



Article

India's Urban System: Sustainability and Imbalanced Growth of Cities

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Abstract: This paper maps out the structure and relative dynamics of cities of various size classes in India. It aims to address their hierarchical distribution, by employing the rank-size rule, Gibrat's law, and a primacy index. The implications of urban concentrations for GDP, banking system, FDI, civic amenities, and various urban externalities (such as pollution and spatial exclusion) are also examined. It shows that India's urban system, though it follows the rank-size rule, is huge and top-heavy. It follows also Gibrat's law of proportionate growth. Although India's cities collectively account for less than one third of the total population, they command more than three fourths of the country's GDP. Megacities have become congested, clogged, polluted, and also show significant social polarization. There is a gridlock situation for the cities, inhibiting their potential for becoming effective economic and social change sites. The top-heavy character of India's urban system also adversely impacts the balanced regional development of the country.

Keywords: urbanization; imbalanced growth; hierarchical distribution; rank-size rule; Gibrat's law; primacy index

1. Introduction

According to population studies by the United Nations, the human geography in our world has entered a new epoch, namely, the 'urban century'. The city—or in a more general sense, the urban agglomeration—has become increasingly the geographic orientation point or magnet of human activity. The city has become the natural economic habitat of people, the 'home of man' [1]. Today, more than 50% of the world population lives in urban areas. The turning point took place around 2008, when for the first time in human history, more than 50% of the world's population (about 3.3 billion) started living in urban areas [2]. Whereas in the Global North, this transformation had already taken place in the twentieth century, the Global South is entering the urban revolution in the 21st century. It is estimated that by 2030, about 5 billion people will be city dwellers, out of which more than 80% will be from developing countries. In the meantime, during the period of 2000 to 2030, the urban population of Asia and Africa will double from 1.7 billion to 3.4 billion [2]. Given the expected positive association between urbanization and economic growth, it is plausible that this transformation to an urban age offers the Global South a unique opportunity for economic development and to improve quality of life for a large share of its deprived population. However, the success of this development will largely depend on how the Global South is able to design, govern, and manage its cities for these strategic ends.

India is one of the major emerging economies of the Global South, after China. The country has a long history of unbalanced urbanization [3]. Like many other countries of the Global South, it is undergoing an urban revolution. Its cities are experiencing a massive growth of population. However, a significant share of its population still lives in poverty and substandard conditions. The ongoing urban revolution offers the country a great opportunity for economic, social, and ecological transformation so as to emerge as a developed country [4]. However, it has been argued by many researchers that Indian urbanization may be unsustainable, as it is largely unmanaged [4–7].

The challenges of unsustainability surround the Indian cities at multiple levels. First, the urban system is dominated by a few large cities, clustered in the western flank of India, with huge implications for balanced regional development. Second, large cities control a significant share of the Indian economy, the propulsive industries, and new economic opportunities. Third, a majority of cities in India face hard challenges related to housing, transport, electricity, water supply, pollution, and congestion. Fourth, internally, most cities are also marked by significant social exclusion, crime, and violence. Fifth, the government policies to tackle the urban challenges and to avail the emerging opportunities have been lackadaisical and, in many ways, irrelevant to solve pressing problems.

In this context, the present paper attempts: (a) To examine India's urban system in terms of the hierarchical distribution of cities; (b) to analyze the concentration of economic resources in cities and how this distribution is shaped by megacities; (c) to understand the housing, water, transport, and related ecological challenges in Indian cities; and (d) to examine the social exclusion, specifically, religious exclusion.

The rest of the paper is organized as follows. Section 2 presents a review of the relevant literature, while Section 3 examines the urban system of India by examining the size-class distribution of cities, using the Rank-Size Rule method, Gibrat's law of proportionate growth and the primacy index. Next, Section 4 focusses on the metropolitanization of the Indian economy through a concentration of economy, bank credits, bank deposits, credit-deposit ratios, and foreign direct investments, while Section 5 examines the issues related to governance, housing, water, transport, and related ecological challenges. Section 6 addresses the social exclusion in Indian cities, while Section 7 concludes the paper.

2. Setting the Context

Cities are not islands, but part of a broader interactive spatial fabric. They have an internal structure and dynamics (e.g., morphology, density, share of public vs. private space), but are also subjected to external driving forces (e.g., economic competition, nodal position in a spatial network). The conceptualization and analysis of cities has followed two streams of approaches, namely, location and agglomeration theory [8–10] and urban systems theory [11–13]. Various hypotheses have been launched in the course of history to understand and explain the complex patterns and dynamics of cities and their hinterland, such as central place theory, spatial dominance theory, core-periphery theory, differential urbanization, and so forth [14]. But most publications were retrospective in nature, and did not foresee the unprecedented dynamics in urbanization which led to the current 'urban century'.

To understand the 'age of the city'—or the '*New Urban World*' [15]—the attention has to be focused on key elements in the force field of modern cities. These are:

- The city as a collective magnet for a great diversity of economic activities ('urban buzz' [16]), caused by the efficiency-enhancing constellation of a city (appropriate infrastructure, market information and access, etc.)
- The city as an externality-driven economic organism that is attracting business and people, as a result of scale and agglomeration advantages (supply of educational facilities, presence of suppliers, etc. [17]).
- The city as a concentration of social capital or as a 'melting pot' [18] of culturally or socially diversified groups.
- The city as a powerful political and economic node in a network of cities, a position referred to as '*urban empire*' in [19].

- The city as an ever-expanding power-block, which reinforces its position to the detriment of towns and villages in its hinterland [20].

The above sketch of the contemporaneous position of cities in our world has to be placed in the perspective of the dynamics of modern settlement systems. Two constituents in the complex force field of cities have to be mentioned here, namely, natural growth and migration. Both factors play a critical role in the rise in urbanization, in particular in the developing world.

Current statistics show an unprecedented rise in urban growth in countries in the emerging and developing world. Especially Latin-American, African, and Asian countries witness a historically unique increase in urbanization, with two particular features: (i) Medium-sized and large cities turn into ever expanding large cities (including mega-cities with more than 10 million inhabitants); (ii) the number of medium-sized and large cities is increasing even faster. This so-called *double urbanization* is one of the striking characteristics of the *New Urban World* [15]. Consequently, the relative share of villages and small cities is decreasing; they tend to become a ‘minority’. This decline in importance of rural or peripheral settlements tends to erode their public amenities (cultural provisions, education, health care systems, etc.), which often prompts a vicious circle of downward change: Less amenities in smaller centers means that more people are attracted by higher-scale amenities in big cities.

The above-mentioned trend takes place in many countries—and certainly in countries in the Global South—and explains to a large extent the current urban revolution in settlement patterns all over the world. This trend is particularly visible in India. The large mega-cities in this country are showing a disproportionately fast growth pace over the past decades, but also the number and size of large and medium-sized cities are rapidly growing, while the rural part of India—which still represents the majority of settlements in this country—is gradually lagging behind, at least relatively. In the next section, we provide an analysis of urban settlement patterns in India.

3. India’s Urban System

With about 1.21 billion in population in 2011, India was one of the second largest countries after China in terms of size of population [21]. Although the present share of the urban population in India is relatively small, namely about 31.2%, but it is quite large in absolute number, namely, about 377 million [22]. Furthermore, the decadal growth of urban population in India, though with a lower base, has been higher than the growth rate of the rural population from 1931 onwards (Table 1). The differences in the growth rates of the urban and rural population have been quite significant in some of the past decades. For instance, in 1951, mainly due to immigration of population from Pakistan (also due to religious riots), many people moved to urban areas where safety was higher; and in later years, the urbanization has reached its own momentum of growth due to (i) migration from rural to urban areas, (ii) the identification of new settlements as urban (There have been some changes in the definition of ‘urban’ over the years, and these changes have impacted the number of settlements declared as urban. However, it is not possible to reconstruct the past data with the revised definitions, therefore, the number of towns and urban population as published by Census of Indian 2011 for the years 1901 to 2011 have been used in this study. In India, prior to 1951, the definition of urban was arbitrary. An urban center was identified on the bases of (i) urban local body or municipality, (ii) civil lines, which were outside the boundary of municipality/local body, and (iii) all the cantonments and all other contiguous clusters of houses inhabited by 5000 or more number of persons. In this identification, the Census superintendent was empowered to take a decision to declare a settlement as urban, keeping in mind the density of dwellings, historic nature of the settlement, importance of the settlement in trade, and to avoid declaring an overgrown village (without urban characteristic) as a town [23]. The Census of 1951 used the following criteria to define a settlement as urban: (i) Population not less than 5000, and (ii) settlements with less than 5000 population, but having urban characteristics like supply of drinking water, electricity, schools, post offices, hospitals, etc. Census superintendents were empowered to take decisions for declaring and identifying settlements as urban based on these characteristics. In 1961, more strict criteria to identify ‘urban’ was adopted, and these were: (a) Statutory towns—all places

with statutory bodies like city corporation, municipality, cantonment boards, or a notified town area committee, (b) census towns—all the places which satisfied the following criteria: (i) Population of 5000 and above; (ii) density of population not less than 400 persons per square kilometer; and (iii) at least 75% of male population engaged in non-agricultural work [24]. A small change in this definition of census towns was brought in 1971, in which the b(iii) criterion was changed to ‘at least 75% of the male main working (a worker is main worker if he/she has worked for not less than 183 days in the year preceding the census) population engaged in a non-agricultural sector. Since 1971, there has not been any change in the definition and criteria of identification of ‘urban’ by the Census of India [22]. The changes of definition in 1951 and 1961 led to a decline in the number of towns from 3060 in 1951 to 2700 in 1961 (see [25] for details). India added 2774 new Census Towns in 2011, more than in any previous censuses without any revision in definition adopted in 1971. Some researchers have called this ‘Census activism’ [26].), and (iii) the natural increase in urban population.

Table 1. Size and growth of urban population in India, 1901–2011.

| Year | Population (in Million) | Absolute Change (in Million) | % of Urban Population | % Change in Urban Population | % Change in Rural Population |
|------|-------------------------|------------------------------|-----------------------|------------------------------|------------------------------|
| 1901 | 25.9 | – | 10.8 | – | – |
| 1911 | 25.9 | 0.1 | 10.3 | 0.4 | 6.4 |
| 1921 | 28.1 | 2.1 | 11.2 | 8.4 | -1.3 |
| 1931 | 33.5 | 5.4 | 12.0 | 19.1 | 10.0 |
| 1941 | 44.2 | 10.7 | 13.9 | 32.0 | 11.8 |
| 1951 | 62.4 | 18.3 | 17.3 | 41.4 | 8.8 |
| 1961 | 78.9 | 16.5 | 18.0 | 26.4 | 20.6 |
| 1971 | 109.1 | 30.2 | 18.2 | 38.2 | 21.9 |
| 1981 | 157.7 | 48.6 | 23.3 | 44.5 | 19.3 |
| 1991 | 215.8 | 58.1 | 25.7 | 36.8 | 19.7 |
| 2001 | 286.1 | 70.3 | 27.8 | 32.6 | 18.3 |
| 2011 | 377.1 | 91.0 | 31.2 | 31.8 | 12.3 |

Source: Based on data from [22]. Note: Some of the computed values may not appear as exact or very small. Changes shown as zero because of rounding off.

3.1. Size-Class Distribution

India’s urban system is top-heavy. That is, a few mega-urban centers accommodate a significantly higher proportion of the total urban population than those by medium and small cities. This top-heavy system has emerged because of the nature of historical experience the Indian economy went through. In the colonial period (roughly mid-19th century to mid-20th century), the port and capital cities acquired major importance. The port cities became major conduit of exports and imports, and in this way Kolkata, Mumbai, and Chennai emerged. Later on, industries—particularly, textile and, after independence, petrochemical industries—also started locating themselves in these urban centers, attracting workers from neighboring regions. Till today, these cities remain major urban centers in their respective regions and also centers of economic opportunities. Delhi—due to political factors, as capital city—started growing, while later educational institutions and industries started locating in and around Delhi. Today, Delhi has emerged as one of the biggest conurbation regions of India, including many negative externalities.

With the economic opportunities diffusing and given the large geographical surface of the country, other secondary urban centers in India also started emerging, giving rise to a second layer: Bangalore, Pune, Nashik, Hyderabad, Mangalore, etc. The top-heaviness of the urban system has not only persisted over the years, but it has also sharpened. This can well be seen from the fact that, though there are a large number of towns in India (see Table 2), the major share of the urban population has been in Class I cities (population of 100,000 and above), whose total share in the total number of towns is significantly small; for instance, it was only 7.6% in 2011, but these towns had 70.2% of the total

urban population (Table 3). The share of other classes of the towns in the total urban population has over the years declined, but their share in the total number of towns, except class VI, has increased. In fact, as we shall see in the following sections, the economic importance of large cities (million plus cities) have consistently increased. The number of million plus cities in India rose from 5 (with a share of the total urban population of 18.81%) in 1951 to 23 (32.54% of the urban population) in 1991, and to 53 (42.62% of the urban population) in 2011 (see Table 4).

This consistent strengthening of ever-increasing large cities in the urban system in India is well illustrated by the Lorenz curve in Figure 1. The Indian urban system—in terms of distribution of population in different size-class of cities—has clearly become more unequal. The small and medium cities' share in total urban population has consistently declined over the years, and that is why the Lorenz curves for the selected years plotted in Figure 1, have progressively shifted away from the diagonal (or the line of equality). As a consequence, and parallel to his observation, the Gini coefficient has increased consistently (Figure 2). The higher increases in the coefficient occurred in 1941, 1951, 1961, and 2011, when the share of population of Class I cities increased substantially. The share of Class I cities in the total urban population was 31.2% in 1931, it increased to 38.2% in 1941, 51.4% in 1961, and 57.2% in 1971. As mentioned above, the share of Class I cities further consolidated between 2001–2011. It has increased to 70.2%, in 2011, of the total urban population in the country from 68.6% in 2001.

Table 2. Number of towns by size-class in India, 1901–2011.

| Year | No. of Towns | | | | | Total Number of Towns | |
|------|--------------|-----|------|------|------|-----------------------|-------|
| | I | II | III | IV | V | IV | Total |
| 1901 | 24 | 43 | 130 | 391 | 744 | 479 | 1811 |
| 1911 | 23 | 40 | 135 | 364 | 707 | 485 | 1754 |
| 1921 | 29 | 45 | 145 | 370 | 734 | 571 | 1894 |
| 1931 | 35 | 56 | 183 | 434 | 800 | 509 | 2017 |
| 1941 | 49 | 74 | 242 | 498 | 920 | 407 | 2190 |
| 1951 | 76 | 91 | 327 | 608 | 1124 | 569 | 2795 |
| 1961 | 102 | 129 | 437 | 719 | 711 | 172 | 2270 |
| 1971 | 148 | 173 | 558 | 827 | 623 | 147 | 2476 |
| 1981 | 218 | 270 | 743 | 1059 | 758 | 253 | 3301 |
| 1991 | 300 | 345 | 947 | 1167 | 740 | 197 | 3696 |
| 2001 | 393 | 401 | 1151 | 1344 | 888 | 191 | 4368 |
| 2011 | 468 | 474 | 1373 | 1683 | 1749 | 424 | 6171 |

Source: Based on data from [22]. Note: Data refer to the number of towns (urban agglomerations (UA) + towns not included in agglomerations). In 2011, there were a total of 298 UA and 170 towns in Class-I (population 100,000 and above); in class II (population 50,000–99,999), 100 UA and 374 towns; in Class III (population 20,000–49,999), 75 UA and 1298 towns; in Class IV (population 10,000–19,999), 1 UA and 1682 Towns; in Class V (population 5000–9999) 0 UA and 1749 towns; in Class VI (population < 5000), 0 UA and 424 towns.

Table 3. Percentage of urban population by size-class in India, 1901–2011.

| Year | Percentage of Urban Population by Size-Class | | | | | |
|------|--|------|------|------|------|-----|
| | I | II | III | IV | V | IV |
| 1901 | 26.0 | 11.2 | 15.6 | 20.8 | 20.1 | 6.1 |
| 1911 | 27.4 | 10.5 | 16.4 | 19.7 | 19.3 | 6.5 |
| 1921 | 29.7 | 10.3 | 15.9 | 18.2 | 18.6 | 7.0 |
| 1931 | 31.2 | 11.6 | 16.8 | 18.0 | 17.1 | 5.2 |
| 1941 | 38.2 | 11.4 | 16.3 | 15.7 | 15.0 | 3.1 |
| 1951 | 44.6 | 9.9 | 15.7 | 13.6 | 12.9 | 3.1 |
| 1961 | 51.4 | 11.2 | 16.9 | 12.7 | 6.8 | 0.7 |
| 1971 | 57.2 | 10.9 | 16.0 | 10.9 | 4.4 | 0.4 |
| 1981 | 60.3 | 11.6 | 14.3 | 9.5 | 3.5 | 0.5 |
| 1991 | 65.2 | 10.9 | 13.1 | 7.7 | 2.6 | 0.3 |

Table 3. Cont.

| Year | Percentage of Urban Population by Size-Class | | | | | |
|------|--|-----|------|-----|-----|-----|
| | I | II | III | IV | V | IV |
| 2001 | 68.6 | 9.7 | 12.2 | 6.8 | 2.3 | 0.2 |
| 2011 | 70.2 | 8.5 | 11.1 | 6.4 | 3.4 | 0.4 |

Source: Based on data from [22].

Table 4. Growth of million plus cities and their population, 1901–2011.

| Census Years | Number of Cities | Population (Million) | City Population as % of | |
|--------------|------------------|----------------------|-------------------------|------------------------|
| | | | Total Population | Total Urban Population |
| 1901 | 1 | 1.51 | 0.63 | 5.84 |
| 1911 | 2 | 2.76 | 1.10 | 10.65 |
| 1921 | 2 | 3.13 | 1.25 | 11.14 |
| 1931 | 2 | 3.41 | 1.22 | 10.18 |
| 1941 | 2 | 5.31 | 1.67 | 12.02 |
| 1951 | 5 | 11.75 | 3.25 | 18.81 |
| 1961 | 7 | 18.10 | 4.12 | 22.93 |
| 1971 | 9 | 27.83 | 5.08 | 25.51 |
| 1981 | 12 | 42.12 | 6.16 | 26.41 |
| 1991 | 23 | 70.16 | 8.37 | 32.54 |
| 2001 | 35 | 107.88 | 10.50 | 37.81 |
| 2011 | 53 | 160.71 | 13.28 | 42.62 |

Source: Based on data from [22].

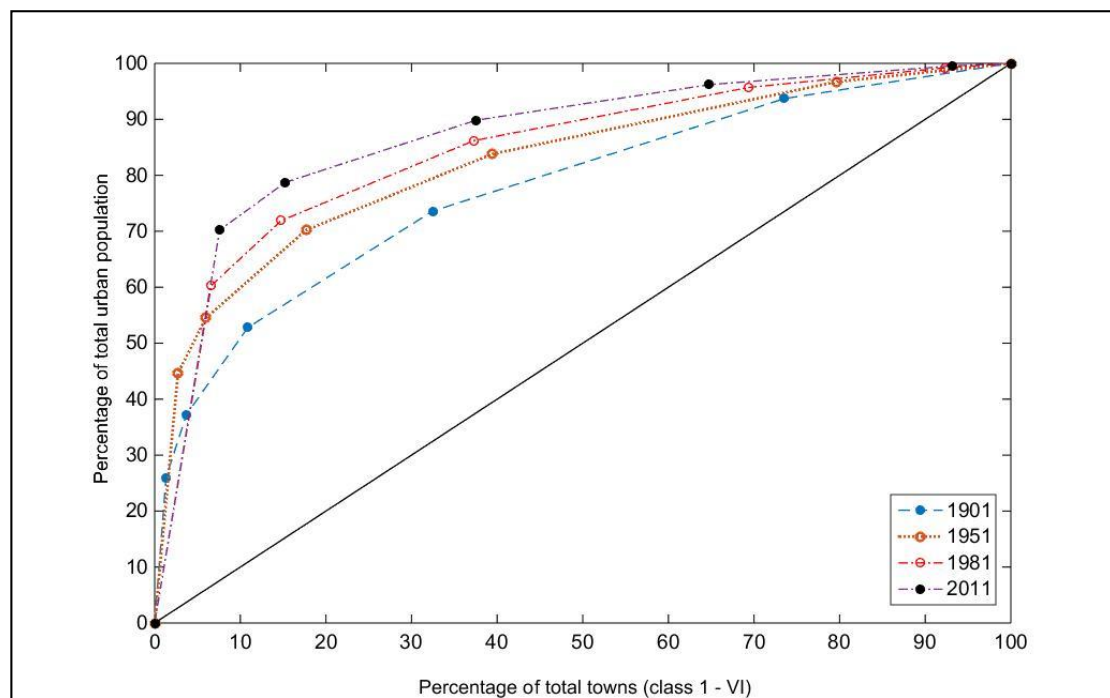


Figure 1. Lorenz curve for towns and urban population in India (1901–2011). Source: Computed using data from [22].

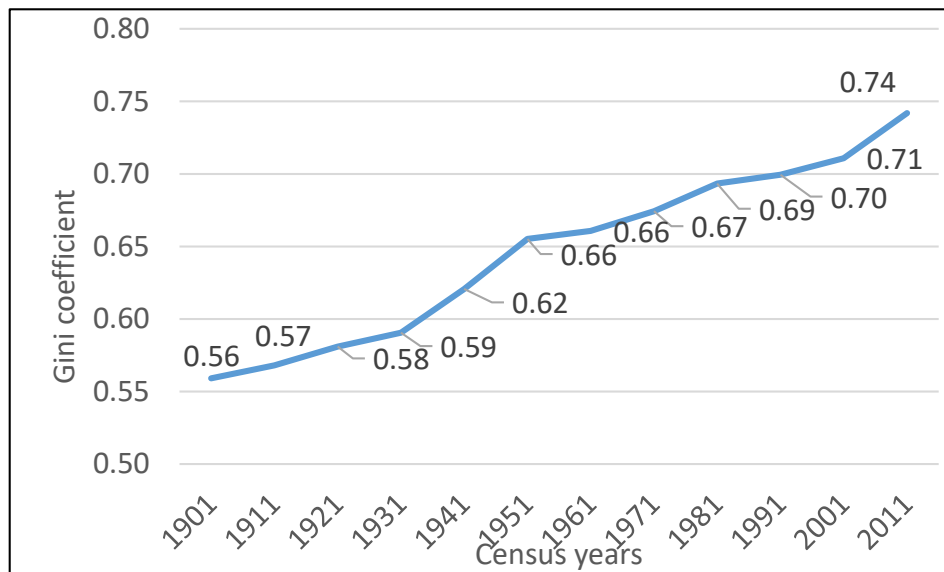


Figure 2. Gini Coefficient for population distribution between size classes of cities (Class I to Class VI) (1901–2011). Source: Computed using data from [22].

3.2. Rank-Size Rule

The hierarchical distribution of cities and their rank orders within a country have been one of the important areas of research in urban systems studies. Empirical analyses have supported this idea that generally the hierarchy of cities in a country conforms to what [27] is called the rank-size rule distribution of cities. In an urban system conforming to a rank-size rule distribution, the population of n^{th} order city (P_n), in descending order of population, is:

$$P_n = \frac{P_1}{n} \quad (1)$$

or

$$P_n = P_1 / r_n^q,$$

where P_1 is the population of the highest-order city, that is, the rank 1 city with the highest volume of population; r_n^q is ordinal rank number of the observed city. If we take the log of the rank and the population of the towns and plot the results on an x-y axis, we observe a straight-line distribution. When we take the log of both sides of Equation (1), we can write Equation (1) as:

$$\ln P_n = \ln P_1 - q \ln r_n \quad (2)$$

This, as mentioned above, gives rise to a linear functional correlation between the population of the cities and the rank of these cities. This functional relationship can also be presented in a regression equation with Y as a rank of the towns, constant (α), and population as X ,

$$\ln Y = \ln \alpha - q \ln X \quad (3)$$

This implies that if the urban system of a country follows a rank-size rule distribution, the estimated coefficient of the downward sloping line will be -1 ; higher values (-1 to 0) will indicate that bigger cities are disproportionately larger and have a large share of the total urban population, while values less than -1 indicate that the population is dispersed in a large number of cities [28]. The empirical results of the rank-size distribution of Indian cities over the period 1901–2011 can be found in Figures 3 and 4.

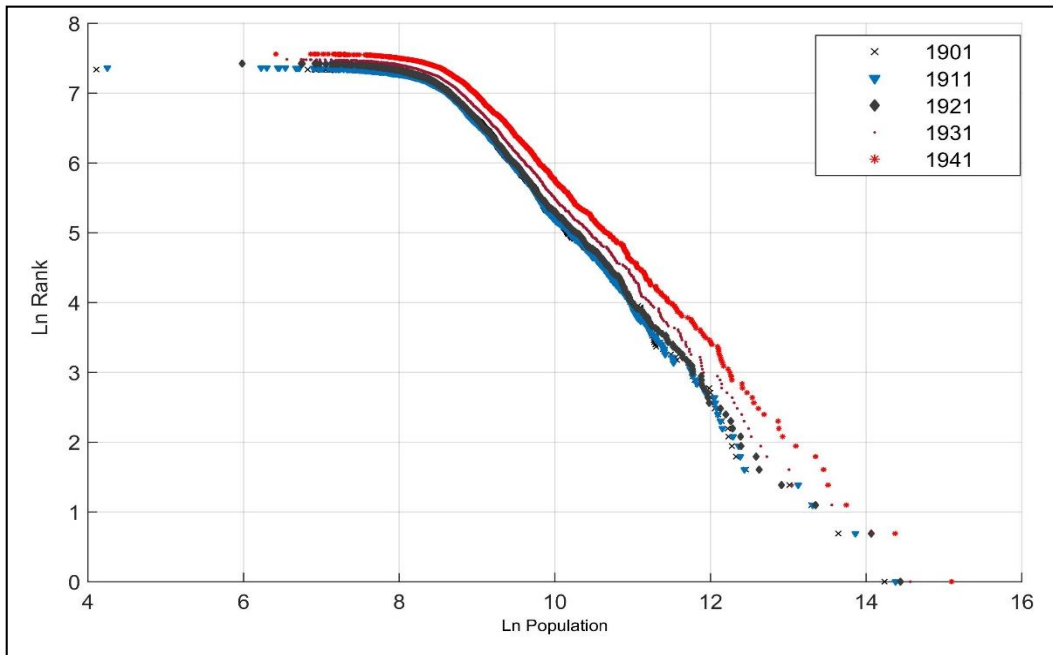


Figure 3. Logarithmic distribution of city population and rank in India, 1901–1941. Source: Computed using data from [22].

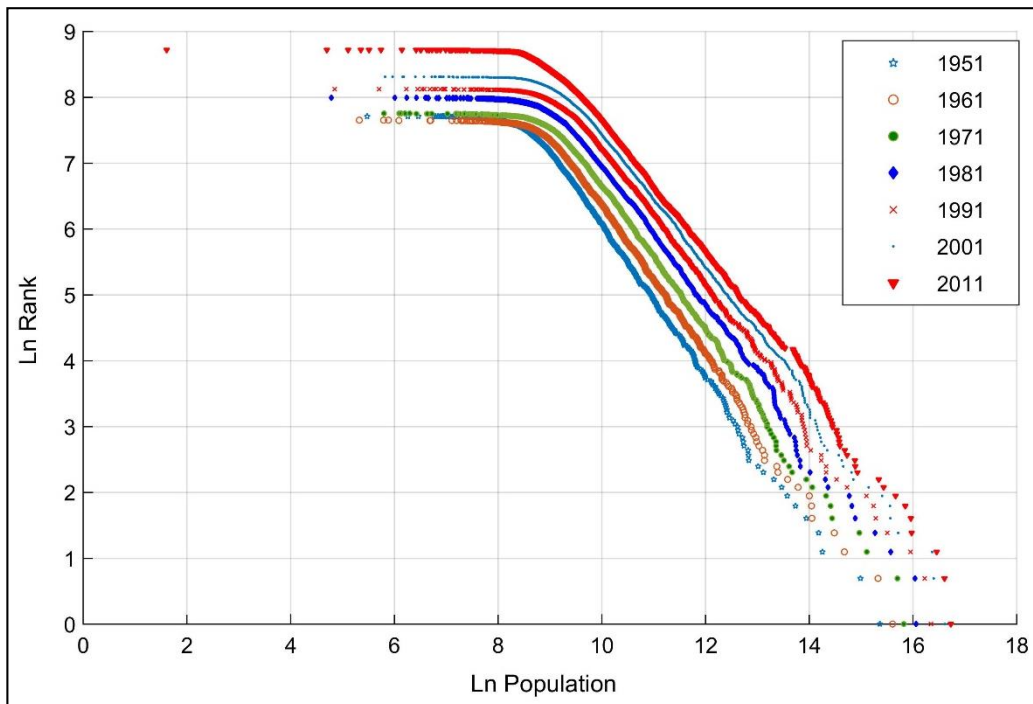


Figure 4. Logarithmic distribution of city population and rank in India, 1951–2011. Source: Computed using data from [22].

In general, the rank-size rule distribution of cities is mostly found in developed countries where there is a relatively balanced regional development. It is plausible to expect that spatially unbalanced developed economies will lead to a migration of population to bigger cities, giving rise to a lower share of the population in lower-order cities in comparison to what is generally expected from the rank-size rule distribution. The concentration of a larger share of the population in top rank cities is also called primacy of these cities. If the rank 1 city has more than double of the population of the 2nd order city

(as expected under a rank-size rule distribution), it is called the primate city. Commonly, the primacy of the city of rank 1—denoted as C_1 —is measured as the ratio between P_1 and P_2 , as presented below:

$$C_1 = P_1/P_2 \quad (4)$$

According to the rank-size rule:

$$P_1 = P_2 + P_3 + P_4 \quad (5)$$

Thus, the population of a rank 1 city is equal to the sum of the population of rank 2, rank 3, and rank 4 cities. Therefore, we can also use the ratio between population of rank 1 city and the sum of the population of ranks 2–4 to find out whether they are equal to 1 (no primacy) or have a primacy, denoted as C_2 , in relation to the 3 lower-order cities. This ratio also helps us to find out the distribution of the population in the 4 top cities and their imbalances, if any, within.

The rank-size rule distribution of the Indian cities from 1901 to 2011 are presented in Figures 3 and 4. It is evident from these figures that over the years there have been definite orders of these cities close to the rank-size rule, but there is also a huge concentration of cities with a low population size at the lower end, with the log of ranks 7–9 having a log of the population of 4.0–8.5. Figure 5—with the urban kernel density function—shows that the highest number of cities was located in the band of the log of population 8.0 to 10.0, although in later years, with an increase in the population of cities, it has shifted to the band of about log 8.0 to 12.0. Further, there seems to be largely a log-normal distribution of cities which is found in the rank-size rule conformity of the urban hierarchy.

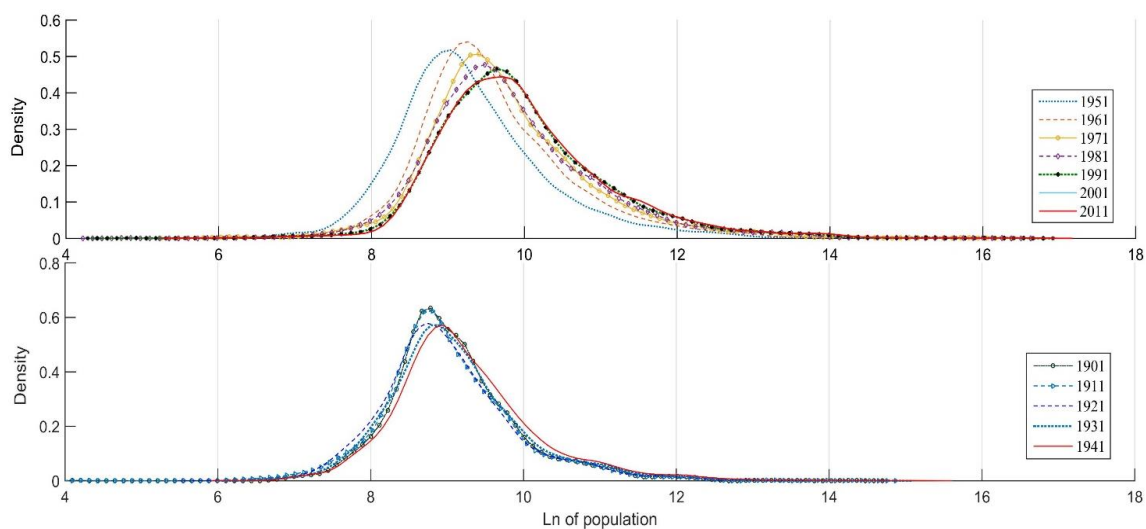


Figure 5. Kernel density function of distribution of cities, 1901–2011. Source: Computed using data from [22].

The regression results produced in Table 5 show that in India from 1901 till 2011, the urban system has followed the rank size rule, but the primacy has been strengthening (the regression coefficient has increased over the years). The Zipf coefficient or β values have increased from -1.099 (nearly in conformity with the rank-size rule) in 1901, to -0.959 in 1951 to -0.854 in 2011, showing that city size distribution in India has progressively and steadily moved away from a rank-size rule distribution towards a dominance of large cities. That means the slope of the lines have become flatter over the years. It is not, therefore, any surprise to see that the size of the largest city population has also risen over the years. In 1901, the size of the largest city (UA) in the total urban population was 1.52 million, which increased to 4.69 million in 1951, and further increased to 18.39 million in 2011. The share of the top five cities (UA) in the total urban population has also increased from 14.15% to 20.82% in 1971, and thereafter it has declined to reach 17.50% in 2011 (Table 6). Further, there have not been many

differences in the size of the top three cities in terms of population in 2001 and 2011, while during 1951–1991 the top three cities had a rather similar population size. This shows that there is not one city dominance in India, but a group of top cities. Given the large geographical size of India and the lop-sided regional economic development [29], this is plausible. Linsky [30] has pointed out that primacy will be more prominent in countries with small territorial extents, but it is noteworthy that India has a large territorial extent. However, the states in India are of the size of many European countries and, as such, the polarized development within the individual states has created a primacy within these states. In all major states of India, a few major cities have a disproportionately large population, for instance, Mumbai in Maharashtra, Kolkata in West Bengal, Chennai in Tamil Nadu, and Hyderabad in Telangana. Given the fact that in India, there is a group of large cities, the primacy indices, both C_1 and C_2 , are, except in 1941, lower than expected as per the conventional rank-size rule (Table 6).

Table 5. Conformity of distribution of Indian cities to Rank-Size Rule, 1901–2011.

| Year | Intercept | Beta Coefficient | t-Value | p-Value | R-Squared |
|------|-----------|------------------|----------|---------|-----------|
| 1901 | 16.343 | −1.099 | −143.880 | 0.000 | 0.931 |
| 1911 | 15.767 | −1.041 | −128.070 | 0.000 | 0.912 |
| 1921 | 16.048 | −1.066 | −165.640 | 0.000 | 0.942 |
| 1931 | 16.020 | −1.045 | −172.380 | 0.000 | 0.943 |
| 1941 | 15.992 | −1.020 | −187.180 | 0.000 | 0.948 |
| 1951 | 15.647 | −0.959 | −195.290 | 0.000 | 0.945 |
| 1961 | 15.747 | −0.946 | −182.870 | 0.000 | 0.941 |
| 1971 | 15.562 | −0.901 | −178.610 | 0.000 | 0.932 |
| 1981 | 15.565 | −0.873 | −215.380 | 0.000 | 0.941 |
| 1991 | 15.749 | −0.866 | −234.550 | 0.000 | 0.942 |
| 2001 | 15.892 | −0.858 | −280.830 | 0.000 | 0.951 |
| 2011 | 16.058 | −0.854 | −374.590 | 0.000 | 0.958 |

Source: Computed using data from [22].

Another, often reported, empirical regularity about cities addresses the proportionate growth of cities. This regularity shows that there is generally no correlation between the size of cities and their population growth rates. The small and big cities grow largely at random rates. This means that the underlying stochastic process of growth is the same for all cities. This is a well-known proposition by Gibrat [31], which was originally put forward by the astronomer Kapteyn [32], who stated, “a stochastic growth process that is proportionate gives rise to an asymptotically lognormal distribution” [33]. In India, the number of cities has risen over the years and therefore, the growth rates can be computed based on the regularities of the cities. We note that many cities have been de-classified or that their names are not matching over the years, and therefore, they have been dropped from the computation of growth rates. We computed the growth of 1190 cities for 1901–2011, and of 1649 cities for 1951–2011 based on the regularity of population data. The growth rates of population are plotted against the *log* of population of these cities in Figures 6 and 7. These results show that the Indian urban system follows the Gibrat’s proportionate growth thesis. This also means that cities will most likely not converge in terms of their population.

Table 6. Top 5 largest city populations and primacy index, 1901–2011.

| Rank | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Total Population of Five Top Rank Cities | C_1 | C_2 | % of Total Urban Population | Mean Population of Cities/Towns | Standard Deviation of Population | Number of Cities/ Towns |
|------|--------|--------|--------|--------|--------|--|-------|-------|--------------------------------|---------------------------------------|--|-------------------------------|
| 1901 | 1.52 | 0.84 | 0.59 | 0.45 | 0.26 | 3.66 | 1.81 | 0.81 | 14.15 | 16,087 | 52,406 | 1537 |
| 1911 | 1.76 | 1.05 | 0.60 | 0.50 | 0.25 | 4.16 | 1.68 | 0.82 | 16.04 | 15,746 | 58,689 | 1579 |
| 1921 | 1.87 | 1.29 | 0.63 | 0.41 | 0.30 | 4.50 | 1.46 | 0.81 | 16.01 | 16,042 | 62,337 | 1678 |
| 1931 | 2.12 | 1.32 | 0.77 | 0.47 | 0.45 | 5.13 | 1.61 | 0.83 | 15.33 | 18,067 | 68,582 | 1777 |
| 1941 | 3.60 | 1.75 | 0.93 | 0.74 | 0.70 | 7.71 | 2.06 | 1.05 | 17.46 | 22,049 | 102,399 | 1924 |
| 1951 | 4.69 | 3.22 | 1.54 | 1.44 | 1.14 | 12.02 | 1.46 | 0.76 | 19.25 | 26,385 | 138,489 | 2237 |
| 1961 | 6.01 | 4.52 | 2.36 | 1.94 | 1.27 | 16.09 | 1.33 | 0.68 | 20.39 | 36,627 | 190,658 | 2104 |
| 1971 | 7.45 | 6.60 | 3.65 | 3.16 | 1.87 | 22.72 | 1.13 | 0.56 | 20.82 | 45,933 | 248,182 | 2333 |
| 1981 | 9.42 | 9.23 | 5.76 | 4.27 | 2.92 | 31.61 | 1.02 | 0.49 | 20.05 | 52,378 | 304,427 | 2960 |
| 1991 | 12.60 | 11.11 | 8.47 | 5.42 | 4.34 | 41.94 | 1.13 | 0.50 | 19.44 | 62,770 | 378,303 | 3381 |
| 2001 | 16.43 | 13.25 | 12.90 | 6.69 | 5.76 | 55.02 | 1.24 | 0.50 | 19.23 | 69,776 | 456,316 | 4075 |
| 2011 | 18.39 | 16.35 | 14.06 | 8.65 | 8.52 | 65.98 | 1.13 | 0.47 | 17.50 | 60,996 | 450,419 | 6134 |

Source: Computed using data from [22]. Note: The ranks of cities have changed over the years—see Appendix A for details; the primacy index of city C_1 is the ratio of population between 1st and 2nd order cities, while C_2 is the ratio of population of the 1st order city and the total population of 2nd, 3rd, and 4th order cities; the number of towns produced in this table are slightly different from those produced in Table 2, as data for individual towns for computation could be meaningfully identified from the records [22] to these numbers of towns.



Figure 6. Relationship between base year population of cities and growth rate of their population (1901–2011). Source: Computed using data from [22].

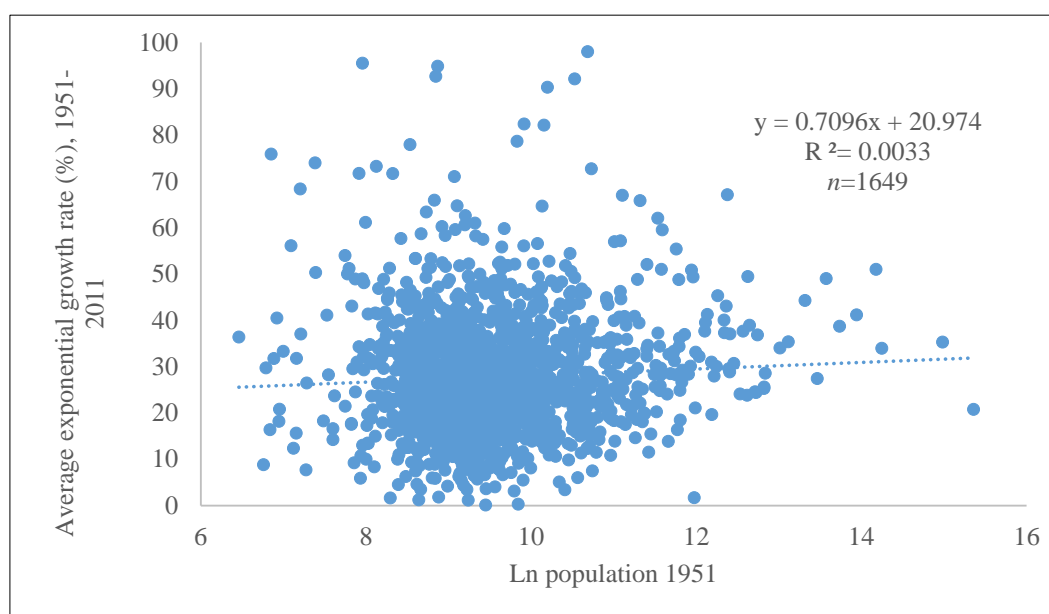


Figure 7. Relationship between base year population of the town and growth rate of population (1951–2011). Source: Computed using data from [22].

4. Metropolitanization of the Indian Economy

India's economy is extremely lop-sided in terms of the urban and rural distribution of Gross Domestic Product (GDP). It is estimated that currently (2020), the share of India's urban population is about 35% of its total population, but the share of total GDP originating from urban areas is about 70 to 75%. The share of urban areas in India's total GDP was 45% in 1990, and rose to 63% in 2014 [34]. It is argued that the rising urbanization will ignite urban consumption, services, and infrastructure, and that the urban focus can put India's economy on a higher growth path through: (a) fueling urban consumption, especially of the premium-end of consumer goods and four-wheelers; (b) powering urban services like consumer banking, healthcare, telecom data services, and internet; and (c) driving the infrastructure sector, including civic urban infrastructure services and real estate [34]. This kind of policy advocacy and understanding has led to an increased investment focus by the Government

of India on urban centers, especially on major urban centers through the Jawaharlal Nehru Urban Renewal Mission launched in 2005 (which was replaced by the Atal Mission for Rejuvenation and Urban Transformation in 2015). The focus of both these missions has been on urban reforms and massive investment in infrastructures, especially in megacities. Another very important program for the urban development, especially of megacities, by the Government of India—accompanied by huge investments in these cities—is the Smart Cities Mission, which aims at making the cities ‘smart’ through: (a) Promoting mixed land-use; (b) housing and inclusiveness; (c) creating walkable localities; (d) preserving and developing open spaces; (e) promoting a variety of transport options; (f) promoting e-governance; (g) giving an identity to the city; and (h) applying smart solutions to infrastructure and services in area-based development [35]. This has made the urban centers, especially the megacities, the sink of government and also private investments, while rural areas, where about 65% of India’s population lives, have suffered, resulting in economic distress among farmers, even leading to suicides, and rural to urban migration of population in search of employment and better quality of life [36,37].

The Indian economy is largely metropolitanised [5]. A large share of the urban population lives in million-plus and class I cities, and they contribute a significant share of India’s GDP, but they also are a sink of savings and investments. Out of a total of 53 million-plus cities in India in 2011, the top 20 (based on population in 2011) is listed in Table 7. These top 20 million-plus cities account for 9.6% of the total population of the country, but controlled 46.3% of total bank deposits and 59.4% of bank credits in India [38]. In some million-plus cities like Mumbai, Chennai, Ahmedabad, Surat, and Coimbatore, the credit-deposit ratio of banks is more than 1, indicating that they also sucked the savings of other regions (in the form of bank deposits). These imbalanced credit creations and deposit mobilizations show the clear spatial lop-sidedness in investments and also of savings. Mumbai and Delhi are two major sinks and poles of the Indian economy. These kinds of economic primacy of megacities raise questions concerning sustainable and equitable regional development in India.

Table 7. Top million-plus cities (UA) and their shares in bank deposits, credits, and credit-deposit ratios.

| Rank in 2011 | UA/City | Population (Million) | | As on 30 September 2019 | | |
|----------------|------------|----------------------|-----------------|---------------------------|-------------------------|----------------------|
| | | Population 2011 | Population 2001 | Deposits in INR (Billion) | Credit in INR (Billion) | Credit-Deposit Ratio |
| 1 | Mumbai | 18.4 | 16.4 | 18,553 | 22,106 | 1.2 |
| 2 | Delhi | 16.3 | 12.9 | 11,820 | 11,959 | 1.0 |
| 3 | Kolkata | 14.0 | 13.2 | 3249 | 2450 | 0.8 |
| 4 | Chennai | 8.7 | 6.6 | 3735 | 4376 | 1.2 |
| 5 | Bangalore | 8.5 | 5.7 | 6288 | 4181 | 0.7 |
| 6 | Hyderabad | 7.7 | 5.7 | 3679 | 3644 | 1.0 |
| 7 | Ahmedabad | 6.4 | 4.5 | 1847 | 2152 | 1.2 |
| 8 | Pune | 5.1 | 3.8 | 2446 | 1824 | 0.7 |
| 9 | Surat | 4.6 | 2.8 | 524 | 623 | 1.2 |
| 10 | Jaipur | 3.0 | 2.3 | 1029 | 971 | 0.9 |
| 11 | Kanpur | 2.9 | 2.7 | 592 | 263 | 0.4 |
| 12 | Lucknow | 2.9 | 2.2 | 1417 | 420 | 0.3 |
| 13 | Nagpur | 2.5 | 2.1 | 674 | 349 | 0.5 |
| 14 | Ghaziabad | 2.4 | 1.0 | 495 | 213 | 0.4 |
| 15 | Indore | 2.2 | 1.5 | 555 | 485 | 0.9 |
| 16 | Coimbatore | 2.1 | 1.5 | 478 | 556 | 1.2 |
| 17 | Kochi | 2.1 | 1.4 | 1008 | 916 | 0.9 |
| 18 | Patna | 2.0 | 1.7 | 965 | 281 | 0.3 |
| 19 | Kozhikode | 2.0 | 0.9 | 290 | 221 | 0.8 |
| 20 | Bhopal | 1.9 | 1.5 | 746 | 566 | 0.8 |
| Total | | 116 | 90.0 | 60,391 | 58,555 | 1.0 |
| % of all-India | | 9.6 | 8.8 | 46.3 | 59.4 | – |

Source: Based on data from [22,38].

The pull of foreign direct investments (FDIs) towards the regions with mega-cities also indicates the power of these cities as investment centers. Out of the total FDI of US \$114.4 billion during the period 2014–2017, 31.1% and 22.3% were pulled in by Mumbai and Delhi, respectively (Table 8). The rest of the cities and regions, except Chennai, Bangalore, and Hyderabad, had only relatively small shares in the total FDI.

Table 8. Regional inflow of foreign direct investments (FDI) in India from 1 April 2014 to 31 March 2017.

| Rank | Regional Offices of RBI | States Covered | Total FDI in US \$ Million | % of Total FDI |
|------|-----------------------------|--|----------------------------|----------------|
| 1 | Mumbai | Maharashtra, Dadra, and Nagar Haveli, Daman and Diu | 35,526.2 | 31.1 |
| 2 | New Delhi | Delhi, Part of UP, and Haryana | 25,501.9 | 22.3 |
| 3 | Chennai | Tamil Nadu, Pondicherry | 10,563.5 | 9.2 |
| 4 | Bangalore | Karnataka | 9697.3 | 8.5 |
| 5 | Ahmedabad | Gujarat | 7141.5 | 6.2 |
| 6 | Hyderabad | Andhra Pradesh | 5120.0 | 4.5 |
| 7 | Kolkata | West Bengal, Sikkim, Andaman, and Nicobar Islands | 1243.5 | 1.1 |
| 8 | Kochi | Kerala, Lakshadweep | 774.3 | 0.7 |
| 9 | Jaipur | Rajasthan | 756.9 | 0.7 |
| 10 | Bhopal | Madhya Pradesh, Chattisgarh | 256.3 | 0.2 |
| 11 | Kanpur | Uttar Pradesh, Uttranchal | 198.1 | 0.2 |
| 12 | Patna | Bihar, Jharkhand | 64.1 | 0.1 |
| 13 | Chandigarh | Chandigarh, Punjab, Haryana, Himachal Pradesh | 71.8 | 0.1 |
| 14 | Panaji | Goa | 135.5 | 0.1 |
| 15 | Guwahati | Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura | 17.2 | 0.0 |
| 16 | Jammu | Jammu and Kashmir | 6.0 | 0.0 |
| 17 | Bhubaneshwar | Orissa | 27.2 | 0.0 |
| | <i>Region Not Indicated</i> | – | 17,308.5 | 15.1 |
| | Grand Total | Grand Total | 114,409.8 | 100 |

Source: [39]. Note: Very small values are shown as zero because of rounding off.

5. Governance and Civic Amenities

The governance in most of the cities in India is rather poor. This has resulted in huge social and physical infrastructural issues. In India, towns, 1971 onwards, are identified on the basis of two important criteria: (a) Statutory towns—include all the places with a municipality, corporation, cantonment board, or notified town area committee, etc.; (b) census towns—are places characterized by the following features: (i) At least 5000 persons; (ii) having a density of population above 400 persons per square kilometer; and (iii) at least 75% of main male working population employed outside the agricultural sector [22]. This means that census towns have no urban governance body, and that they are in a way unregulated and ungoverned. If there exists any governance body, it may be village panchayats (village administrative units). This compromises the effective governance of these towns and the development of their social and physical infrastructure. Data show that in 2001, 1362 (26.4% of the total towns in 2001) of the total towns were census towns, while in 2011, due to the inclusion of new settlements as towns, this number has increased to 3894 (49.1% of the total towns in 2011) (Table 9). This shows that almost 50% of Indian towns do not have urban local bodies for their governance and development. The finance and financial grants to the towns are recommended by the Finance Commission of India from time to time. A town becomes eligible for finance if it has local body. As about half of the towns do not have local bodies, they are deprived of this benefit.

Table 9. Types of towns in India on the basis of local bodies and agglomerations. (2001 and 2011).

| Type of Urban Units | 2001 | | 2011 | |
|-------------------------|-----------------|----------------------|-----------------|----------------------|
| | Number of Towns | % of the Total Towns | Number of Towns | % of the Total Towns |
| 1. Towns: | 5161 | 100 | 7935 | 100 |
| (a) Statutory Towns | 3799 | 73.6 | 4041 | 50.9 |
| (b) Census Towns | 1362 | 26.4 | 3894 | 49.1 |
| 2. Urban Agglomerations | 384 | – | 475 | – |
| 3. Out Growths (OGs) | 953 | – | 981 | – |

Source: Based on data from [22]. Note: Out Growths (OGs): Areas around a core city or town, such well recognized places, like a railway colony, university campus, port area, etc., located outside the boundaries of a town.

It is not surprising, therefore, that in 2011, 38% of the urban households in India did not have tap-water from treated sources. Furthermore, the share of households not having the source of drinking water within their premises was about 28%. About 12.6% of the households were without any access to a latrine and were defecating in the open air, while 6.0% were using community latrines. The Swachh Barata Mission or Clean India Mission has improved the situation, but only the next Census in 2021 may be able to show the comprehensive success of this mission. Next, bathing facilities are not available within the owned premises for 13.2% of the total of 78.9 million households in urban centers [40].

The situation of housing has been very grim. Out of 4041 statutory towns, slums were reported in 63% of the towns in the 2011 Census. A total of 13.7 million households, accounting for 68 million persons, were living in these slums, constituting 17.4% of the total urban households. As the million-plus cities have a disproportionate concentration of economic activities, a large share of rural and small-town migrants over the years have moved to these centers. As a consequence, the slum formations in these cities has been quite high. In 2011, 38.1% of the total households in 53 million-plus cities were living in slums, and the share was as high as 41.3% in the Greater Mumbai Municipal Corporation area, 29.6% in the Kolkata Municipal Corporation area, 28.5% in the Chennai Municipal Corporation, and 14.6% in the Delhi Municipal Corporation (Table 10). The homeless population in urban areas has risen over the years in the country. Where the homeless population in urban areas was about 0.2 million in 1961, it increased to 0.73 million in 1991, and further increased to 0.94 million in 2011. The megacities like Kolkata, Mumbai, and Chennai has large share of these homeless people [41].

Table 10. Top 10 million-plus cities in terms of share of households in slums (2011).

| Million Plus Cities | Proportion of Slum HHs to Total Urban HHs (%) |
|--|---|
| 1. Greater Visakhapatnam (Municipal Corporation) | 44.1 |
| 2. Jabalpur Cantt (Cantonment Board) | 43.3 |
| 3. Greater Mumbai (Municipal Corporation) | 41.3 |
| 4. Vijayawada (Municipal Corporation) | 40.6 |
| 5. Meerut (Municipal Corporation) | 40.0 |
| 6. Raipur (Municipal Corporation) | 39.0 |
| 7. Nagpur (Municipal Corporation) | 34.3 |
| 8. Greater Hyderabad (Municipal Corporation) | 31.9 |
| 9. Kota (Municipal Corporation) | 31.8 |
| 10. Agra (Municipal Corporation) | 29.8 |

Source: Based on data from [40].

The Indian cities—and specifically the million-plus cities—have become extremely congested. The neglect of public transport systems over the years and later, after the economic liberalization in 1992–1993 due to rise of the middle class, the boom in demand of the automobile sector in cities have choked these cities, besides adding to the toxicity of the air. The number of motorized vehicles registered in India was 0.3 million in 1951, which rose to 230.06 million in 2015, an approximately 767 times increase [42,43]. As of 31 March 2016, Delhi (8.85 million), Bangalore (6.11 million), Chennai (4.94 million), and Greater Mumbai (2.82 million) were the top-4 cities in the country in terms of registered motor vehicles. Between 2006 and 2016, in these respective cities the number of registered motor vehicles rose 1.97 times (Delhi), 2.34 times (Bangalore), 2.11 times (Chennai), and 2.02 times (Greater Mumbai) [43]. In fact, these vehicles clog the roads of the cities, and people suffer from loss of time in traffic jams, more payments to hired vehicles due to traffic jams, and burning of fuels, besides emission of carbons and other toxic gases [44]. The air in these cities, and especially in Delhi, Bangalore, have turned toxic, and have been a cause of various respiratory diseases. In Delhi, health emergencies have been declared many times [45,46]. Besides equitable distribution of welfare, these features raise questions about the sustainability of the top-heavy urban centers of India.

6. Social Exclusion and Spatial Segregation

In a modernist paradigm, the cities have a social promise—the promise of social change leading to liberty, equality, and freedom. It is then imagined that with the rise of capitalism (through cities), the negative city identities will disappear, and the status and identity of individuals will largely be determined by his/her achievements. However, this has been a belief, though not a total failure everywhere. In India, the cities' internal morphology largely corresponds to the ethnic identities, with some exceptions of social inclusion in a limited number of cities. All the major cities are known for their ethnic spaces, and the space identities are determined by the ethnic communities living therein. Riots between communities, and especially between Muslims and Hindus, and occasionally between lower castes and upper caste Hindus, have become common phenomena in cities, and especially in megacities like Mumbai, Ahmedabad, Delhi, Kanpur, Surat, etc. Even the small and medium cities are affected by these divides and violence [47,48]. Cities like Ahmedabad have become extremely divided on the basis of religion after the Hindu-Muslim riots in 2002 [49]. Delhi is well known for its Hindu-Muslim segregated settlements, while in Mumbai, the highest segregation of population is also based on religion. The dissimilarity index [50] computed for the Muslim-Non-Muslim segregations based on the voter list data of 2014 for polling-booths are as high as 0.609, while (using the data at the ward level) between non-lower castes and lower castes (called Scheduled Castes) this index is 0.231. This shows that in Mumbai, almost about 23% of the lower castes population needs to move in order to create a uniform distribution of population of lower and non-lower castes at the ward level. Furthermore, about 61% of the Muslim population would need to move so as to create a uniform distribution of the population at the polling-booth level in the city. This shows the very high spatial

segregation of Muslims in the city [48]. This observation raises even more questions about the social sustainability and the equitable development of Indian cities.

7. Conclusions and Discussion on Sustainability

This paper examined India's evolving urban system in terms of hierarchical distribution of cities, the concentration of economic resources in cities in relation to urban hierarchy, development of infrastructure, and ecological and social inclusion issues in the cities. India's urban system is huge, with an enormous volume of population. Though India's national urban system does not deviate significantly from the rank-size rule distribution over the years 1901–2011, it is top-heavy, that is, a few cities control a significant share of the total urban population. Furthermore, the top-heavy nature of the urban system in India has significantly increased over the years. The share of population of cities with 100,000-plus has risen, and this tendency is even more seen with regard to million-plus cities. As such, a small percentage of total cities account for a large share of India's urban population. This is a result of distorted regional economic development, where because of rural economic distress and income poverty, people migrate to cities with employment opportunities. As such, cities are relatively larger in population size. This process further reinforces the size of such cities. India's urban system does not have any correlation between the size of the city and population growth rate, which reinforces the proportionate growth of cities as explained by Gibrat [31]. India's economy is also found to be very metropolitan-centric, that is, big cities control a significant share of the country's GDP. Overall, about 70–75% of total India's GDP is generated by urban centers, and in this class, the share of megacities (above 10 million population) and million-plus cities is very high. The top 20 biggest cities contribute to about half of India's bank deposits, and three-fifths of bank credits. Some of these cities, like Mumbai, Chennai, Ahmedabad, and Coimbatore, are also investment sinks, as they absorb more bank credits (depriving other cities and rural areas) than what they would get in the form of their own deposits. In fact, Delhi and Mumbai (metropolitan regions) also account for more than half of the FDI inflows in India.

Notwithstanding their economic powers, the megacities in India suffer from acute shortages of social and physical infrastructures (schools, health facilities, roads, public transport, water supply, housing, and air quality, water quality). A significant share of the households in these cities live in slums. Furthermore, they also have been affected by social polarization and violence, especially on religious and caste bases, leading to socio-spatial segregations. The story of the small and medium-size towns in India (below 100,000 population) is reverse in economic terms. They are often the centers of stagnation and lack necessary civic infrastructure and amenities. As such, the Indian urban system/cities can be said to be far away from the sustainability triad of economy, equity, and environment. These three aspects can create gridlock situations for the cities and inhibit their potential for becoming effective economic and social change sites, unless all these issues are addressed comprehensively and without any neglect of the less privileged rural and regional economies, which are the major source of migration to large cities. The urban system in India is clearly facing major sustainability and resilience challenges.

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Appendix A

Table A1. Top 5 cities in terms of total population in India (1901–2011).

| Rank | 1901 | 1911 | 1921 | 1931 |
|------|---------------------|-------------------|-------------------|---------------------|
| 1. | Kolkata UA | Kolkata UA | Kolkata UA | Kolkata UA |
| 2. | Greater Mumbai UA | Greater Mumbai UA | Greater Mumbai UA | Greater Mumbai UA |
| 3. | Chennai UA | Chennai UA | Chennai UA | Chennai UA |
| 4. | Hyderabad UA | Hyderabad UA | Hyderabad UA | Hyderabad UA |
| 5. | Lucknow UA | Lucknow UA | Delhi UA | Delhi UA |
| Rank | 1941 | 1951 | 1961 | 1971 |
| 1. | Kolkata UA | Kolkata UA | Kolkata UA | Kolkata UA |
| 2. | Greater Mumbai UA | Greater Mumbai UA | Greater Mumbai UA | Greater Mumbai UA |
| 3. | Chennai UA | Chennai UA | Delhi UA | Delhi UA |
| 4. | Hyderabad UA | Delhi UA | Chennai UA | Chennai UA |
| 5. | Delhi UA | Hyderabad UA | Ahmadabad UA | Ahmadabad UA |
| Rank | 1981 | 1991 | 2001 | 2011 |
| 1. | Greater Mumbai UA | Greater Mumbai UA | Greater Mumbai UA | Greater Mumbai UA |
| 2. | Kolkata UA | Kolkata UA | Kolkata UA | Delhi UA |
| 3. | Delhi UA | Delhi UA | Delhi UA | Kolkata UA |
| 4. | Chennai UA | Chennai UA | Chennai UA | Chennai UA |
| 5. | Bruhat Bangalore UA | Hyderabad UA | Hyderabad UA | Bruhat Bangalore UA |

Source: Based on data from [22]. Note: Cities population is UA population.

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