Decomposition and Progression of Urbanisation in India

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Abstract

This study, using data from the Census of India for 2001 and 2011, decomposes urbanisation ratio into its mathematical components to explain the causes of changes in this ratio over time. Using statistical techniques, we adjust current urbanisation levels of major states in India according to the progression of towns to larger sizes and estimate Class Progression Indices to arrive at a meaningful discussion on the spread of urbanisation.

Keywords: *Urbanisation, Decomposition, Progression*

Introduction

Urbanisation or the proportion of urban population to total population is a standard measure of urbanisation and an indicator of development. Corresponding to nearly 8% growth of Indian economy since 2000, Census 2011 data showed an increase in urban population at the rate of 2.76% which led to beliefs of positive relation between economic growth and urbanisation (Bhagat, 2011) amidst opposing expectations of slow urban growth claiming urbanisation to be exclusionary (Kundu 2011). In fact, Kundu (2003) had argued that over time, highly urban states such as Tamil Nadu, Punjab and Karnataka displayed lower urban population growth while backward states with low urban population such as Bihar, Uttar Pradesh, Rajasthan, and Odisha showed larger urban growth, negating the above argument.

Correlations between per capita income, infrastructure, industrialisation and urbanisation have been found to be positive throughout the literature, with the caveat that growth often led to inequalities due to concentration of urbanisation in a few large cities while others remained poor and rural, with high levels of rural to urban migration (Myrdal, 1957; Preston, 1979; Kundu, 1983; Kundu and Saraswati, 2011). Components of urban growth are thus important. For any policy discourse on urbanisation, composition of urban growth becomes vital. There is a vast literature relating to measurement issues in relation to urbanisation, looking at decomposing the urbanisation ratio for the projection of urban growth for policy discussions (for instance see United Nations: World Urbanisation Prospects, 2001; Bocquier, 2005).

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Data and approach

Using Census data for 2001 and 2011, this paper decomposes the degree of urbanisation is using Das Gupta's decomposition (Das Gupta, 1991) in terms of share of contribution of growth in urban population and fall in total population. We further estimate the spread of urbanisation over time and region through progressions ratios looking at the transformation of towns from lower class sizes to higher class sizes, indicating their progress from less concentrated areas to more developed areas.

The paper is structured as follows. Following a brief discussion on measurement of ratios, urbanisation ratio is decomposed with respect to its mathematical components as well as using Dasgupta's decomposition. This is followed by an analysis of the spread of urbanisation through Class Progression Ratios and a Class Progression Index which is used to then readjust true urbanisation ratios. The last section concludes with providing better estimation techniques to make development policies more target oriented.

Measurement of Ratios

The issue of indiscriminate comparison of ratios missing out on the product-moment correlation between components was raised by Pearson (1897). Another issue in measuring ratios is with regards to the *comparability* of relevant measures. The urban population to total population (U/T) ratio is not strictly comparable, given significant differences in the nature and characteristics of population in various regions. For instance, while comparing U/T ratios between countries/states or regions, (where U is the urban population size and T is the total population size), it is possible that for U1/T1 and U2/T2, where 'i' denotes countries 1 and 2, no correlation between the components exists i.e. $rU1T1 = rU2T2 = rU1U2 = rT1T2=0$.

Similarly, while comparing urbanisation between towns in the same district i.e. U1/T1 and U2/T1, there may be some correlation between U1 and U2 if there is a migratory flow from one town to the other. Thus, it becomes important to decompose ratios into their component variables. For example, while comparing two towns within the same district, T1 can be decomposed as U1+ R1 and in case of rural to urban migration from town 1 to town 2, the denominator of the urbanisation ratio of the second town would capture this as U1 + R2 + R1. However, due to such a migration, the denominator of the second town's ratio rises, as a result of which the share of urban population to the new total population falls.

At the same time, it is also important to look at the characteristics of the component variables of such ratios; the quality of base populations in two different countries might differ in their access to infrastructure amenities for instance, making one set of population superior to the other which is difficult to capture. The decomposition is however possible using a natural logarithm to decompose the chain effects and to convert ratios into differences; U1/T1 can be written as *ln* (U1) – *ln* (T1). Further, if U1/T1 be written as a product of the characteristics such that U1/T1 = U1/X1. X1/T1, where Xi is a characteristic of the population, say for instance literacy rate, the chain rule log differentiation would give a better decomposition.

Measuring Urbanisation: Mathematical Decomposition of the U/T Ratio

Urbanisation is generally measured in terms of the ratio of urban population to the total population. Higher the urban population as a percentage of total population, higher is the urbanisation. However, urbanisation ratio can go up even if the total population falls, total population growth is slow, or rural population growth is slower than urban population growth. Urbanisation is defined as U/T, where U is the urban population and T is the total population at a given point of time. Total population is the sum of rural population and urban population. Urbanisation is calculated as follows: Urbanisation = U/ (U+R) or U/T.

With an increase in urban population, or a fall in total population (or in rural population), the urbanisation ratio may go up. Therefore, attributing urbanisation merely to the growth of urban population is inappropriate. It is important to appreciate that urbanisation is a product of two variables: U and (1/T). There are three possible ways in which urbanisation as per the stated definition[5] can increase:

a. Urban population increases, ceteris paribus,
b. Total population falls, ceteris paribus,
c. Urban population increases and total population falls (due to fall in rural population, natural or due to migration)

[5]Measurement of Urbanisation is given by the U/T ratio. In India however, there are irregularities in measurement of the U population itself; Urban population can either belong to Statutory Towns which by definition are urban because of the presence of a Municipality etc., or from a Census Town which has the following three attributes: having *at least* 5000 population, 400 population density per square kilometre and *at least* 75 per cent of male main working population in non-agricultural activities. However, Municipal status is given only to statutory towns, while economically and demographically urban Census towns are governed by local bodies (Bhagat, 2005).

The relative rates of change or growth in each of these parameters are extremely important. The proportion of increase in urbanisation thus depends on the degree of change in each of its two components; a larger increase in U compared to T , a fall in U accompanied by a larger fall in T, an increase in U accompanied by a fall in T are some of the possibilities. The level of urbanisation therefore needs to be decomposed into the degree of change (in either direction, keeping in mind the comparative magnitudes) in its two components. Mathematically, U/T = U. (1/T) = α.β. U/T can therefore be affected by α, β or by a combination of both. From an urbanisation rate of U_1/T_1 at a particular point of time to U_2/T_2 at another time point in future, the change in population dynamics plays an important role; be it changes in urban population or total population. At time point t_1, let the urbanisation rate be U_1/T_1, so that at time point t_2, it becomes U_2/T_2. Then,

$$\frac{U_2}{T_2} = \frac{U_1}{T_2} + \frac{(U_2 - U_1)}{T_2}, \quad \text{where} \quad \frac{U_1}{T_2} = \frac{U_1}{T_1}.\frac{T_1}{T_2} \text{ , or, } \frac{U_1}{T_2} = \frac{\frac{U_1}{T_1}}{\frac{T_2}{T_1}} \tag{1}$$

$$\text{Also, } \frac{(U_2 - U_1)}{T_2} = \frac{U_2 - U_1}{T_2 - T_1}.\frac{T_2 - T_1}{T_1}.\frac{T_1}{T_2}, \quad \text{or, } \frac{(U_2 - U_1)}{T_2} = \frac{\frac{U2 - U1}{T1}}{\frac{T2}{T1}} \tag{2}$$

From equations (1) and (2),

$$\frac{U_2}{T_2} = \frac{\frac{U_1}{T_1}}{\frac{T_2}{T_1}} + \frac{\frac{U2 - U1}{T1}}{\frac{T2}{T1}}. \tag{3}$$

Now, $T_2 = T_1 (1+\eta)$, where η is the percentage of addition to the total population from T_1 in time point t_1 to T_2 in time point t_2. Therefore, U_2/T_2 ratio will be higher for those areas where U_1/T_1 ratio is already higher or where T_2/T_1 ratio is small, i.e. the percentage of growth of total population (η) is low. For instance, given a comparatively lower urban fertility rate or a somewhat stable urban population growth, a fall in rural fertility levels would lead to a slower growth of total population, leading to an increase in urbanisation ratio. Similarly, rural to urban migration would lead to an increase in the urbanisation ratio. U_1/T_1 or the initial level of urbanisation is significant, as urbanisation begets urbanisation. Moreover, U_1/T_1 would be high only if there existed a somewhat dispersed and less concentrated form of urbanisation, not limited to just a few sections or areas within a larger area. Hence, while looking at urbanisation per se in terms of the U/T ratio, the change in this ratio might be due to either a change in U, or a change in T or both. An already high U_1/T_1 ratio, marginal increases in total population (given by the T_2/T_1 ratio or total population growth rate η, or an increase in U_2 over U_1) might all play significant roles in increasing the U/T ratio individually or in unison.

Table 1: Changes in U/T Ratio from 2001 to 2011 for Major Indian states

State	U/T Ratio 2011	U_2	T_2	U/T Ratio 2001	U_1	T_1	% change urbanisation 2001-11	% change U 2001-11	% change T 2001-11
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
PUNJAB	0.37	10399146	27743338	0.34	8262511	24358999	10.51	25.86	13.89
UTTARAKHAND	0.30	3049338	10086292	0.26	2179074	8489349	17.78	39.94	18.81
HARYANA	0.35	8842103	25351462	0.29	6115304	21144564	20.60	44.59	19.90
RAJASTHAN	0.25	17048085	68548437	0.23	13214375	56507188	6.35	29.01	21.31
UTTAR PRADESH	0.22	44495063	199812341	0.21	34539582	166197921	7.15	28.82	20.23
BIHAR	0.11	11758016	104099452	0.10	8681800	82998509	7.98	35.43	25.42
WEST BENGAL	0.32	29093002	91276115	0.28	22427251	80176197	13.95	29.72	13.84
JHARKHAND	0.24	7933061	32988134	0.22	5993741	26945829	8.11	32.36	22.42
ODISHA	0.17	7003656	41974218	0.15	5517238	36804660	11.31	26.94	14.05
CHHATTISGARH	0.23	5937237	25545198	0.20	4185747	20833803	15.68	41.84	22.61
MADHYA PRADESH	0.28	20069405	72626809	0.26	15967145	60348023	4.44	25.69	20.35
GUJARAT	0.43	25745083	60439692	0.37	18930250	50671017	14.02	36.00	19.28
MAHARASHTRA	0.45	50818259	112374333	0.42	41100980	96878627	6.59	23.64	15.99
ANDHRA PRADESH	0.33	28219075	84580777	0.31	23475111	76210007	8.31	20.21	10.98
KARNATAKA	0.39	23625962	61095297	0.34	17961529	52850562	13.79	31.54	15.60
KERALA	0.48	15934926	33406061	0.26	8266925	31841374	83.73	92.76	4.91
TAMIL NADU	0.48	34917440	72147030	0.44	27483998	62405679	9.89	27.05	15.61

Source: Calculated from Census of India, Primary Census Abstract for states, 2001 and 2011

Table 1 shows the trends in urbanisation between 2001 and 2011 for 17 major Indian states. Column 2 shows urbanisation ratio in 2011, column 3 shows state wise total urban population in 2011, column 4 shows state wise total population in 2011. Similarly, column 5, 6 and 7 show corresponding figures of state wise urbanisation ratio, total urban population and total population respectively for 2001. Column 8 shows percentage change in urbanisation ratio, column 9 shows percentage change in urban population, while column 10 shows percentage change in total population of the states. The urbanisation ratio in 2011 is significantly high for Tamil Nadu, Kerala, Maharashtra, Gujarat, Punjab and Haryana (ranging between 35% and 48%), while it is moderately high for Andhra Pradesh, West Bengal and Uttarakhand (ranging between 30 and 35%). It is comparatively lower for Madhya Pradesh, Rajasthan, Jharkhand, Chattisgarh and Uttar Pradesh (ranging between 22 and 30%). It is the lowest for Odisha with 17% and Bihar with 11%.

The urbanisation ratios for states in 2011 have grown quite significantly since 2001. The growth has been maximum (83.73%) for Kerala. Other states with some growth in urbanisation ratio include Haryana, Uttarakhand, Chattisgarh, Gujarat, West Bengal and Karnataka (ranging between 14 and 20%).There has been a little increase in urbanisation ratio since 2001 for the states of Punjab, Tamil Nadu, Andhra Pradesh, Maharashtra and Odisha(ranging between 7 and 11%). However, Tamil Nadu and Maharashtra had high levels of urbanisation in 2001 and the growth has been further incremental. The slow rate of increase in urbanisation in states such as Rajasthan, Uttar Pradesh, Bihar, Jharkhand and Madhya Pradesh requires more attention given the low levels of urbanisation ratio earlier, which are improving very gradually.

Another point to note here is that the increase in urbanisation has been relatively higher for states which have had a larger increase in total urban population and a comparatively lower increase in total population growth. For instance, Kerala's high increase in urbanisation ratio is accompanied by a high growth in its urban population along with a low rate of growth of total population. Similarly, increase in the ratio of urbanisation in Haryana, West Bengal and Karnataka for instance is accompanied by an increase in their urban population and a comparatively lower increase in total population. Meanwhile, for states such as Bihar and Jharkhand, the urban population growth is accompanied by a large growth in total population as well, reducing the urbanisation ratio. In this context, it becomes pertinent to examine the various components in the process of urbanisation, which individually or as a whole determine the magnitude of urbanisation.

Table 2: Components of urbanisation growth from 2001 to 2011: Major Indian states

State	U2/T2	U1/T1	U2-U1	(U2-U1)/T1	T2/T1	η
(1)	(2)	(3)	(4)	(5)	(6)	(7)
PUNJAB	0.37	0.34	2136635	0.09	1.14	13.89
UTTARAKHAND	0.30	0.26	870264	0.10	1.19	18.81
HARYANA	0.35	0.29	2726799	0.13	1.20	19.90
RAJASTHAN	0.25	0.23	3833710	0.07	1.21	21.31
UTTAR PRADESH	0.22	0.21	9955481	0.06	1.20	20.23
BIHAR	0.11	0.10	3076216	0.04	1.25	25.42
WEST BENGAL	0.32	0.28	6665751	0.08	1.14	13.84
JHARKHAND	0.24	0.22	1939320	0.07	1.22	22.42
ODISHA	0.17	0.15	1486418	0.04	1.14	14.05
CHHATTISGARH	0.23	0.20	1751490	0.08	1.23	22.61
MADHYA PRADESH	0.28	0.26	4102260	0.07	1.20	20.35
GUJARAT	0.43	0.37	6814833	0.13	1.19	19.28
MAHARASHTRA	0.45	0.42	9717279	0.10	1.16	15.99
ANDHRA PRADESH	0.33	0.31	4743964	0.06	1.11	10.98
KARNATAKA	0.39	0.34	5664433	0.11	1.16	15.60
KERALA	0.48	0.26	7668001	0.24	1.05	4.91
TAMIL NADU	0.48	0.44	7433442	0.10	1.16	15.61

Source: Calculated from Census of India 2001, 2011

The various components of growth in urbanisation ratio given by equation (3) are examined in Table 2. Column 2 represents urbanisation ratio in 2011, while column 3 represents urbanisation ratio in 2001 i.e. the initial level according to equation (3). Column 5 shows the growth in urban population as a proportion of total population in the previous period (2001). Column 6 shows the ratio of total population in 2011 to that in 2001 and column 7 represents column 6 in percentage growth rate of total population as a proportion of existing population.

It is evident yet again that the urbanisation ratio in 2011 is higher for those states where urbanisation ratio in 2001 was also sufficiently high, or when growth in urban population has been significant and accompanied with a smaller growth in total population. For instance, Tamil Nadu has a high urbanisation ratio in 2011 as it had a high urbanisation ratio in 2001 as well. Kerala on the other hand, has shown a remarkable increase in the urbanisation ratio in 2001 due to increase in urban population (column 5), as well as relatively slow growth of total population (column 7). On the other hand, Bihar has remained more or less stagnant at an urbanisation ratio of 11%, low growth of urban population as well as high growth rate of total population.

Based on these parameters, it is meaningful to rank states based on their urbanisation levels between 2001 and 2011. However, it is important to note that though a simple ranking based on U/T ratio would show some indication of the situation of urbanisation in different states, it may also at times be misleading. This is because the rank of a state per se might remain the same in relative terms, however in actual and absolute terms it might have improved, worsened or remained the same. To measure the positional variation of states in relative terms of their actual performance, the positional ranking in Table 3 is done using the following formula:

$$Positional\ Rank = \frac{Observation - Minimum\ Value\ in\ the\ series}{Maximum - Minimum\ Value\ in\ the\ series}$$

Such a positional ranking gives an indexed value for each state between 0 and 1. An indexed positional rank closer to 1 indicates a better position. States such as Punjab, West Bengal, Gujarat, and Karnataka show deterioration in rank although their positional ranks show an improvement in urbanisation. Similarly, Haryana and Chattisgarh retain the same rank but have positionally marginally improved. On the other hand, Rajasthan and Uttar Pradesh retain the same rank but have positionally worsened. Other states more or less show similar patterns for rank as well as positional ranks. These rankings as well as decomposition of U/T into the relative changes in its components would be better reflected in district-level data.

Table 3: Ranking and positional changes in urbanisation: Major Indian states 2001-11

State	Ranking by 2001 U/T ratio	Ranking by 2011 U/T ratio	Position U/T 2001	Position U/T 2011
(1)	(2)	(3)	(4)	(5)
PUNJAB	5	6	0.70	0.72
UTTARAKHAND	11	10	0.46	0.52
HARYANA	7	7	0.56	0.65
RAJASTHAN	12	12	0.39	0.37
UTTAR PRADESH	14	14	0.32	0.30
BIHAR	17	17	0.01	0.01
WEST BENGAL	8	9	0.53	0.56
JHARKHAND	13	13	0.36	0.35
ODISHA	16	16	0.15	0.15
CHHATTISGARH	15	15	0.30	0.33
MADHYA PRADESH	9	11	0.48	0.45
GUJARAT	3	4	0.80	0.85
MAHARASHTRA	2	3	0.95	0.92
ANDHRA PRADESH	6	8	0.61	0.60
KARNATAKA	4	5	0.71	0.75
KERALA	10	2	0.47	0.99
TAMIL NADU	1	1	1.00	1.00

Measuring Urbanisation: Dasgupta's Decomposition

A similar decomposition was also suggested by Dasgupta (1991). The author suggested that a ratio which is expressed as a product of two factors can be decomposed separately into the impact of each factor, keeping the other factor constant. The measures formulated by him for the same are explained as follows. Using Dasgupta's notations, if a ratio or rate R over two populations be compared, where R is a product of two factors α and β, i.e. R = α.β, then the values taken by α and β in population or period 1 would be A and B, while in population or period 2, α and β would take values a and b respectively. In short,

R_1 = A.B and R_2 = a.b

The difference in the rate between two populations or two time periods is $R_1 - R_2$. Keeping β fixed over the two populations, if α changes as A and a, β-standardised rates in the two populations are given as follows.

β-standardised rate in population 1 = $\frac{b+B}{2}$ A

β-standardised rate in population 2 = $\frac{b+B}{2}$ a

Similarly, keeping α fixed over the two populations, if β changes as B and b, α-standardised rates in the two populations are given as follows

α-standardised rate in population 1 = $\frac{a+A}{2}$ B

α-standardised rate in population 2 = $\frac{a+A}{2}$ b

Thus,

$$\alpha_{effect} = \frac{b+B}{2}(a-A)$$

And

$$\beta_{effect} = \frac{a+A}{2}(b-B)$$

The change in the rate R can thus be expressed as α-effect + β-effect.

A similar exercise can be tried with the urbanisation rate as well. Urbanisation is a product of α = U (urban population) and β = 1/T (total population). The change in urbanisation for two populations or two periods of 2001 and 2011 with respect to each of these factors keeping the other fixed is shown below.

Table 4: Factor standardised decomposition of urbanisation rate: Indian states 2001-2011

			T standardised rate		U standardised rate		U effect	T effect	U2/T2 - U1/T1	U share	T share
			2001	2011	2001	2011			U effect + T effect		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)*	(11)*
State	U1/T1	U2/T2	A*(b+B)/2	a*(b+B)/2	B*(a+A)/2	b*(a+A)/2	(a-A)*(b+B)/2	(b-B)*(a+A)/2			
PUNJAB	0.34	0.37	0.32	0.4	0.38	0.34	0.08	-0.05	0.04	0.34	0.66
UTTARAKHAND	0.26	0.3	0.24	0.33	0.31	0.26	0.09	-0.05	0.05	0.31	0.69
HARYANA	0.29	0.35	0.27	0.38	0.35	0.3	0.12	-0.06	0.06	0.3	0.7
RAJASTHAN	0.23	0.25	0.21	0.28	0.27	0.22	0.06	-0.05	0.01	0.6	0.4
UTTAR PRADESH	0.21	0.22	0.19	0.25	0.24	0.2	0.05	-0.04	0.01	0.52	0.48
BIHAR	0.1	0.11	0.09	0.13	0.12	0.1	0.03	-0.02	0.01	0.58	0.42
WEST BENGAL	0.28	0.32	0.26	0.34	0.32	0.28	0.08	-0.04	0.04	0.3	0.7
JHARKHAND	0.22	0.24	0.2	0.27	0.26	0.21	0.07	-0.05	0.02	0.51	0.49
ODISHA	0.15	0.17	0.14	0.18	0.17	0.15	0.04	-0.02	0.02	0.35	0.65
CHHATTISGARH	0.2	0.23	0.18	0.26	0.24	0.2	0.08	-0.04	0.03	0.36	0.64
MADHYA PRADESH	0.26	0.28	0.24	0.3	0.3	0.25	0.06	-0.05	0.01	0.74	0.26
GUJARAT	0.37	0.43	0.34	0.47	0.44	0.37	0.12	-0.07	0.05	0.37	0.63
MAHARASHTRA	0.42	0.45	0.4	0.49	0.47	0.41	0.09	-0.07	0.03	0.48	0.52
ANDHRA PRADESH	0.31	0.33	0.29	0.35	0.34	0.31	0.06	-0.03	0.03	0.35	0.65
KARNATAKA	0.34	0.39	0.32	0.42	0.39	0.34	0.1	-0.05	0.05	0.32	0.68
KERALA	0.26	0.48	0.25	0.49	0.38	0.36	0.24	-0.02	0.22	0.3	0.7
TAMIL NADU	0.44	0.48	0.41	0.52	0.5	0.43	0.11	-0.07	0.04	0.39	0.61

Source: Calculated according to Das Gupta's methodology using Census data 2001-11

**U share and T share have been estimated using logarithmic transformation and rounded figures are shown up to 2 decimals*

Here, urbanisation rate in 2001 is U_1/T_1 and urbanisation rate in 2011 is U_2/T_2. U_1 and U_2 are analogously taken as A and a according to Dasgupta's formula and $1/T_1$ and $1/T_2$ are taken as B and b to arrive at T-standardised and U standardised rates, with T and u fixed respectively (see columns 3,4. 5 and6). The U and T effects corresponding to α and β effects are shown in columns 7 and 8. It is interesting to note that the change in urbanisation rate from 2001 to 2011 is marked by a percentage share of only change in U, as well as a percentage of contribution due to change in only T. This is shown in columns 10 and 11. To make the shares in percentage terms more meaningful, a simple logarithmic transformation has been taken. Since the factor T is in the denominator, percentage shares would give negative values for which a logarithmic transformation of the form *log (a + t)* has been taken, with a = 6[6] given the range of the values obtained. The shares thus obtained can be easily interpreted.[7]

For most states (with the exception of Uttar Pradesh, Rajasthan, Madhya Pradesh and Maharashtra to some extent which have an increase in U/T due to a larger increase in urban population rather than fall in growth of total population as also argued and found by Kundu (2003)), the contribution of rise in urban population has been in the range of 30 to 40%, while a larger contribution to the increase in urbanisation in these states has been due to a fall in total population. Especially in the case of Kerala, a large fall (70%) in total population has contributed to a sharp rise in urbanisation. For the other states, the U/T ratio has increased due to increase in the numerator rather than a larger fall in the denominator. This is analogous to the mere addition axiom or paradox[8] used in the poverty literature, which explains the importance of addition to population in the numerator and/or denominator; an addition to the numerator which is in this case the urban population leads to an increase in urbanisation which is positive. Meanwhile, an addition to the denominator increases the total population and reduces urbanisation although the numerator did not change in absolute terms. Similarly, a constant increase in both numerator and denominator keeps the ratio unchanged, while in actual fact the urban population also increased, but the increase was nullified by a similar increase in total population.

[6]'a' has been taken to be 6, since conversion of log for negative numbers takes the next number, and the least negative number here was -5.

[7]Although T = U + R, but since the share of u is already obtained and is significant (almost around 30 per cent for all states), the contribution of T can also be correspondingly envisaged.

[8]See Hassoun, Nicole (2010), 'Another Mere Addition Paradox? Some Reflections on Variable Population Poverty Measurement', UNU-WIDER Working Paper No. 2010/120, November 2010

Thus, Dasgupta's decomposition helps to overcome these confusions by looking at the components of urbanisation, keeping one fixed at a time. Urbanisation must be understood by its nature and factors causing such a change. Mere addition to urban population or fall in total population can only indicate the pace and direction of the urbanisation process; the nature of this process needs to be understood from the changes that this ratio brings to standard of living differentials between urban and rural populations and its direction over time.

Spread of Urbanisation: Class Progressions

The early 1990s in India showed signs of growth of urbanisation mainly in the form of growth of first class urban centres rather than increased number of smaller and medium towns[9]. The subsequent concentration of population in larger cities was blamed for infrastructural differentials between different urban centres. With a higher concentration of population in an area, provision of amenities becomes easier. However, with an exploding level of population density, it is difficult for amenities to be provided to all[10]. Given that urbanisation is understood to be an indicator of the modernisation and development of regions, it becomes very important to accurately track the performance and pattern of urbanisation in terms of the *level, pace, degree* and subsequently the *quality* of urbanisation.

Now, while looking at urbanisation per se, it becomes important to look not only at the U/T ratios, but also to consider in detail the transformation of towns from lower class sizes to higher class sizes, indicating their progress from less concentrated areas to more developed areas with higher standards of living, given easy access to amenities. It is in this context that it has been argued that urbanisation should be defined not just in terms of its growth or share in terms of total population, but also in terms of its spatial distribution and concentration (Mishra, Rajan and Ramanathan, 1999).

Hitherto, the most common measures looking at urbanisation have been the U/T ratio or the proportion of urban to total population. For studying size classes and large city concentrations, the primacy and concentration indices have been used; where urban primacy looks at the largest primate city (El-Shakhs, 1972; Mutlu, 1989). Meanwhile, a concentration measure for cities was developed later in 1989 by Mutlu, which when closer to 1 indicates a monopolising city. However, setting cut-offs for the index has been argued to be difficult.

[9]See for instance,Mishra U S, Irudaya Rajan and M Ramanathan (1999)
[10]See for instance Kundu (2003)

Moreover, the interpretation of these indices has not been found to yield much; Wheaton and Shusido (1981) for instance found inconsistent relationships between development and 'relative urbanisation'; their analysis revealed curvilinear relationships between primacy and development, with 'rising primacy from low to intermediate levels of development, and declining thereafter' (Kasarda and Crenshaw, 1991). The very concept and comparability of what is 'urban' hence raises difficulties.

Meanwhile, simply comparing urban growth rates with respect to total population also does not give a true reflection of the urbanisation process; for instance, Rajan (1986) argues that though growth of U/T ratio for Tamil Nadu during 1981-1991 was lower compared to other states, it was more 'orderly' and evenly spread. Merely investigating on the number of primate cities using such indices similarly does not depict a true picture of the progression of smaller towns to bigger towns and shows a static picture which is not easily comparable. Table 5shows the growth in urbanisation rate in terms of urban population as a proportion of total population for 17 major states in India since 1991.

Table 5 Growth in urbanisation rate

Rank	Major states	2011	2001	1991	1981	1971	1961	Change 1961-2011
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	Tamil Nadu	48.45	44.04	34.2	32.95	30.26	26.39	22.06
2	Kerala	47.72	25.96	26.44	18.74	16.24	11.11	36.61
3	Maharashtra	45.23	42.43	38.73	35.03	31.17	28.22	17.01
4	Gujarat	42.58	37.36	34.4	31.1	28.08	25.77	16.81
5	Karnataka	38.57	33.99	30.91	28.89	24.31	22.33	16.24
6	Punjab	37.49	33.92	29.72	27.68	23.73	23.06	14.43
7	Haryana	34.79	28.92	24.79	21.88	17.66	17.23	17.56
8	Andhra Pradesh	33.49	27.3	26.84	23.82	19.31	17.44	16.05
9	West Bengal	31.89	27.97	27.89	26.47	24.75	24.45	7.44
10	Uttarakhand	30.55	25.67	-	-	-	-	-
11	Madhya Pradesh	27.63	26.46	23.21	20.29	16.29	14.29	13.34
12	Rajasthan	24.89	23.39	22.88	21.94	17.63	16.28	8.61
13	Jharkhand	24.05	22.24	-	-	-	-	-
14	Chattisgarh	23.24	20.09	-	-	-	-	-
15	Uttar Pradesh	22.28	20.78	19.89	17.95	14.02	12.85	9.43
16	Odisha	16.68	14.99	13.43	11.79	8.41	6.32	10.36
17	Bihar	11.3	10.46	13.17	12.47	10	8.11	3.19
	India	**31.16**	**27.81**	**25.72**	**23.7**	**20.21**	**18.24**	**12.92**

Source: Census of India, various years

Note: Jharkhand, Chattisgarh and Uttarakhand were formed in 2001, prior to which they are included within Bihar, Madhya Pradesh and Uttar Pradesh respectively.

The highest increase over the period has been in Kerala (36.61%), followed by Tamil Nadu (22.06%), which is followed by Maharashtra, Haryana, Gujarat, Andhra Pradesh and

Karnataka, as compared to 12.9% increase in India. The trends over the periods remain more or less the same. States such as Bihar, Odisha, Uttar Pradesh, Rajasthan and Madhya Pradesh show slow signs of urban growth. However, the story is incomplete without delving deeper into the nature of urban population growth; whether it is due to concentration of population in higher class towns or whether it is evenly spread with an increase in number of small/ medium towns. Table 6 shows the major states ranked in order of their urbanisation rates in 2011, with the number of Urban Agglomerations and/or Towns within each.

Table 6: Ranking of major Indian states by urbanisation rate

Rank	Major states	% Urban 2011	Urban Population 2011	Number of UAs/Towns 2011	Growth Rate urban 2001-2011
(1)	(2)	(3)	(4)	(5)	(6)
1	Tamil Nadu	48.45	3,49,49,729	1097	27.16
2	Kerala	47.72	1,59,32,171	520	92.72
3	Maharashtra	45.23	5,08,27,531	535	23.67
4	Gujarat	42.58	2,57,12,811	348	35.83
5	Karnataka	38.57	2,35,78,175	347	31.27
6	Punjab	37.49	1,03,87,436	217	25.72
7	Haryana	34.79	88,21,588	154	44.25
8	Andhra Pradesh	33.49	2,83,53,745	353	36.26
9	West Bengal	31.89	2,91,34,060	909	29.9
10	Uttarakhand	30.55	3091169	116	41.86
11	Madhya Pradesh	27.63	2,00,59,666	476	25.63
12	Rajasthan	24.89	1,70,80,776	297	29.26
13	Jharkhand	24.05	7929292	228	32.29
14	Chattisgarh	23.24	5936538	182	41.83
15	Uttar Pradesh	22.28	4,44,70,455	915	28.75
16	Odisha	16.68	69,96,124	223	26.8
17	Bihar	11.3	1,17,29,609	199	35.11
	India	**31.16**	**37,71,05,760**	**7935**	**31.8**

Source: Census of India, 2011

The total urban population in India is spread over 7935 towns, accounting for 31.2% of the country's total population in 2011. Out of these 7935 towns, Tamil Nadu accounts for 1097 towns followed by Uttar Pradesh (915 towns), while Uttarakhand has the least number of towns (116) followed by Bihar (199). However, somewhat contrary to expectations, growth rate of urbanisation from 2001-11 is highest for Kerala (93%), while Tamil Nadu which has almost double the number of towns compared to Kerala shows a growth in urban population by just 27%. However, Tamil Nadu although has a large number of towns, is argued to have an evenly-spread distribution of such towns, with less concentration in the form of just a few primate cities (See S. Irudaya Rajan, 1986).

Therefore, it is more meaningful to compare the share of urban population in various size classes of towns for each state to obtain a clearer picture of the spread of urbanisation. The different classes of urban towns classified by the Census of India are in terms of population size, given as: *Class I:* Above 100000; *Class II*: 50000 – 99999; *Class III*: 20000 – 49999; *Class IV*: 10000 -19999; *Class V:* 5000 – 9999; *Class VI*: Below 5000. Table 7 shows the proportion of urban population in each class size for the 17 major Indian states in 2011.

Table 7: Proportion of urban population in each class size, 2011

2011	Size Class					
States	**I**	**II**	**III**	**IV**	**V**	**VI**
Punjab	57.4	16	13.7	8.6	3.4	0.8
Uttarakhand	46.4	11.1	17.1	15	9.3	1
Haryana	68.4	7.3	15	5.8	3	0.3
Rajasthan	61.7	10.5	18.9	6.5	2	0.2
Uttar Pradesh	61.63	9.2	15.6	9.6	3.7	0.2
Bihar	62.08	13.14	21.00	2.05	1.57	0.17
Jharkhand	54.5	11.1	16.1	8.4	8	1.6
West Bengal	62	8.8	8	9.3	10.5	1.3
Odisha	45.3	16	18.6	10.4	7.8	1.7
Chattisgarh	55.4	6.1	15.5	12.3	9.4	1
Madhya Pradesh	55.6	10.6	16.6	12.4	4.4	0.2
Gujarat	72.2	9.2	10.6	5.7	1.8	0.2
Maharashtra	76.7	7.4	10.4	3.7	1.5	0.2
Andhra Pradesh	74.98	14.81	6.78	2.38	0.98	0.07
Karnataka	67.5	10.5	13.9	5.3	2.5	0.2
Kerala	20.48	11.85	49.75	14.77	2.93	0.23
Tamil Nadu	39.6	15.8	20.9	16.7	6.5	0.4

Source: Computed from Primary Census Abstract, Census of India, 2011

As is visible from the table, there is a significant amount of concentration of urban population in class I cities, with lower population in each subsequent class size. This is highest for Maharashtra (76%) and Andhra Pradesh (75%) mainly due to the presence of the two large cities of Mumbai and Hyderabad. Tamil Nadu and Kerala are the only states which show some evenness in the spread of urban population in various class sizes. This shows evenness in the distribution of different-sized class towns, with less concentration in the so-called 'primate' cities. This even spread is desirable for the simple reason that provision of amenities becomes feasible and less costlier across all size classes of towns, given a significant share of population in each size class.

Moreover, it is important to note here that the distances of populations in lower class sizes is quite low compared to those among the higher class sizes. For instance, in the case of Punjab, moving from size class VI to V is easy, as the addition to population required to increase

from 0.8 to 3.4% is very less, as compared to moving from class II to I (from 16% to 57.4%). In the case of Maharashtra, these differentials are exacerbated; moving from size class VI to V needs an increase of population from 0.2 to 1.5%, while moving from class II to I requires a very large increase in population from 7.4 to 76.7%. This shows the extent of unevenness in the spread of urban towns in Maharashtra. In the case of say Tamil Nadu on the other hand, moving from class VI to V requires an increase in population from 0.4 to 6.5%, moving from class IV to III requires a population increase from 16.7 to 20.9%, while a progression from class II to I requires a population increase from 15.8 to 39.6%. These differentials are comparatively lower, showing an evener spread of urban towns.

Therefore, a more holistic approach towards measuring the level and pattern of urbanisation should be to look at population concentration in different size-classes of towns. An increase in the number of small and medium towns would indicate a uniform development process. Keeping this in mind, Mishra, Rajan and Ramanathan (1999) devised a measure called *Class Progression ratio*, which measures the 'shift of a particular size class urban settlement from lower to any higher size classes. This is useful to look at the concentration of population in different size classes of towns, as well as compare the progression of towns into higher size classes. The ratio has been defined as follows:

$$CPR(i) = \frac{Number\ of\ towns\ in\ size\ classes\ below\ i}{Number\ of\ towns\ in\ size\ classes\ upto\ i}$$

For instance, if CPR(V) were to be measured, it would be equal to the total number of towns in class sizes I through IV, divided by total number of towns from class size I through V. CPR(i) here measures the change or progression of a town *i* into a size class higher than it. In other words, it measures the probability of a town moving into a higher size class due to population increase in the near future, although the ratio is computed at a given point of time. This is simply explained as follows; the towns in class V when added to the higher categories (class I through IV) would progress to that category, the probability of this occurring is given by the ratio of number of towns in classes I through IV to that of the number of towns in classes I through V so that the probability is less than 1. This measure has been derived in a similar manner to that of cohort analysis used in fertility parity progression analysis; to cumulate age specific fertility rates in a cohort of women to determine the expected fertility per woman in the near future (see Mishra, Rajan and Ramanathan, 1999)

Table 8 shows the Class Progression Ratios for 17 major Indian states each for 2001 as well as 2011 using the methodology given by Mishra et al (1999). The least quality of urbanisation

is associated with high progression at the top end, i.e. from a high size class to a higher one. Meanwhile, a high progression at the lower end in a temporal sense, with a larger transition from smaller class size towns to larger ones shows a healthier urbanisation in the form of an even spread of urban population. It should be noted that the lesser the progression from Class II to Class I and the higher the progression from Class VI to Class V is desired for the progressions to converge and the spread of urbanisation to be even. Especially given the argument that towns grow and engulf nearby areas although the present definition of urban does not capture this suburbanisation process as it has no element of transition (Bhagat, 2005), the analysis of class progressions becomes all the more meaningful and pertinent.

On comparing the CPR for 2001 to 2011 for each class size, it becomes quite apparent that the desired trends in urbanisation are not visible; for most of the states except Uttarakhand, there is a fall in CPR from Class VI to V from 2001 to 2011. This is discouraging, especially given that in most cases, it is accompanied by a rise in progression from Class II to I towns over the decade, showing no signs of convergence towards an even spread of the urban transition. For instance, in the case of Maharashtra, CPR (VI) or P_6, defined as the probability of progressing from being a Class VI town to a Class V town has actually worsened from 0.98 to 0.95 over the decade, and the same trend continues for all other classes. Bihar on the other hand shows a worse case of divergence, with a fall in P_6 from 1 to 0.97 and P_5 from 0.95 to 0.84 from 2001-11, while there is a steady increase in progressions at the higher end (P_3 from 0.36 to 0.41 and P_2 from 0.50 to 0.53). A contrary case is observed in Uttarakhand, with an increase in all progressions, though the progressions from the lower end towards higher size classes are higher. Tamil Nadu and Kerala on the other hand show almost stagnant scenarios in the case of Progressions from Class VI to Class V towns, although progressions at the higher end are falling, leading to a more convergent pattern leading to a more even nature of the urbanisation process.

Table 8: Class Progression Ratios for 17 major Indian states for the years 2001 and 2011

2001	Class Progression Ratio of Order					2011	Class Progression Ratio of Order				
States	VI (P6)	V (P5)	IV (P4)	III (P3)	II (P2)	States	VI (P6)	V (P5)	IV (P4)	III (P3)	II (P2)
Punjab	0.96	0.81	0.56	0.47	0.44	Punjab	0.91	0.75	0.59	0.43	0.41
Uttarakhand	0.79	0.59	0.60	0.33	0.38	Uttarakhand	0.88	0.63	0.48	0.40	0.50
Haryana	0.99	0.85	0.60	0.51	0.74	Haryana	0.95	0.75	0.69	0.40	0.67
Rajasthan	0.98	0.91	0.69	0.34	0.41	Rajasthan	0.96	0.84	0.68	0.35	0.54
Uttar Pradesh	0.98	0.81	0.53	0.37	0.50	Uttar Pradesh	0.97	0.75	0.54	0.35	0.52
Bihar	1.00	0.95	0.85	0.36	0.50	Bihar	0.97	0.84	0.89	0.41	0.53
Jharkhand	0.93	0.68	0.64	0.40	0.28	Jharkhand	0.87	0.55	0.56	0.36	0.45
West Bengal	0.93	0.63	0.66	0.60	0.67	West Bengal	0.90	0.46	0.48	0.55	0.63
Odisha	0.96	0.82	0.56	0.40	0.38	Odisha	0.87	0.60	0.57	0.39	0.38
Chattisgarh	1.00	0.76	0.49	0.39	0.50	Chattisgarh	0.93	0.57	0.48	0.33	0.69
Madhya Pradesh	0.97	0.78	0.48	0.35	0.49	Madhya Pradesh	0.97	0.76	0.50	0.36	0.51
Gujarat	0.93	0.90	0.72	0.44	0.43	Gujarat	0.91	0.79	0.61	0.42	0.48
Maharashtra	0.98	0.86	0.68	0.38	0.48	Maharashtra	0.95	0.79	0.67	0.37	0.45
Andhra Pradesh	0.99	0.90	0.82	0.64	0.47	Andhra Pradesh	0.98	0.84	0.79	0.65	0.42
Karnataka	0.97	0.86	0.73	0.35	0.52	Karnataka	0.96	0.76	0.67	0.38	0.40
Kerala	0.99	0.91	0.74	0.32	0.29	Kerala	0.98	0.88	0.65	0.13	0.24
Tamil Nadu	0.98	0.74	0.44	0.31	0.32	Tamil Nadu	0.97	0.72	0.47	0.31	0.29

Source: Computed as per the methodology suggested by Mishra et al (1999), using data from Primary Census Abstract of 2001 and 2011 released by the Census of India

It is also visible from Table 8 that for the states which show a more or less converging trend, the CPR (II) would be the lowest in 2011. This is because the progressions towards the higher end have decreased; while it is expected that progression at the lower end towards higher class sizes would increase, leading to a convergence. This is manifest in the form of Chattisgarh having the worst scenario with maximum progression still towards the higher end. Kerala on the other hand shows a healthier urbanisation due to an even spread, with decreasing population concentration in higher class sizes. In essence, the progressions over the past decade do not seem to be encouraging in terms of the spread of urbanisation although the degree of urbanisation given by the U/T ratio has been increasing for all the states unanimously. This being said, it is necessary to treat the degree of urbanisation with caution and it must be discount for the uneven nature of the spread of the urbanisation process.

Class Progression Index- 2001-11

Since the Class Progression Ratios become difficult to compare over a large period of time and across a large number of states, the Class Progression Index may be used to provide a more aggregated picture. This is measured as follows:

$CPI = P_6 + P_6P_5 + P_6P_5P_4 + P_6P_5P_4P_3 + P_6P_5P_4P_3P_2$, where Pi denotes CPR (i)[11]

Table 9: Class Progression Index: 2001 to 2011

	CPI		Growth
States	**2001**	**2011**	**2001-11**
Punjab	2.46	2.23	-9.617
Uttarakhand	1.66	1.87	12.297
Haryana	2.77	2.47	-11.035
Rajasthan	2.77	2.60	-5.976
Uttar Pradesh	2.43	2.30	-5.400
Bihar	3.20	2.96	-7.346
Jharkhand	2.19	1.76	-19.720
West Bengal	2.28	1.69	-25.761
Odisha	2.41	1.85	-23.464
Chattisgarh	2.35	1.85	-21.406
Madhya Pradesh	2.29	2.28	-0.523
Gujarat	2.72	2.35	-13.824
Maharashtra	2.73	2.47	-9.784
Andhra Pradesh	3.31	3.06	-7.609
Karnataka	2.74	2.43	-11.061
Kerala	2.84	2.50	-11.727
Tamil Nadu	2.16	2.12	-1.719

Source: Computed as per the methodology suggested by Mishra et al (1999), using data from Primary Census Abstract of 2001 and 2011 released by the Census of India.

The Class Progression Index between the two decades of 2001 and 2011 show a falling trend in most states except Uttarakhand, where a positive trend is seen. Subsequently, the growth rates of the CPI from 2001-11 for these states are negative. This shows an unhealthy nature of urbanisation, with higher negative growth witnessed in the states where the convergence of the CPR between the two periods across class sizes as desired is not witnessed. For instance, West Bengal is a case where the progression from Class VI to V has actually worsened from 0.93 to 0.90 from 2001 to 2011, while there is only a minute fall in CPR from Class II to I from 2001-11 (0.67 to 0.63). The largest inequalities in these terms are seen in the states with the most negative growth rates in the CPI, namely West Bengal, Odisha, Chattisgarh and Jharkhand leading the rest. It is therefore important to interpret these ratios and indices carefully, so as to arrive at the true picture of the spread of the urbanisation in these states.

[11] See Mishra U S, Irudaya Rajan and M Ramanathan (1999)

Degree and Spread adjustment

In view of the findings above, the urbanisation ratio for the major Indian states is adjusted by the Class Progression Index. A high CPI shows better progression from lower classes to higher class towns/cities while the gap between the extreme ends i.e. the highest class towns and the lower class towns is reducing. Therefore, with the highest CPI being given a value 1, other CPI values are indexed based on the maximum CPI in the series as follows:

$$Indexed\ CPI = \frac{CPI\ of\ a\ particular\ state}{Highest\ CPI\ in\ the\ series}$$

This gives indexed CPI for states relative to the ideal CPI or the state with the highest CPI. Once the CPI of each state is indexed according to the ideal, the series is multiplied with the original U/T ratio to adjust the same with CPI. This in a way acts as a punishment strategy for the states with an unhealthy spread of urbanisation with large gaps between progression among different class sizes; the indexed value of CPI against the ideal CPI then acts as a deflator of the existing U/T ratio in cases and to the extent of unhealthy spread of urbanisation.

Table 10: Spread adjusted degree of urbanisation

States	U/T	CPI	Indexed	Adjusted U/T
Andhra Pradesh	0.33	3.06	1.00	0.33
Bihar	0.11	2.96	0.97	0.11
Rajasthan	0.25	2.60	0.85	0.21
Kerala	0.48	2.50	0.82	0.39
Haryana	0.35	2.47	0.81	0.28
Maharashtra	0.45	2.47	0.81	0.36
Karnataka	0.39	2.43	0.80	0.31
Gujarat	0.43	2.35	0.77	0.33
Uttar Pradesh	0.22	2.30	0.75	0.17
Madhya Pradesh	0.28	2.28	0.75	0.21
Punjab	0.37	2.23	0.73	0.27
Tamil Nadu	0.48	2.12	0.69	0.33
Uttarakhand	0.30	1.87	0.61	0.18
Chattisgarh	0.23	1.85	0.60	0.14
Odisha	0.17	1.85	0.60	0.10
Jharkhand	0.24	1.76	0.58	0.14
West Bengal	0.32	1.69	0.55	0.18

Source: Own calculations based on above analysis

This being said however, it is more important to note that the gaps between states in terms of urbanisation change drastically once adjusted for the spread of urbanisation. For instance, with Andhra Pradesh having the highest CPI, the U/T ratio remains as before. The gap between Andhra Pradesh and Gujarat however has fallen largely as a result of the adjustment; with 43% as the U/T ratio in Gujarat and 33% in Andhra Pradesh, the adjustment has brought down the distance from (0.43-0.33) to 0, by reducing U/T in Gujarat to 33%. Similarly, the gap between Andhra Pradesh and West Bengal, originally 1% has risen to 15 per cent. This in turn gives a clear picture of the degree as well as spread of urbanisation which is comparable between states.

Conclusion

This paper has summarised different ways of correctly interpreting the mathematical and statistical nuances of urbanisation ratio for meaningful policy discussions. The Dasgupta decomposition has been done at the state level and gives insights into the main driving force behind growth in urbanisation in various states; whether it is due to a larger increase in urban population(as a result of increase in the number of Census towns leading to a larger urban population, or migration of population towards towns) or whether it is due to a lower increase in the denominator; i.e. the total population in which case urbanisation is not increase in urban population, but a mere calculation with no policy insight or use. We find that generally, the U/T ratio has increased due to increase in the numerator rather than a larger fall in the denominator. The mathematical also decomposition shows that urbanisation ratio in 2011 is higher for those states where urbanisation ratio in 2001 was sufficiently high, or when growth in urban population has been significant and accompanied with smaller growth in total population. Urbanisation has however not been spreading evenly; for most of the states there is a fall in Class Progression Ratio from Class VI to V from 2001 to 2011. This is discouraging, especially given that in most cases, it is accompanied by a rise in progression from Class II to I towns over the decade which indicates bias towards larger towns; thus showing no signs of convergence towards an even spread of the urban transition.

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