12	FUC	18.8	30.5	28.6	13.6	2.59	4	12
		CC	31.5	41.9	36.8	13.2	2.51	–	–
Gifu	13	FUC	10.1	8.3	8.7	5.7	1.12	11	13
		CC	14.6	7.7	6.0	0.4	0.08	–	–
Shizuoka	14	FUC	8.5	7.7	7.1	3.8	0.75	16	14
		CC	9.1	8.8	7.3	2.5	0.50	–	–
Hamamatsu	15	FUC	4.8	6.2	7.8	6.1	1.19	21	15
		CC	10.0	10.1	8.5	4.7	0.92	–	–
Himeji	16	FUC	7.4	6.8	7.2	3.9	0.76	17	16
		CC	11.7	9.3	6.8	2.3	0.46	–	–

Naha	17	FUC	11.5	7.5	15.2	7.9	1.54	9	17
		CC	15.3	7.5	6.8	0.2	0.05	—	—
Niigata	18	FUC	4.0	4.3	6.9	6.9	1.34	22	18
		CC	9.6	7.8	10.2	8.2	1.58	—	—
Kumamoto	19	FUC	2.8	4.4	7.0	9.0	1.75	28	19
		CC*	8.9	8.1	10.9	7.7	1.49	—	—
Okayama	20	FUC	3.7	7.0	11.2	6.4	1.24	24	20
		CC	10.4	10.8	36.9	6.3	1.23	—	—
Utsunomiya	21	FUC	3.4	7.2	11.4	8.0	1.55	25	21
		CC	11.2	13.4	14.3	9.7	1.86	—	—
Takamatsu	22	FUC	0.2	3.6	8.2	5.7	1.11	29	22
		CC	5.8	6.5	9.0	5.9	1.15	—	—
Kagoshima	23	FUC	5.1	5.3	10.8	10.2	1.96	20	24
		CC	10.9	8.7	13.3	10.6	2.02	—	—
Kanazawa	24	FUC	5.2	6.4	11.2	7.7	1.50	19	26
		CC	7.3	7.6	9.4	5.7	1.11	—	—
Oita	25	FUC	3.8	5.9	12.7	7.5	1.45	23	28
		CC	9.3	15.1	22.9	12.6	2.40	—	—
Fukuyama	26	FUC	3.2	11.0	11.0	3.0	0.58	27	23
		CC*	11.5	24.6	29.3	4.9	0.97	—	—
Nagasaki	27	FUC	3.4	4.2	8.6	4.3	0.84	26	27
		CC*	6.4	3.9	6.9	-0.7	-0.14	—	—
Wakayama	28	FUC	8.6	7.1	5.1	2.6	0.52	15	25
		CC	15.3	11.1	6.7	3.0	0.60	—	—
Toyota	29	FUC	17.1	22.1	18.1	12.2	2.33	7	29
		CC	30.8	44.2	26.2	13.2	2.51	—	—
Toyohashi	30	FUC	8.8	7.7	10.0	6.4	1.26	14	30
		CC	10.7	8.3	10.1	6.9	1.35	—	—
Average (weighted)		FUC	14.7	12.5	11.1	5.8	1.14		
		CC**	10.5	5.1	4.2	1.3	1.26		
Average (simple)		FUC	9.7	10.1	11.4	6.8	1.33		
		CC**	13.6	11.6	10.4	5.0	0.98		
Japan			5.2	5.5	7.0	4.6	0.90		

Notes:

1 CC stands for central city.
2 See note 3 of Table 5 for the central cities with *.
3 **excluding Fukuoka, Hiroshima, Kumamoto, Okayama, Fukuyama and Nagasaki cities.

SMSAs – the 30 largest FUCs, including both decline-approaching and rapidly growing FUCs, into nine groups (A through I) based on average annual population growth rates for the 1975–80 period.

Twenty-two FUCs grew faster than the national average. Seventeen of them (Chiba, Toyota, Sapporo, Fukuoka, Kagoshima, Sendai, Kumamoto, Utsunomiya, Hiroshima, Yokohama, Kanazawa, Oita, Niigata, Toyohashi, Okayama, Hamamatsu, and Takamatsu) belonged in Group D, and hence they were farthest from the disurbanisation stage. Tokyo, the single FUC in Group C, was at the third sub-stage of the spatial cycle scheme and, of the 22 actively growing FUCs, the one situated most closely to the disurbanisation stage.

Regarding the quasi-growing FUCs, Fukuyama was the only one belonging in Group D at the first sub-stage. For Group E, we have Wakayama where the population growth rate has continuously dropped since 1960 and, although the FUC was situated at the first sub-stage, its population between 1975 and 1980 grew the slowest of the 30 largest FUCs. Group E also included four FUCs at the second sub-stage (Kobe, Himeji, Shizuoka, and Kitakyushu). The population growth rate for two of them (Kobe and Shizuoka) has declined continuously since 1960. Group F consisted of only two FUCs, Nagasaki at the third sub-stage and Osaka at the fourth sub-stage.

The absence of any cases of degenerating FUCs in either Group G, H, or I clearly indicates that the Japanese urban system had not reached the disurbanisation phase by 1980. This implies, nonetheless, that there exists in the Japanese urban system a sub-surface momentum approaching the early phase of disurbanisation. This point is reinforced by the fact that the very biggest of the 30 largest FUCs, such as Tokyo, Osaka, and Nagoya, have experienced continuously declining growth rates. Among them, Osaka FUC appears to be closer to the disurbanisation stage than any of the others, and a near second would be Tokyo FUC.

Meanwhile, Wakayama FUC seems to be situated in a peculiar position of the spatial cycle if we adopt the type-γ scheme described in Figure 1(c). In that scheme, development occurs as a counter-clockwise rotation around the centre point P whose coordinates are (z, z) where z expresses the average growth rate of total national population. Wakayama emerges from this scheme as the single large FUC to have already arrived at the sixth sub-stage by 1980. The scheme also shows that other FUCs among the 30 largest were at sub-stages lower than the sixth. For example, Osaka, Nagasaki, and Shizuoka were at the fifth sub-stage, and Tokyo and Nagoya were at the fourth. The reason why I touch on the type-γ scheme here is to demonstrate the existence of a reasonable possibility, within the framework of the generalised spatial cycle hypothesis,[8] that the

Table 7
Three categories and nine groups of FUCs

FUC	Annual PGR 1975–80 (%) FUC	Annual PGR 1975–80 (%) Central city	Sub-stage of spatial cycles	Annual PGR of FUC (%) 1960–70	Annual PGR of FUC (%) 1970–75
Category 1					
Actively growing FUCs					
Group A					
Chiba	2.59	2.51	2	4.47	5.17
Toyota	2.33	2.51	2	3.65	3.40
Sapporo	2.29	2.47	1	3.97	3.53
Fukuoka	2.19	1.67	2	2.16	3.03
Kagoshima	1.96	2.02	1	1.03	2.08
Sendai	1.83	1.55	2	1.71	2.62
Kumamoto	1.75	1.49	2	0.71	1.33
Utsunomiya	1.55	1.86	1	1.03	2.17
Hiroshima	1.54	1.07	2	3.12	3.22
Yokohama	1.52	1.13	2	4.72	3.40
Kanazawa	1.50	1.11	2	1.12	2.16
Oita	1.45	2.40	1	0.95	2.41
Niigata	1.34	1.58	1	0.82	1.34
Toyohashi	1.26	1.35	1	1.59	1.95
Okayama	1.24	1.23	2	1.05	2.13
Hamamatsu	1.19	0.92	2	1.06	1.52
Takamatsu	1.11	1.15	1	0.36	1.60
Group B					
Naha	1.54	0.05	2	1.82	2.89
Gifu	1.12	0.08	2	1.78	1.67
Kyoto	0.99	0.16	2	1.82	1.87
Nagoya	0.94	0.08	2	2.61	1.90
Group C					
Tokyo	1.07	-0.69	3	3.01	2.08
Category 2					
Quasi-growing FUCs					
Group D					
Fukuyama	0.58	0.97	1	1.36	2.11
Group E					
Kobe	0.82	0.10	2	1.90	1.86
Himeji	0.76	0.46	2	1.39	1.39
Shizuoka	0.75	0.50	2	1.57	1.39
Kitakyushu	0.64	0.13	2	-0.11	0.68
Wakayama	0.52	0.60	1	1.52	0.99
Group F					
Nagasaki	0.84	-0.14	3	0.73	1.67
Osaka	0.61	-0.96	4	3.34	1.73
Category 3					
Degenerating FUCs					
Group G – null					
Group H – null					
Group I – null					

Note: Sub-stages of spatial cycles are those appearing in type-β spatial cycle scheme described in Figure 1.

population growth rate of the Wakayama FUC in Group E at the first sub-stage in the type-β scheme would continuously drop until eventually it turned negative, probably in the not too distant future. Recall that Wakayama FUC's growth rate has both dropped constantly since 1960 and was the lowest among the 30 largest FUCs during the 1975–80 period. A similar possibility might also characterise some other FUCs in Group E after a careful study of their patterns of urban change.

ROXY index analysis

As suggested earlier, the 'larger'[9] FUCs are growing relatively slower than the other 30 largest. One indicator for quantitatively measuring how evenly or unevenly the growth rates are distributed between larger and smaller FUCs is the ROXY index, as defined by Kawashima (1981).[10] Put another way, the ROXY index comprehensively measures the acceleration or deceleration of spatial concentration or deconcentration of population in conjunction with the relative share of population per unit. Though it is a rather rough-hewn measurement device, the ROXY index would therefore be useful for drawing a comprehensive picture of how the speed of population growth or decline varies among spatial units of different sizes.

Table 8 shows the ROXY indices for the 30 largest FUCs and all 86 FUCs calculated for four consecutive five-year periods. In this table we see that:

- The ROXY index for the 30 largest FUCs continuously fell from 89.2 during 1960–65 to -19.3 during 1975–80 with the positive sign turning negative around 1970. This implies that before 1970 the population growth rates of 'larger' FUCs generally exceeded those of 'non-larger' FUCs, but also that the discrepancy in rates between the two size groups of FUCs was narrowing. For a while around 1970, population growth in the 30 FUCs became more balanced. After 1970, however, the rates of 'non-larger' FUCs generally exceeded those of 'larger' FUCs and, at the same time, the discrepancy in rates between the size groups was widening.
- The ROXY index for the 86 FUCs remained positive throughout the entire 1960–80 period, implying that, during this 20-year period, the larger FUCs generally grew faster than those with smaller populations. The ROXY index, however, continuously decreased from 121.0 for the 1960–65 period to nearly zero (0.5) for 1975–80, implying that the discrepancy in population growth rates between larger and smaller FUCs constantly narrowed during the two decades.

Table 8
ROXY index (type II) for urbanisation in Japan

	Period			
Group of spatial units	1960–65	1965–70	1970–75	1975–80
30 FUCs	89.2	42.8	-6.1	-19.3
86 FUCs	121.0	84.5	39.5	0.5

Note:

$$\text{ROXY index} = \left[\frac{\text{growth ratio (weighted average)}}{\text{growth ratio (simple average)}} - 1.0 \right] \times 10000$$

where growth ratio (weighted average) [per annum]

$$= \sum_{i=1}^{n} p_i^{t+1} \Big/ \sum_{i=1}^{n} p_i^{t}$$

growth ratio (simple average) [per annum]

$$= \sum_{i=1}^{n} \left[p_i^{t+1} / p_i^{t} \right] \times \frac{1}{n}$$

p_i^{τ} — Population level of spatial unit i at time τ

n — Number of spatial units.

Table 9
ROXY index (type II) for urbanisation in the US

	Period		
Group of spatial units	1960–70	1970–75	1975–80
30 SMSAs	-68.5	-59.0	-53.5

For comparison purposes, Table 9 furnishes ROXY index values for the 30 largest US SMSAs during the 1960–70, 1970–75, and 1975–80 periods. This table shows that the index remained negative throughout the entire 20 year period, but that its absolute value gradually decreased. This implies that, since 1960, the rates of growth (or decline) of 'non-larger' SMSAs exceeded (or were exceeded by) those of 'larger' SMSAs, but that the discrepancy in growth (or decline) rates between 'larger' and 'non-larger' SMSAs was narrowing over time.

The above analysis leads to the following conclusions. First, in the Japanese urban system of 86 FUCs, population was generally still concentrating into the large FUCs even during the most recent 1975–80 period. The speed of spatial concentration, however, has continuously decelerated since 1960. From the trend in the values of the ROXY index, it is quite probable that values have turned negative in recent periods such as 1980–85. That is, the smaller FUCs will in general begin to grow faster than the larger FUCs – for the first time in Japan's postwar history. This phenomenon corresponds to the disurbanisation stage in the spatial cycle scheme of type-γ and might be referred to as relative disurbanisation to indicate the general emergence of a *lower* population growth rate. Thus, the early 1980s would perhaps be viewed as epoch-making years in the history of the Japanese urban system.

Second, in the 30 largest FUCs of the Japanese urban system the smaller ('non-larger') FUCs began to grow faster than the largest FUCs in the early 1970s, and the absolute value of the negative ROXY index has steadily increased. If we bravely assume that the Japanese urban system will generally follow along the path of its US counterpart – which would be regarded as an 'advanced country in the sphere of urbanisation' – and if we compare Tables 8 and 9, the ROXY index for the 30 largest FUCs will possibly decline to values ranging from, say, -50 to -100 in the future, and then once again gradually increase in value. This would imply that some large FUCs would most probably start to lose population in the foreseeable future.

To sum up the analysis of this section, there appear to be possible shifts of this order in the Japanese urban system:

- The urban system of 86 FUCs will possibly reach the relative disurbanisation stage in the 1980s.
- Higher growth rates will be observed for 'non-larger' FUCs, thus increasing the discrepancy between the two size groups of the 30 largest FUCs.
- Osaka FUC will reach disurbanisation during the first half of the 1980s at the earliest.
- Tokyo, Nagasaki, Wakayama, Shizuoka, and Nagoya are among the 'disurbanisation reserve' FUCs, some of which will start losing population even within the decade of the 1980s.

Conclusion

Returning to our initial question, the answer derived from the investigation carried out on the Japanese urban system, using spatial cycle analysis and ROXY index analysis, would be, 'Yes, disurbanisation is foreseeable in Japan'. It should be kept in mind, however, that the validity of this answer must be carefully checked through studies on, for example, urban agglomerations and disagglomeration economies (including amenity agglomeration economies), age structure of urban populations, transportation and communication network systems, spatial distribution of industrial activities, product cycle of industry, regional development policies, regional tax systems, cost of living, and technological innovation, all of which will affect the promotion or hinder the arrival of disurbanisation.

Notes

1 Preliminary versions of this chapter were presented at the Second International Congress of Arts and Sciences, Erasmus University, Rotterdam, The Netherlands, in June 1984 and at the Sixth Advanced Summer Institute in Regional Science, University of Bamberg, in the Federal Republic of Germany, in August 1984. The author would like to thank participants of those meetings for helpful comments on earlier drafts of this chapter. Partial financial support for the research from the Tokyo Marine Kagami Memorial Foundation is also gratefully acknowledged.

2 For a discussion of population decline in the large metropolitan areas of Europe and the USA, see, for example, Alden (1981), Beale (1975), Berry (1978), van den Berg and Klaassen (1979, 1984), van den Berg et al. (1982), Gordon (1979), Hall and Hay (1980), Kawashima and Korcelli (1982), Klaassen and Paelinck (1979), Korcelli (1982), and Leven (1978).

3 The boundaries of central cities were not fixed but variable over time. However, city boundaries usually change due to merger. Therefore, in most cases, the area of the central city would expand whenever it changed. From this point of view, the decrease in the populations of central cities shown in the table would fairly reflect the actual loss of central city population, which could have been observed had the boundary remained fixed.

4 It should be noted that, in the case of New York, the decreases in the population of SMSA and central city began simultaneously in the 1970–75 period.

5 This is because the rate of population decline in the SMSA, divided by that in the central city, is highest for the New York SMSA among the ten disurbanising SMSAs.

6 SMSAs in Groups C and F will be termed 'pre-disurbanisation SMSAs' since they are straightforwardly approaching disurbanisation cell 6, as shown in Figure 2(c).

7 Westward movement of the wave of population upsurge does not necessarily mean that the SMSAs located along the west coast are all among the fastest growing of the 30 largest.

8 The generalised spatial cycle hypothesis involves the concepts of the three types of spatial cycle schemes illustrated in Figure 1 as well as other types of schemes that could directly grow out of the original spatial cycle scheme.

9 The word 'larger' indicates the FUCs that are relatively large even among the 30 largest FUCs; the 'non-larger' FUCs refers to FUCs that are relatively small among the 30 largest FUCs.

10 Precisely, the ROXY index used in this chapter is the ROXY index (Type II) which is a slightly revised version of the original (Type I) developed by T. Kawashima (1982); the relationship between the two types of ROXY indices is:

ROXY index (Type II) = [ROXY index (Type I) -1.0] x 10,000.

For a discussion of the basic features of the ROXY index, see Kawashima (1985).

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