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Factor Decomposition of Urbanisation Growth

IT is rather well known that the traditional index of urbanisation is not distribution-sensitive. In recent years Chaubey (1992, 1993, 1994) has generalised the traditional index and produced a new index, which is distribution-sensitive. It is different than those produced by Roy (1988), Ramachandran (1989) and Rukmani (1996) on the one hand and those by Arriaga (1969), Gibbs (1966) and Kundu (1980) on the other. A comparison of these indices is available in Chaubey (1996).

The purpose of this paper is rather different. It considers the factor decomposition of urbanisation growth which is defined as percentage change in a given urbanisation index. We have considered here three indices only—the urban rural ratio, urban proportion of population and the new index proposed by Chaubey.

I

An urbanisation index at the minimum considers the division of population between rural and urban segments. For population size *P*, urban population size [/and the rural population size *R*, the following identity that holds is obvious:

$$P=U+R \tag{1}$$

Two urbanisation indices based on this division may be given as:

$$I_A = \frac{U}{R} \tag{2}$$

and

$$I_B = \frac{U}{p} \tag{3}$$

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Despite recommendations by Kinsley Davis (1972), the former could not be popular and the latter ruled the roost. I have called it the traditional index as its authorship is unclaimed. Both of these indices are distribution-insensitive as they ignore the distribution of population over urban units. Gibbs (1966), Arriaga (1969) and Kundu (1980) have made some attempts to incorporate distributional dimension. These indices did not get popularity as they show some perverse tendencies less or are not easy to interpret.

There is a substantial section of scholars who advocate diversification of economic activities of rural habitations, particularly of those that are big. They also recommend for strengthening economic base of smaller towns and for provisioning of civic amenities therein. But they abhor monstrous growth of large cities, metropolises and megalopolises as they are growing beyond the level where any scale of economies were available. On the contrary they are responsible for diversion of capital from productive sphere to infrastructure development. Thus there is a positive dimension as well as a negative dimension of urbanisation process. As a measure to correct this lopsidedness, many scholars such as Bose (1978) have suggested that the traditional index needs to be supplemented by some index of distribution of population over urban units. RGI (1984), in a monograph prepared by S. K. Sinha, has not only suggested that the level index of urbanisation be supplemented with measures of size-structure but actually provided Gini coefficient of concentration. However, nobody undertook to combine the two traits of the process in one single index so that comparison overtime or across space could be undertaken with ease. In order to make the gap good Chaubey (1992, 1993, 1994) produced the following index:

$$I_{(\cdot} = \frac{U}{P}(1 - G_{t;}) \tag{4}$$

where $G_{t/}$ denotes the Gini coefficient of concentration.

II

Urban population increases due to natural process of birth, migration from rural to urban areas, and reclassification of rural habitations into urban ones. It decreases for the reasons of deaths, migration from urban to rural areas and declassification of urban habitations. On balance urban growth therefore owes to natural increase, net migration and net reclassification of habitations. Urban growth in relation to rural growth in normally captured through what is called urban-rural growth differential *(URGD).* The *URGD* may be defined as the difference between the relative rate of growth of urban population and the relative rate of rural population. In other words,

$$URGD = \frac{dU}{U} - \frac{dR}{R} \tag{5}$$

which can also be written as:

$$URGD = d\log U - d\log R = d(\log U/R) \tag{6}$$

It is taken as a measure of the tempo of urbanisation and is recommended for projection of future urban population. One of the measurement definition of tempo is said to be 'the

annual rate at which the level of urbanisation rises' (RGI, 1984: p. 9) and the level of urbanisation is measured by the proportion of population living in the urban areas. We will however show that the *URGD* shows growth in an index of urbanisation when it is measured by I_A, that is *(U/R)* not by I_B which is *(U/P)*. In case we measure it by I_B, as we usually do, the *URGD* has to be multiplied by the ratio *(R/P)*, that is proportion of population living in the rural areas. In case we use I_c, the product of *(RIP)* and *URGD* needs to be augmented by another factor showing the relative change in the level of concentration of population in larger urban habitations.

III

Let us define the relative rate of growth in an index I as:

$$g = (1/I)dI = d \log I \tag{7}$$

and therefore for the three indices suggested in this paper we can write

$$g_i = d \log I_i, \; i = A, B, C. \tag{8}$$

We can develop the decomposition of the three indices in the following way:

$$(1) \quad g_A = d \log(U/R) = d \log U - d \log R = URGD \tag{9}$$

$$(2) \quad g_B = d \log (U/P) = d \log U - d \log P = \frac{dU}{U} - \frac{dP}{P} = \frac{dU}{U} - \frac{dU}{P} - \frac{dR}{R}$$

$$= \frac{dU}{U} - \frac{U}{P}\frac{dU}{U} - \frac{R}{P}\frac{dR}{R} = \frac{R}{P}\frac{dU}{U} - \frac{R}{P}\frac{dR}{R} = (R/P)\, URGD \tag{10}$$

$$(3) \quad g_C = d\log(U/P)(1 - G_U) = d\log(U/P) + d\log(1 - G_U)$$

$$= (R/P)URGD + d(1 - G_U)/(1 - G_U) = (R/P)URGD - dG_U/(1 - G_U) \tag{11}$$

It is easy to see that (10) could be written in log-additive form:

$$\log g_B = \log(R/P) + \log(URGD) \tag{12}$$

In sum, we may say that while growth in urban to rural ratio (g_A) is equivalent to *URGD*, that in urban proportion (g_B) is equivalent to augmented *URGD*, augmented by rural proportion which by no means is constant. The growth in the new index may be said to be equivalent to augmented *URGD* adjusted for concentration.

IV

We propose to carry out an empirical exercise as an illustration. This is based on the population data for 1981 and 1991 censuses of India. The exercise is carried out for the major states of India.

There are two ways of estimating the growth. One is definitional and the other is compositional. For a stretch as long as a decade, we have to approximate, at the minimum, denominators by the means of the values at the two ends of the period. On the definitional side,

$$g_i = 2(I_{i2} - I_{i1})/(I_{i1} + I_{i2}) \quad (13)$$

where subscript $i = A, B, C$ and subscripts 1 and 2 denote 1981 and 1991 respectively.

On the compositional side, we find that there are three components in all : (1) *URGD*, (2) (R/P) and (3) $dG_{ij}/(1-G_{ij})$. Their approximations can be given as below:

$$\text{(ii)}\ (R/P) = 2((R/P)_2 - (R/P)_1)/((R/P)_1 + (R/P)_2) \quad (15)$$

$$\text{(iii)}\ dG_{ij}/(1-G_{ij}) = 2((G_{ij2} - G_{ij1})/2 - G_{ij1} - G_{ij2})) \quad (16)$$

V

Tables 1,2 and 3 present both-the definitional and the compositional-sides of computation of growth in three indices I_A, I_B and I_C respectively for the major states of India during the eighties. Normally in order to find out the differential we first estimate the curve and then

TABLE 1 : GROWTH IN URBAN-RURAL RATIO AND URGD

State	*Urban Rural Ratio*			*Urban Growth*	*Rural Growth*	*Urban Rural Differential*
	1981	*1991*	*Growth*			
Andhra Pradesh	30.41	36.70	18.73	35.15	16.69	18.46
Assam	10.96	12.46	12.82	32.38	19.76	12.62
Bihar	14.25	15.16	06.23	26.38	20.23	06.15
Gujarat	45.14	52.44	14.96	28.77	13.97	14.80
Haryana	28.01	32.96	16.25	35.44	19.47	15.97
Karnataka	40.63	44.74	09.63	25.39	15.86	09.53
Kerala	23.07	35.94	43.63	46.68	03.21	43.47
Madhya Pradesh	25.45	30.22	17.13	36.72	19.91	16.81
Maharashtra	53.92	63.20	15.85	32.40	16.76	15.64
Orissa	13.37	15.52	14.84	30.57	15.91	14.66
Punjab	38.28	42.29	09.95	25.41	15.56	09.85
Rajasthan	26.65	29.67	10.70	32.81	22.30	10.51
Tamilnadu	49.15	51.97	05.58	17.58	12.03	05.55
Utter Pradesh	21.88	24.83	12.64	32.62	20.18	12.44
West Bengal	36.00	37.73	04.69	25.25	20.62	04.63

Note : All figures have been expressed in terms of percentage.

take appropriate differential. In this case we have to be content with differences. We try to retrieve the situation by using the arithmetic means in the denominators. Yet, our results do not show the discrepancy to be any greater than 2 percent with the sole exception of Rajasthan and that too only in the case of new index (see Table 1).

It may be seen in Table 1 that the definitional estimates are slightly higher than the compositional estimates. One can also see the same relationship in Table 2. A comparison of Tables 1 and 2 further suggests that urban-rural ratio shows higher figures than urban proportions in both the level and its growth.

TABLE 2: GROWTH IN URBAN PROPORTION AND AUGMENTED URGD

State	*Urban Proportion*			*Average Rural Ratio*	*URGD .*	*Augmented URGD*
	1981	*1991*	*Growth*			
Andhra Pradesh	23.32	26.84	14.06	74.92	18.46	13.83
Assam	09.88	11.08	11.48	89.52	12.62	11.29
Bihar	12.47	13.17	05.44	87.18	06.15	05.36
Gujarat	31.10	34.40	10.07	67.25	14.80	09.96
Haryana	21.88	24.79	12.47	76.66	15.97	12.24
Kamataka	28.89	30.91	06.75	70.10	09.53	06.68
Kerala	18.75	26.44	34.06	77.41	43.47	33.65
Madhya Pradesh	20.29	23.21	13.42	78.25	16.81	13.16
Maharashtra	35.03	38.73	10.02	63.12	15.63	09.87
Orissa	11.79	13.43	12.98	87.39	14.66	12.81
Punjab	27.68	29.72	07.10	71.29	09.85	07.02
Rajasthan	21.05	22.88	08.36	78.00	10.51	08.20
Tamilnadu	32.95	34.20	03.71	66.42	05.55	03.69
UHer Pradesh	17.95	19.89	10.26	81.08	12.44	10.08
West Bengal	26.47	27.39	03.43	73.07	0.4.63	0.3.38

Note: All figures have been given in terms of percentage.

From Table 3 one finds that the levels are lower but more importantly the growth in most cases is negative. The compositional estimates are mathematically lower, which means that in the case of negative numbers the compositional estimates are numerically higher.

Table 4 shows that the discrepancy in the case of growth in first two indices is very low but there is some volatility in the case of third index.

TABLE 3: GROWTH IN NEW INDEX AND AUGMENTED ADJUSTED URGD

State	*New Index*			*Augmented URGD*	*/ Growth in Gini Ratio*	*Adjusted Augmented URGD*
	1981	*1991*	*Growth*			
Andhra Pradesh	09.82	10.72	08.78	13.83	05.29	08.54
Bihar	05.94	05.26	-12.12	05.36	17.52	-12.16
Gujarat	11.63	10.57	-09.56	09.96	19.58	-09.62
Haryana	10.15	08.94	-12.68	12.24	25.05	-12.81
Kamataka	11.99	08.58	-33.18	06.68	39.71	-33.03
Kerala	10.55	10.28	-02.57	33.65	36.55	-02.90
Madhya Pradesh	08.95	08.55	-04.49	13.16	17.88	-04.73
Maharashtra	08.86	09.41	05.99	09.87	04.03	05.84
Orissa	06.22	07.42	17.73	12.81	-05.46	18.27
Punjab	10.85	10.57	-02.67	07.02	09.76	-02.74
Rajasthan	09.45	09.53	00.85	08.20	07.51	01.28
Tamilnadu	11.57	10.71	-07.65	03.69	11.35	-07.66
Uttar Pradesh	07.13	06.64	-06.98	10.08	17.20	-07.12
West Bengal	09.26	07.23	-24.68	03.38	28.05	-24.67

Note: All figures are expressed in terms of percentage. The estimates of the New Index for 1981 and 1991 have been taken from Chaubey (1993).

TABLE 4: DISCREPANCY BETWEEN DEFINITIONAL AND COMPOSITIONAL ESTIMATES

	Urban Rural Ratio (Davis)	*Urban Proportion (Traditional)*	*New Index of Urbanisation (Chaubey)*
Andhra Pradesh	01.47	01.63	02.79
Bihar	01.33	01.35	-00.37
Gujarat	01.01	01.13	-00.69
Haryana	01.73	01.84	-01.03
Karnataka	01.01	01.06	00.45
Kerala	01.37	01.21	-01.29
Madhya Pradesh	01.83	01.96	-05.22
Maharashtra	01.36	01.50	02.61
Orissa	01.22	01.28	03.96
Punjab	00.99	01.04	-02.58
Rajasthan	01.83	01.82	18.66
Tamilnadu	00,53	01.55	-01.59
Uttar Pradesh	01.65	01.71	-02.06
West Bengal	01.30	01.32	00.06

Note: All figures have been expressed in terms of percentage.

VI

Urban rural growth differential, defined as the difference between relative growth of urban population and relative growth of rural population, is the most popular measure of the tempo of urbanisation which itself is defined as the rate at which the level of urbanisation rises. The paper intended in the main to show that the *URGD,* the most popular measure of tempo of urbanisation, is the correct measure of tempo only when the level of urbanisation is measured by urban rural ratio, not when it is measured by urban population ratio. If the level of urbanisation has to be measured by urban proportion of population, as is normally done, then *URGD* has to be corrected by the additive inverse of urban proportion'. The paper has also picked up, for such factoral decomposition, a new measure of urbanisation that takes into consideration the distribution of population over urban habitation. The corrected *URGD* has to be further corrected for this factor by subtracting the rate of change in what may be called the coefficient of non-concentration. Finally, the paper attempted an empirical exercise for major states of India and found the discrepancies to be small.

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'In mathematics, the additive inverse of a number is the number itself with a minus sign. Economists have however used the term for 1—the number which is usually a proportion less than 1.

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TABLE 1: POPULATION SIZE WITH RURAL URBAN DISTRIBUTION

States	*Census 1981*			*Census 1991*		
	Total	*Urban*	*Rural*	*Total*	*Urban*	*Rural*
Andhra Pradesh	53551026	12487576	41063450	66354559	17812693	48541866
Assam	18041248	1782376	16258872	22294562	2470888	19823674
Bihar	69914734	8718990	61195744	86338853	11368889	74969964
Gujarat	34085799	10601653	23484146	41174343	14164301	27010042
Haryana	12922119	2827387	10094732	16317715	4045170	12272545
Kamataka	37135714	10729606	26406108	44806468	13850702	30955766
Kerala	25453680	4771275	20682405	29032828	7676371	21356457
Madhya Pradesh	52178844	10586459	41592385	66135862	15348047	50787815
Maharashtra	62782818	21993594	40789224	78748215	30496352	48251863
Orissa	26370271	3110287	23259984	31512070	4232455	27279615
Punjab	16788915	4647757	12141158	20190795	6000882	14189913
Rajasthan	34261862	7210508	27051354	43880640	10040118	33840522
Tamilnadu	48408077	15951875	32456202	55638318	19027033	36611285
Uttar Pradesh	110862512	19899115	90963397	139031130	27653410	111377720
West Bengal	54580647	14446721	40133926	67982732	18622014	49360718