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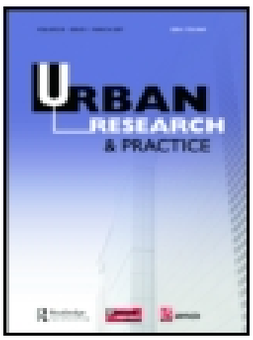

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Growth of metro cities in India: trends, patterns and determinants

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Using city-level census data this paper examines the trends, patterns and determinants of metro city growth in India and finds that the post-economic reforms period has heralded a rapid pace of metropolitan development, causing a dispersed pattern of metropolitan growth in the last two decades. The empirical results show that metro cities located along a riverbank and situated in the northern, eastern and southern regions of India; cities with better quality public services and those which are state capitals are revealed to grow faster than others. A proximity to a large city also spurs on nearby urban centres to become larger, highlighting agglomeration effects. In contrast, initial city size has a negative impact on metro growth, reflecting some conditional convergence in population growth across cities. It is also found that the older cities have not grown at a rapid pace, with many of them flagging remarkably low demographic growth, suggesting a process of population drift towards the periphery from the core city areas, thereby leading to an 'agglomerated trend' of metropolitan development in India. Finally, we argue that diverting investment and development projects towards regressive regions as well as to secondary cities for strengthening their infrastructure and economic bases may herald sustainable and balanced metropolitan development.

Keywords: urbanization; million plus city; core-periphery; urban growth; India

1. Introduction

Today, more than half of the world's population (54%) live in an urban setting and this figure is expected to double by 2050, with nearly 90% of the increase occurring in Asia and Africa (UN DESA 2014) alone. The rapid growth of urban population in Asian countries during the second half of the twentieth century has ushered a scenario of urban explosion in this region. Many scholars have thus propounded views such as *over-urbanization* (Davies and Golden 1954), *pseudo urbanization* (Mc Gee 1967), *subsistence urbanization* (Breese 1966) and have claimed that *the fulcrum of urban growth* has dramatically shifted from Africa and Latin America to the countries of Asia (Kundu, A. 2011a). With the mean latitude of global urban population moving steadily to the south (Mohan and Dasgupta 2005), India has been earmarked as a major supplier to the incremental urban populace, owing to both her tremendous demographic pressure and her dynamics of urbanization. As compared to the other developing nations of the World, India's urban structure is remarkably 'top-heavy' in nature (Kundu 2014), since more than 70% of her urbanites are residing in cities today[1].

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The latest Indian Census of 2011 has revealed some crucial facts such as for the first time since independence, the absolute urban population has grown more than its rural counterpart and is slightly higher than expected (Bhagat 2011; Kundu 2011b; Premi and Das 2011). In absolute terms, no country in the world has ever encountered such colossal urbanization, with the exception of China. Furthermore, India is now in an escalating phase of urbanization and the pace will become even more rapid in the times ahead (Nijman 2012). Secondly, the urban demographic growth rate, which fell in the preceding two decades, has also risen in the last census. The major surprise has been, however, the huge increase in the number of the *Census Towns* from 1362 to 3894, while the number of *Statutory Towns* increased only marginally from 3799 to 4041. Simultaneously, the quantum jump in the number of metro cities (cities with population greater than one million) during 2001–2011 to 52, compared to there being just 35 in 2001, and which today house about 42.31% of the national urban population is an unprecedented phenomena. These 52 million plus cities are estimated to produce about one-third (32%) of the nation's total economic output (Gross Domestic Product (GDP)) though occupying only 0.2% of India's land area (Indian Institute for Human Settlements 2011). As a result, the regional patterns of economy and urbanization are heavily influenced by these large cities, as they are India's engines of growth and its magnets, attracting people from the adjoining rural areas, small and medium towns, and from comparatively regressive regions (Shaw 2012a).

Prior to 1981, the focus on million plus cities was marginal as they were few in number (12 in 1981), with their numbers growing slowly. In the wake of the 1990's economic reforms, India has, however, experienced a substantial growth in the number of million plus cities, which is now four times greater than since 1980s. Against the backdrop of such a rapid emergence of metro cities, coupled with their regional, national as well as global significance in terms of economy and population, our paper examines three lines of questioning. Firstly, what has been the trend and regional pattern of growth of these metro cities? Secondly, what is the ongoing nature and trend of demographic growth dynamics in these cities? Finally, Has there been changes in the growth dynamism of any individual metro city in terms of its core vis-a-vis periphery area during the last two decades? Addressing these particular questions, we delve into how the peripheral growth around some cities has played key role in its growth through urban sprawl and also analyse the driving forces contributing towards such rapid growth of metro cities.

Thus, our paper seeks to find empirical explanations for the observed variations in growth experienced across these metro cities, over the decades. Which metros grew most, which one shrank and why? The rest of the paper is set up as follows: Section 2 details some of the theoretical underpinnings and perspectives and contextualizes the current study in the light of related past literature on urbanization process and the determinants of city growth. Section 3 offers data description, model and estimation framework of city growth, which are used to further the analyses. In Section 4, we discuss key findings from the empirical analysis and focus our attention on examining driving forces of city growth. Section 5 presents an overall summary of the whole study.

2. Theoretical orientation and glimpses of prior researches

2.1. Urbanization: trends, patterns and process

The world is progressively becoming urban as more than half the people now reside in urban areas (UN DESA 2014). This is the midst of a revolution similar to that which

accompanied the industrialization period during the second half of the nineteenth century. However, the recent transformation is more gargantuan in dimension. Presently, twice as many people the world over reside in cities than the corresponding number only three decades ago (Nijman 2012: 8). This has added as many as 60 million people to the global urban population every year since the 1980s (United Nations Population Divisions 2011). As was the trend in the nineteenth century, this urban development did not precipitate everywhere simultaneously. Then, such phenomena were by and large spatially highly skewed being mainly concentrated in Great Britain, mainland north-western Europe and North America. However, the present manifestation of this urbanization phenomena is occurring with increasing prominence in the East Asia and South East Asian countries (Cohen 2004; Mohan and Dasgupta 2005; UNCTAD 2006; Song and Ding 2007). Some studies also contend that presently many of the developed nations of the world have reached a very high level of urbanization and some of them are in the last stage of the urbanization process and thereby are confronting a deceleration of urban development due to varied reasons (Brockerhoff 1999; Brockerhoff and Brennam 1998). The patterns of this urban transition in the second half of the twentieth century is unlike that which occurred in the first half of that century (Mohan and Dasgupta 2005; Cohen 2004). Cohen (2004) stated that there were many factors that marked this transition and that the scale of change was striking. Secondly, the present urbanization has occurred at a relatively rapid (if not extraordinary) pace. Most significantly, he opined that urbanization has presently been taking place more rapidly in the low-income countries, under an admixture of demographic trajectories. He ascribes this to the urban change being now more minutely linked to changes in the global economy than ever before.

Among earlier empirical studies regarding the issues of trends and patterns of urbanization in India, those by Bose (1973; 1978) were pioneering. Employing time-series census data, he examined the specific factors that gave impetus to Indian's urbanization pattern in various decades. According to him, each decade had prime aspects that affected the urban population growth, and during the first half of the twentieth century there was no 'normal' decade of urban population growth. A multitude of factors like famine, plague, influenza epidemics, war and partition, among others, had a dominance on the then urban scene. He further surmised that the stagnancy of small and medium towns, regardless of the overall rapid urbanization, has persisted since the colonial period, despite the framing of new policies for the development of growth poles or the dispersal of industries. The large cities continue to have dominance over the urban scene. However, urban growth in India in the initial decades of the twenty-first century has been somewhat different from the earlier (Das and Bhushan 2014, 520). Many studies (Bhagat 2004; Kundu, D. 2013; Kundu, A. 2013; Das and Bhushan 2014) make it evident that the big cities have encountered a declining population growth in their core areas and a corresponding relatively higher growth in its adjoining peripheral areas due to a substantial short-distance outmigration from the core towards the periphery. In this respect, Fainstein and Campbell (2002) felt that overall, the city cores are still vital, but there is a mechanism of decline and city cores are losing their attraction. Similarly, Gilbert's (1993) *Polarization reversal* theory explained the third world's urbanization process and altered patterns of urban settlement system. As per this theory, the diffusion of employment opportunities and economic activities from the centre of the metropolitan cities to its peripheral area and other small towns/cities has occurred due to the rapid development of transportation facilities and export-oriented industrialization. This distinct mechanism spurs on and yields the growth of peripheral regions and other nearby small towns and cities and ultimately produces a polycentric urban form which Denis, Mukhopadhyay, and

Zerah (2012) have termed as *subaltern urbanization* (e.g. see Samanta 2012; Guin and Das 2015; Guin 2016). On the other hand, due to the acceptance of *Structural Adjustment Programmes (SAPs)*, which drives the termination of the import-substituting industrial development, the city centre has thus been declining. Among the other studies that have focussed on issues relating to India's urbanization using census data, Pradhan (2013), Bhagat (2011) and Guin and Das (2015) have contended that the apparent impetus of relatively higher urban growth during the last decade comes from the huge addition of new towns due to rural–urban reclassification. However, the contribution of natural increase in urban growth has diminished in terms of proportion over the decades. Actually over the decades, the inherent processes governing and influencing India's urbanization have themselves altered, as recent studies have made evident. Using the 2011 census data, Mitra and Kumar (2015) expounded on these newer patterns and trends of Indian urbanization, especially with regard to the colossal emergence of the new census towns during last decade. Their findings surmised that activities in areas that have already been demarcated as urban tend to shift to the rural hinterland and then bring a change in their settlement classification status as a result. Apart from this, rural occupational diversification, primarily the movement of labour to non-farm sectors, due to the scarcity of effective livelihood sources in the agricultural sector, is also a vital reason. This is attested to by other studies like Mathur (2005), which opined that urban growth in post-liberalized India has been caused by the huge growth of urban populace and changes in the proportion of employment in manufacturing and service sectors, while Mills and Mitra (1997) showed that cities revealing a higher population pressure index are relatively small in size and are situated in the regressive regions. They further argued that large cities are not actually overpopulated. Shaw (2012a) has examined the growth and management of metro cities since 1991 and identified significant changes in the urban policies that were adopted over preceding two decades, with the state switching its presence in many sectors and inviting private investment in the economy. The stark regional disparity in terms of investment patterns for metro development has also been discerned. A similar picture holds true in fund allocation for urban development across the states and city sizes as well (see Khan 2013). In a recent study, Bhattacharjee (2016) provided a detail account of the trends and patterns of Indian's urbanization (1901–2011) and opined that the recent higher urban growth could be attributable to the problems of urban infrastructures, basic amenities and medical facilities among others.

2.2. Driving forces of city growth

A range of literature has delved into the causative factors of city growth. In an attempt to decipher the relevant factors conducive for the concentration of population and economic activities in large urban agglomerations (UAs), the linkages between UAs and economic growth were examined in the new economic geography (NEG) framework pioneered by Krugman (1991) and Fujita, Krugman, and Venables (1999). The NEG models examined how the benefits of agglomeration economies are achieved when firms and people locate near to each other, that is, agglomeration effects of large cities. Depending on the differences of productivity, which result in a shift of resources to urban sectors (or core area) from agricultural (or hinterland) areas, the NEG model gives a general equilibrium framework of location theory with the assumption of imperfect competitive market. It explains the causes responsible for the construction of a large variety of economic agglomeration in a geographical location. The agglomeration forces basically come from economic externalities by interacting among increasing returns, transportation

costs and the movement of production factors. For deciphering agglomeration economies, it requires a tension between the 'centripetal' forces (pure external economics, divers market scale effects and diffusion of knowledge), which are likely to attract population and the production process towards agglomerations, and the 'centrifugal' forces (crime, congestion, pollution, urban land use and rents control, higher transportation costs and competition), which tend to break up such agglomerations (Overman and Ioannides 2001; Tabuchi 1998). The economy would then end up with a core–periphery nature, in which all manufacturing units are concentrated in area, only if forward (i.e. the incentive of labourers to be close to the producer of consumer goods) and backward (i.e. the incentive for producers to amass where the market is bigger) linkages are strong enough to curb the centrifugal forces caused by immobile farmers. Nonetheless, the NEG models are crucial for policy assessment and these frameworks are static and committed to dealing with the distribution of economic activities over the space.

In the backdrop of assessing the suitable factors conducive for the city growth, First Nature Geography, which is based on past location theories, gives emphasis to natural resources, for instance, climate, presence of natural port or navigable rivers. To examine the role of NEG models with other pertinent factors in explaining UA, Ades and Glaeser (1995) noticed that, as surmised by Krugman and Elizondo (1996), countries having high share of trade in GDP or low tariff barriers (after controlling for trade levels) rarely have their population concentrated in a single city but remain unclear as to the presence of a direct causal relation. Cross-country analysis inferred the negative effect of the growth of transportation network and the positive effect of a capital city dummy, non-urbanized population of a country, urbanized population outside the main city, real GDP per capita, share of workforce in non-farm sectors and the concentration of power in the hands of a small cadre of agents residing in the capital city of a country. Glaeser, Scheinkman, and Shleifer (1995) assessed economic growth in a cross section of American cities, examining the association between urban characteristics in 1960 and urban growth between 1960 and 1990. They observed that income and population growth are concomitant and that both are positively related to an individual's initial schooling, while being negatively related to initial unemployment, which is followed by initial employment in manufacturing sectors as well. Apart from this, government expenditures (bereft of that for sanitation) demonstrated no correlation with city growth, although the amount of government debt is positively correlated with later growth. Considering counties in the United States as the unit of analysis, Beeson, DeJong, and Troesken (2001) found that natural characteristics which influenced critical civic services such as supply of water largely influenced where populations resided in 1840, while produced characteristics (for instance educational infrastructure) showed a statistically significant impact on their subsequent growth. They noticed evidence of population convergence only when the most heavily populated counties in 1840 were eliminated from the sample. Furthermore, when counties situated on the western frontier were eliminated from the total sample, on the belief that they were relatively distant from their steady-state populations, evidence was observed of population divergence. Similarly, Da Mata et al. (2005) studied the factors behind city growth in Brazil. Considering a model of a city, which combined aspects of standard urban economics and the NEG literatures, they postulated that an increase in supply of rural populace, betterment of inter-regional transport linkages and the educational attainment of the labour force has a strong influence on city growth. They also observed that local crime and violence, measured by homicide rate, have an effect on city growth. Contrastingly, a greater share of the private sector industrial capital in the local economy fuels growth. Haurin (1980) estimated the influence of a suitable climate (i.e. a site-specific factor) on

city population (along with the housing price and price of factors) and noticed that a relative increase in the climatic variation would encourage migration toward the improved region. Applying this model, Haurin also found that in equilibrium, the mean wage rate will differ among regions and compensate for differentials in characteristics in site-specific attributes. He further found that compensation would also occur through variations in the housing prices, and this finding is dependent on the indicators of the model and the way in which the location-specific factor (climate) influences production and consumption. Therefore, there is sufficient logic for us to expect that urban areas better endowed with location-related factors are more alluring to people and thereby grow more as compared to areas having an uncomfortable climate. Economic models of cities have suggested an inverted-U shape of real income per employee against city employment, where the inverted-U shifts with industrial composition across the settlement hierarchy of cities. Such a model given by Au and Henderson (2006) estimated net UA economies for cities in China and found that UA benefits are high as the real income per employees rises distinctly with increase in city size. They also observed that the real income (per labour) levels out close to the peak and then drop very slowly once past the peak. It is further noticed that a sizeable chunk of cities in China is undersized, because of the nationally imposed, stringent migration restrictions, causing huge income losses, which a greater agglomeration may have avoided.

Research on the determinants of city growth in the Indian context is however minimal. Mills and Becker (1986) examined and estimated city growth in India, first utilizing a national sample of large Indian cities and then choosing a sample of cities in a large Indian state, Madhya Pradesh. Their study inferred that the fast growth of a city's manufacturing employment and also of the national population fosters further growth in a city's population. It is also observed that a large initial national population encourages growth in cities having a lower initial population level, but this effect does not occur at cities having a higher initial population. This implies that a large initial population impedes further city growth, starting at initial populations somewhat less than one million, and that cities grow more in states with higher income than they do in lower income states. By and large, they surmised that the further cities are from the nearest Class-I city, the faster they grow. Sridhar (2010) in her study of the linkages between urbanization and economic growth in India estimated the factors of city growth and city output both at the city and district levels and surmised that aspects like proximity to large city and the process of shifting from agricultural to manufacturing, results in nearby cities to be larger, showing agglomeration effects. Kundu, A. (2006) argued that the Urban Land Ceiling and Regulation Act (ULCRA) has been regarded one of the prime constraints in city development, emphasizing that it would be crucial to examine its influence on the functioning of land, labour and capital markets in urban areas and to assess how the law has affected the pace and nature of urban growth in India. In a recent study, using NEG models, Tripathi (2013) found that the market size control variable, city located in a riverbank dummy, level of state trade openness, state per capita income and the share of population engaged in non-farm activity have a significant positive effect on the large city agglomeration in India. In a related study in Punjab, Tripathi and Mahey (2016) surmised that the distance to the nearest railway station from a city and the city's received rainfall have a negative impact while civic infrastructure facilities (such as school, latrines, hospitals and water availability) have a positive effect on urbanization and economic growth. Apart from this, some other studies in the Indian context (Lall and Rodrigo 2001; Lall, Shalizi, and Deichmann 2004; Lall and Mengistae 2005; Chakravorty and Lall 2007) have focused

on the industrialization-related agglomeration and urban economic growth using these NEG models.

The earlier brief review makes it evident that much of the researches were confined to national/macro-level studies in general and that meagre attention has been paid to actually examining the factors of city growth in the Indian context. However, some scholars (Shaw 1999; Bhagat 2004; Shaw 2012a; Kundu 2013b) have studied Indian metropolitan urbanization partially. Still, considering the immediate backdrop of the emergence of a sizeable number of metro cities during last census, a more in-depth analysis regarding the trends and patterns of metro city growth, their spatio-temporal distribution across the different regions, growth dynamism of each city in terms of their core vis-a-vis periphery along with underlying processes therein and finally an examination what drives the growth of these cities is quite significant today.

3. Data and methods used and descriptions of variables analysed

After reviewing the ample literature in the preceding section, we felt it appropriate to examine the determinants of individual metro city growth along with their trends, patterns and contemporary growth mechanisms in order to make relevant prescriptions for future policy direction. This would also facilitate projections on the future trends of metropolitan urbanization in India.

In this paper, the metro city size/city growth regressions are estimated using measures of state- and city-level indicators through the following ordinary least square (OLS) regression model:

$$Y_{\text{lnCPi}} \text{ or } Y_{\text{CGRit}} = a_0 + \sum_{i=1}^{21} \alpha_i X_i + \varepsilon_i$$

where Y_{lnCPi} or Y_{CGRit} is the dependent variable, X_i is the vector of select independent variables of ith metro city. a_0 and α_i denote the intercept and regression coefficients, respectively. ε_i is the unexplained error term that is supposed to be independent and identically distributed (iid). In this model, based on previous urban literatures (Da Mata et al. 2005; Sridhar 2010; Tripathi 2013), we measure city growth by the level of city population as well as growth rate of population in cities as the function of characteristics explained in the following section. For the regression analysis, we constructed a data set of 52 studied metro cities using information from Census 2001 and 2011 and other relevant sources. Table 1 reports in detail the variables (and their descriptions) considered in this paper.

3.1. City growth – the dependent variable(s)

Log of population of City i in time t (lnCP_i) and annual exponential growth rate (AEGR) of population in city i between time t–1 and t (CGR_{it}) are the two dependent variables of our regression analysis.

3.2. Control variables

Geographic/site specific factor: to capture the influence of regional/site-specific factors on metro city growth, we consider the following three variables, such as (a) first of all, we

felt appropriate to include regional dummies (North, East, West and South) to capture the huge regional influences on metro growth in India especially the resource availability, state/central government policies, among others; (b) city located in a riverbank dummy as it represents the proximity to natural methods of communication, infrastructural development and access to a larger fertile and well-populated hinterland, on the ground that it helps develop the large hubs of foreign trade by absorbing the potential initial advantages of the benefits accrued from easy access to the international and domestic market (Krugman 1993); (c) climatic factors, basically the nature of rainfall and temperature differences among cities, can have some bearing on their growth. Since these are the indicative of a natural amenity, these are considered as an exogenous factor affecting city growth, following the literature (for example, Hourin (1980) found the impact of climate on population and migration). These data come from the 2011 census Town Directory. The temperature difference was computed between the maximum and minimum temperatures for each metro city, a relatively lower temperature difference indicating a more comfortable climate.

NEG models primarily explain city growth by taking into account the appropriate positive and negative factors. Positive factors include the market size, as a larger market attracts firms to produce a greater variety of goods and services mainly because of the benefits of increasing returns at firm level and a pooled labour market that could be consumed by the city population. To measure this indicator, we use the percentage share of a state's urban population living in its metro city as a proxy for city market size because they indicate a higher percentage with higher population in the metro city (Tripathi 2013). Negative indicators, on the other hand, include the following two variables: (i) *market potential/gravity* effect measured by the distance to state headquarter and the distance to a large city (with population one lakh and above) can deter a city's growth, as found in many studies (Mills and Becker 1986; Au and Henderson 2006; Sridhar 2010; Tripathi 2013). Here the assumption is that proximity to a large metro city would stunt the growth of small cities. If so, a city's growth rate would be positively correlated with its distance from the nearby large city. Conversely, extreme proximity location in the periphery of a big city could be supposed to have a positive effect on the growth rate of a city. This is why when the rents rise in the city core, the decentralization of the urban area accelerates. Furthermore, if the entire urban area is growing faster as a consequence of its already large size, the periphery would grow rapidly as well. Accordingly, the nearness to a large city may fuel the growth of extremely close other cities and thwart the growth of moderately distant small cities owing to the absence of agglomeration effects. To measure the market potential, the distance from each city to a city with population of one lakh or greater is obtained from 2011 census Town Directory. (ii) *Transportation costs* high internal transport costs give incentive for the concentration of economic activities (Ades and Glaeser 1995). Following Tripathi (2013), the state government capital expenditure on transport (roads and bridges) and the state-wise length of the rail network is considered as a proxy measure for transportation costs since it measures the internal transport costs (Krugman 1991).

Apart from this, some other indicators could have a crucial bearing on metro city growth in India. For instance, the quality of public services or higher government expenditure on different development projects allures more workers and firms to the city. The desirable measures of public services are the *pucca* road length per square kilometre and number of schools (secondary and higher) per 1000 population. These are indicative of the quality of public services as they are utilized by all. Better quality public services such as higher road length and an adequate number of schools would attract

residents and firms and encourage city growth (Sridhar 2010). Apart from this, a state capital dummy as a proxy of the presence of a large public sector is taken into account as well. The hypothesis herein is that state capital cities are deemed to be the centre of administrative and political power and therefore reinforces the concerned government to mobilize resources to such places, and allure migrants in the process (Ades and Glaeser 1995). *Industrial structure*: In common parlance, industrialization is the bedrock for metropolitan urbanization and cities with a proportionately large intermediate and capital goods manufacturing sector experience higher growth rates (Milla and Becker 1986). Bearing this in mind, using data from the 2011 Town Directory, we constitute an industrial structure binary variable (Dummy) assigning a value of 1 if the city's two primary manufactured commodities are either an intermediate goods, capital goods, or high-technology industry and zero otherwise. This enables us to examine to what extent and also what nature of manufacturing output favour growth in individual cities. *Degree of urbanization*: the higher level of urbanization of a state is expected to be associated with a higher population concentration in metro cities. Apart from this, it is largely expected that a substantial base population stimulates a further city growth just because they are large. If this surmise is true, then the initial population of a metro city would be correlated with its growth rate. Therefore, the city-wise population of 2001 is also incorporated into the study. *Economic opportunities*: as measure of economic opportunities, we consider the expected wage. The expected wages are measured by a proxy indicator, which is real per capita net domestic product (NSDP) in the state in which city *i* is situated, since no city-level income data is available in India. This particular measure may have crucial bearing on the city growth: the higher the income, the faster the growth and vice-versa (Mill and Becker 1986). People generally move away from lower skilled cities, because cities having a higher level of human capital are regarded to have greater productivity and are thus are the first sites expected to attract firms and then exert a pull effect on more people due to the higher wages offered (see Lucas 1988; Glaeser, Kolko, and Saiz 2001; Glaeser and Shapiro 2003).

Political instability may have a negative effect on city growth on the ground that it results in an unfavourable environment for the city dwellers (Da Mata et al. 2005; Tripathi 2013). The city crime rate is taken as a proxy measure for political instability as it reflects the law and order situation in a city. Data for this particular indicator comes from the National Crime Records Bureau, Ministry of Home Affairs, GOI. *Presence of land-use control policy*: In the Becker–Mills–Williamson model, which is a computable general equilibrium model of the Indian economy, limits to city growth is shown to take place because of the inflation in urban site rents. Rents are exacerbated in Indian cities due to the presence of strong land-use controls such as rent control and ULCRA. 'The ULCRA' act of 1976 came into being to exercise social control over city land in order to distribute it equitably. Nevertheless, it hindered private holdings of vacant land above certain limits within city areas and was subsequently revoked in 1999, apart from in some states. Freed from this hindrance, city land should be in a position to claim its market price unhindered. This could facilitate more affordable housing and stimulate city growth (see Sridhar 2010). To see how the existence or otherwise of the ULCRA Act affected metro growth, we have included an indicator for strong land-use control existing or not in a city in the form of a dummy variable for ULCRA. The data pertaining to the presence or otherwise of the ULCRA Act in the states whose cities are examined have been accrued from the Ministry of Urban Development, GoI. Nearly 33% of the sample cities continue to have the ULCRA Act still enforced in places (Table 1). Appendix 1 reports the results of the correlation coefficients of these indicators used in the regression models.

Table 1. Description of data used in regressions.

	Variable	Obs	Mean	Std. Dev.	Min	Max
Dependent variables						
X1	City population 2011	52	3,068,870	3,790,421	1,001,694	1.84E +07
X2	Growth rate of city population (2001–2011) (in %)	52	3.28	2.73	0.59	16.96
Independent variables						
X3	City located in northern region dummy	52	0.29	0.46	0	1
X4	City located in eastern region dummy	52	0.12	0.32	0	1
X5	City located in western region dummy	52	0.19	0.40	0	1
X6	City located in southern region dummy	52	0.29	0.46	0	1
X7	City located in a river bank dummy	52	0.46	0.50	0	1
X8	City rainfall (in millimetres)	51	1130.00	711.53	332.80	3053.00
X9	City temperature difference (in degree centigrade)	52	29.68	12.09	3.00	43.80
X10	Distance to state head quarter (in kms)	52	216.10	201.64	0	857
X11	Distance to nearest Class-I city (in kms)	52	30.40	37.50	0	160
X12	% of state's urban population living in the metro city	52	14.03	15.79	2.35	99.88
X13	State's expenditure on transport (in Rs. crore)	51	666.76	455.28	52.23	1681.22
X14	Rail network (in kms) per lakh population in the state	52	5.40	1.86	1.09	8.7
X15	Pucca road length/sq km in the city	51	10.08	9.44	0.12	53.34
X16	School (secondary and higher) per 1000 population in the city	52	6.57	4.00	1.20	20.11
X17	Capital city dummy	52	0.27	0.45	0	1
X18	Industrial structure dummy[a]	52	0.83	0.38	0	1
X19	State's level of urbanization (%)	52	36.10	13.66	11.29	97.5
X20	City population 2001	52	2,375,297	3,272,328	311,558	1.64E+07
X21	NSDP per capita of the state (Rs. in lakh)	52	41,784.17	18,617.37	13,149	106,677
X22	City crime rate	52	392.33	198.82	123.2	834.3
X23	Existence of ULCRA in the city dummy[b]	52	0.33	0.47	0	1

Notes: [a]It takes value 1 if the city's two leading manufactured commodities are intermediate goods, capital goods or high technology industry and 0 otherwise.
[b]Existence of Urban Land Ceiling and Regulation Act (ULCRA) in the City is assigned value 1, and 0 otherwise.
Source: Primary Census Abstract, Town Directory 2001 and 2011, Census of India; Ministry of Urban Development (MoUD), Ministry of Statistics and Programme Implementation (MoSPI); Ministry of Railways; Ministry of Finance and Ministry of Home Affairs, Govt. of India (GOI).

4. Key findings and discussions

4.1. Dynamics of urban growth and metropolitan development in India

4.1.1. Urbanization trends in India

From the very beginning of the twentieth century, India had been undergoing an ever-accelerating urban growth over the decades, albeit with a relatively low level of urbanization. This low level of India's urbanization was due to the fact that though its urban populace increased, the increase of the rural population was sizeable too. Indeed, barring the 1911–1921 decade, for the first time in India's urbanization history, absolute urban population grew more (by 91.8 million) than that of their rural counterpart (by 91.5 million) only during the 2001–2011 period.

Table 2 shows that the total urban population on the eve of the 2011 Census stood at 377.11 million as compared to 286.12 million in the preceding decade. While the AEGR of urban population has increased only in the second decimal point (i.e. from 2.74% to 2.76% during 2001–2011), a 3.34% point increase in the level of urbanization has been recorded, compared to the 2.1% point increase during the 1991–2001 period. Considering that the nation's economy has grown from about 6% during the 1990s to about 8% per annum during the first decade of the 2000s (Ahluwalia 2011), the potentiality of economic growth giving rise to the relatively higher urban growth during the last decade is implied[2]. Meanwhile, a quantum leap in the number of towns from 1915 at the beginning of the twentieth century to 7935 in the first decade of twenty-first century has marked the urban transformation in India. The number of towns dropped in the 1961 Census, primarily due to the stringent census criteria for identifying towns which caused considerable declassification of the so-called new towns. The 2011 Census identified 2774 new towns, and none of the other preceding decades had ever experienced such a large addition of new urban centres. The possible reasons behind such a stunning increase of towns could be the population increase in many urban outgrowths (OGs) or reclassification of formerly suburbanized areas that obtained the eligibility of being now denoted as a town according to the existing census criteria. By and large, the diminishing trends in the urban demographic growth rate, noticeable since the 1970s, are reversed, and the level of urbanization has increased at a slightly faster rate during the recent decade. Recent studies (Bhagat 2011; Pradhan 2013) have surmised that the rapid increase in the number of new towns along with rural–urban migration has substantially contributed to this relatively higher urban growth during 2001–2011, in spite of the sluggish growth of many metropolitan cities (Kundu 2011b). Contrarily, the contribution of natural increase in urban growth has diminished markedly from 59% to 44% during the same time. However, this component still appended as many as 40 million people into urban India during 2001–2011 (Bhagat 2011).

Table 2. Process of urbanization in India since 1901.

Census year	Population (in millions)		Level of urbanization (%)	No. of urban centres	AGER of urban population (%)[a]	Tempo of urbanization
	Total	Urban				
1901	238.4	25.85	10.84	1915	–	–
1911	252.09	25.94	10.29	1864	0.03	−0.52
1921	251.32	28.09	11.18	2018	0.80	0.83
1931	278.98	33.46	11.99	2188	1.75	0.71
1941	318.66	44.15	13.85	2392	2.77	1.44
1951	361.1	62.44	17.29	3035	3.47	2.22
1961	439.09	78.94	17.98	2657	2.34	0.39
1971	548.23	109.11	19.90	3081	3.24	1.02
1981	683.33[b]	159.46	23.34	3981	3.79	1.59
1991	846.39[b]	217.55	25.70	4615	3.11	0.97
2001	1028.61	286.12	27.82	5161	2.74	0.79
2011	1210.19	377.11	31.16	7935	2.76	1.14

Notes: [a]Annual exponential growth rate.
[b]Estimated population has been taken for Assam and Jammu and Kashmir in 1981 and 1991, respectively.
Source: Computed by the authors from census data of various years.

4.1.2. Metropolitan development in India

As stated in Table 3, the unique feature of India's urbanization is its large city orientation and this is indicative of the increasing disparity and inequality in the urban population distribution, precipitating a top-heavy urban structure in India. Class-I cities (city with population of one lakh or more) are the critical manifestation of such top heaviness-induced urbanization, culminating into the formation of new big metro cities over time. These metropolitan or million plus cities (often termed as 'Mother City') are recognized through their urban way of life or urbanism and heterogeneity of inhabitants (Premi 2010; Banerjee 2013). Their growth pattern showcases metropolitanization as the striking attribute of Indian urbanization in her post-independence era because of their escalating growth in number and furthermore the increasing per cent share of the overall urban populace in these cities.

At the beginning of twentieth century there was only one metro city, namely Kolkata (Calcutta), the then capital of British India with a population of 1.52 million (Table 3). Mumbai (Bombay) entered this league in 1911. These two cities dominated the urban scene till 1951 when their number increased to five with the addition of Chennai (Madras), Delhi and Hyderabad. Subsequently the number of metro cities continued to rise to 23 in 1991, 35 in 2001 and to 52 in the 2011 Census, which observed a substantial increase in their numbers owing to the graduation of several Class-I cities to the current group of million plus cities. It is worth mentioning here that not only have these million plus cities increased in number but that their respective shares in the nation's total urban population and in the nation's total population have also registered considerable increase over the decades. In 1901, only one and half million urban Indians lived in metro cities as against 159.57 million today (Table 3), while their per cent share of the urban population has registered a sevenfold increase from 6% in 1901 to 42% in 2011. The decadal wave of metropolitan growth also shows some distinct trends. As apparent from Table 3, the AEGR of population was quite flat during the inter-war period but rapid during the 1940s to 1960s, basically due to post-war urban movement and the huge influx of refugees in the wake of partition. Since then, the demographic growth in metro cities has been more or less steady, hovering around 4% to less than 5%, except in the last decade, which recorded the lowest growth rate since independence. It is discernible that the national metropolitan growth rate was always higher than India's urban growth rate over these decades as well. Apart from this, the concentration of urbanites in metro cities has increased significantly over time, from one-fourth in the 1970s and 1980s to more than two-fifths today, pointing to the mammoth metropolitan development in India since these cities' inception. This huge amassing of people in these cities is the end product of the marked concentration of economic activities therein, attracting ever more population from the surrounding locales, mostly from rural areas and from other lower order cities/towns as well (Sharma 2001). This has ensued in OGs sprouting up around the metros and the emergence of new towns, the fallout of accelerated metropolitan agglomerations. This process has consumed considerable rural areas adjacent to the original cities and changed the physical landscape as well as socioeconomic framework of these locales.

4.2. *Trends and patterns of metro city development: a regional-level perspective*

Contemporary India's urbanization is underlain by her almost 200-year-long colonial legacy. Most of the present-day Indian metro cities have their genesis in the early independence period, and since then India has been characterized by 'metropolitan

Table 3. Process of metropolitanization in India since 1901.

Census year	Metro city						Class-I city		
	No. of city	Population (in millions)	Share of country's total population (%)	Share of country's urban population (%)	Mean city size (in millions)	AEGR of population (%)	Population (in millions)	Share of country's urban population	AEGR (%)
1901	1	1.52	0.64	5.88	1.52	–	6.72	26.00	–
1911	2	2.80	1.11	10.81	1.40	6.12	7.13	27.48	0.59
1921	2	3.16	1.26	11.24	1.58	1.19	8.34	29.70	1.57
1931	2	3.44	1.23	10.28	1.72	0.85	10.44	31.20	2.24
1941	2	5.34	1.68	12.11	2.67	4.41	16.88	38.23	4.80
1951	5	12.01	3.33	19.24	2.40	8.10	27.87	44.63	5.01
1961	7	18.48	4.21	23.41	2.64	4.31	40.59	51.42	3.76
1971	9	28.45	5.19	26.07	3.16	4.31	62.45	57.24	4.31
1981	12	43.29	6.34	27.15	3.61	4.20	96.19	60.32	4.32
1991	23	70.99	8.39	32.63	3.09	4.95	141.17	64.89	3.84
2001	35	108.29	10.53	37.85	3.09	4.22	196.48	68.67	3.31
2011	52	159.57	13.19	42.31	3.07	3.88	264.88	70.24	2.99

Source: Same as Table 2.

dominance' or urban growth in a few pockets. This legacy of metro city development in India showcases some interesting trends and regional patterns (Figures 1). Here, we divide India into six specific urban regions for analytical purposes and examine the growth patterns of metro cities since 1901[3]. This particular exercise would be of great help to construe the region-specific factors in the growth of metros in each region minutely.

Table 4 shows that at the beginning of the twentieth century, Kolkata (Calcutta) had emerged from eastern region as the first metropolitan entity, serving as the vital colonial port city and administrative capital of then British India. In the next decade, Mumbai (Bombay), another leading port city, joined this league from the western region, and both

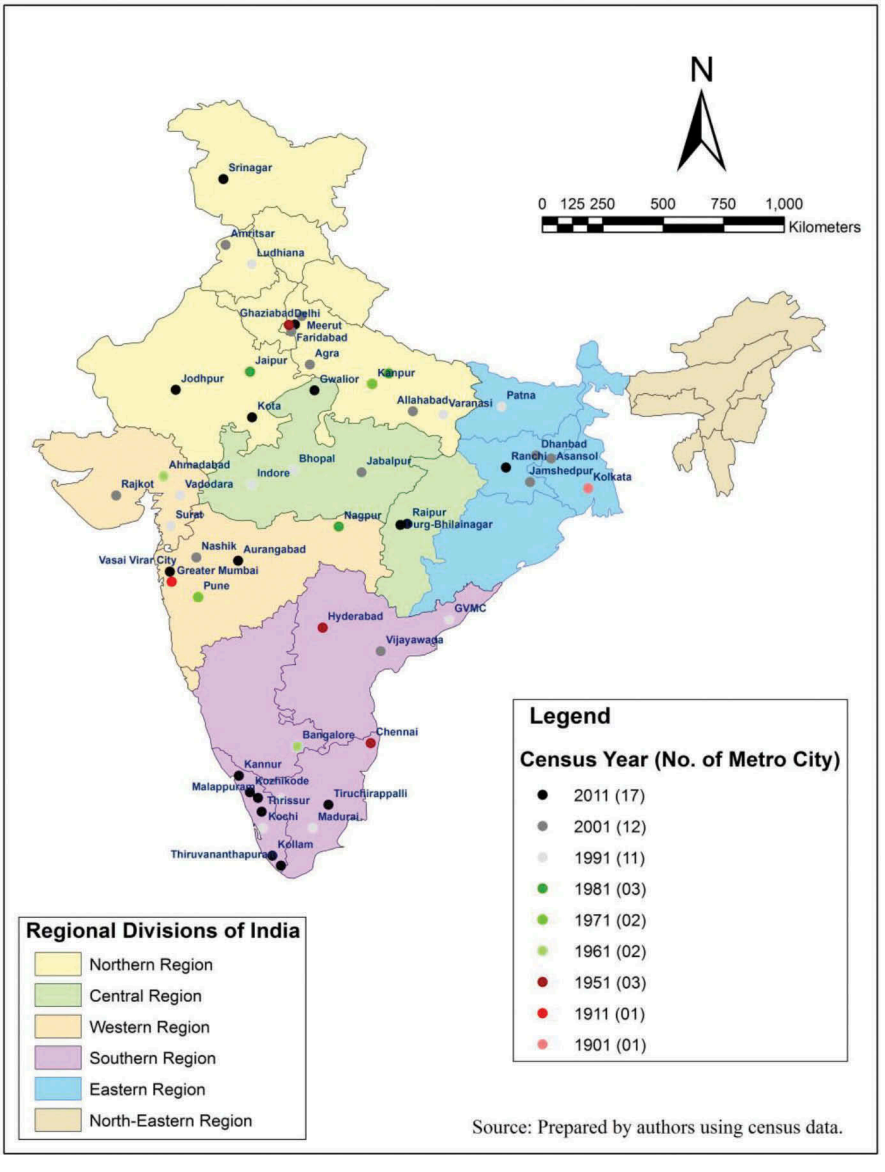

Figure 1. Million plus cities in India: 1901–2011.

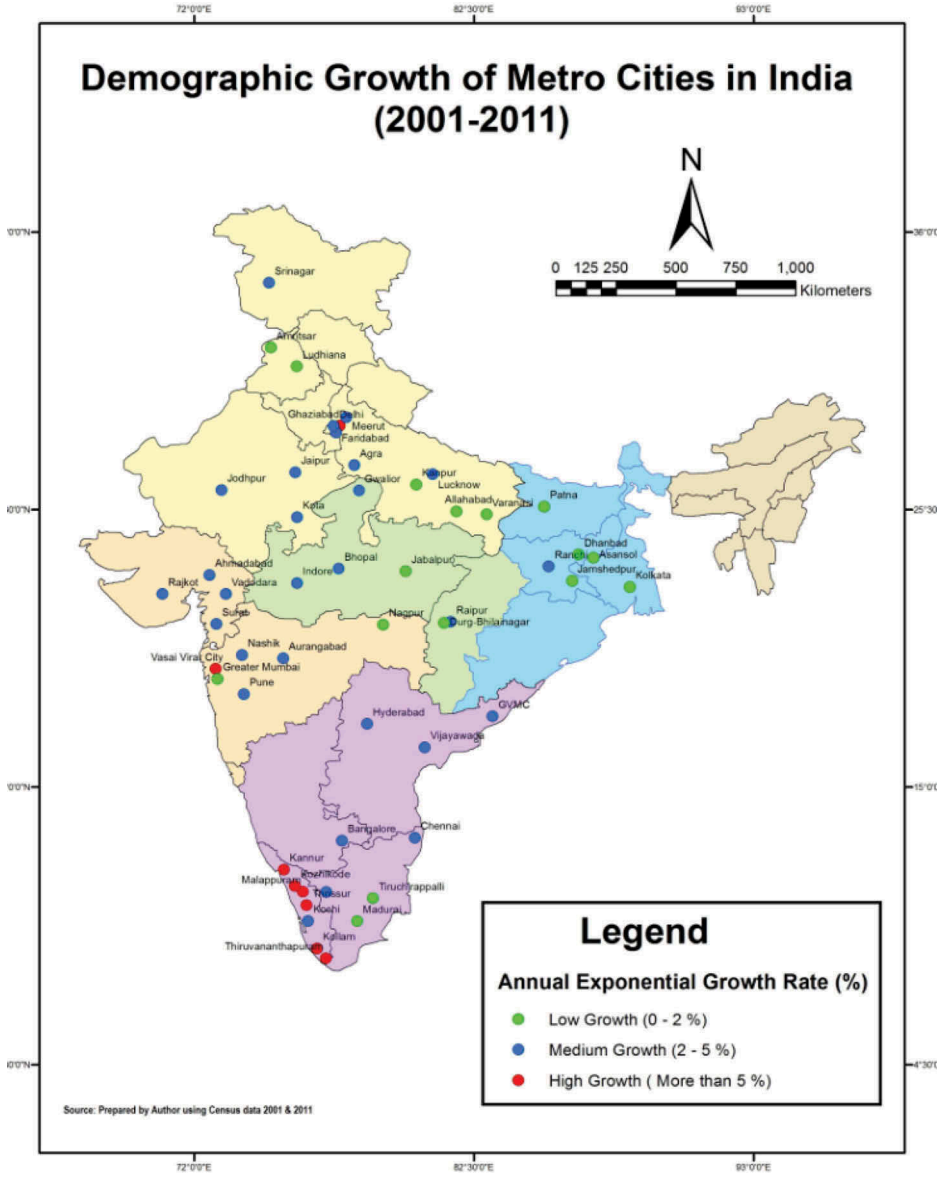

Figure 2. Demographic growth of metro cities in India (2001–2011).

remained thus until 1951 with their strong industrial bases. After independence, Delhi from the northern urban region (the later-day British capital), and from the southern region, Hyderabad and Chennai (Madras, another colonial port city) entered this list. Similarly, Ahmedabad from the west and Bangalore from the south in 1961; Kanpur from the north and Pune from the west in 1971; Jaipur and Lucknow from north and Nagpur from west joined in 1981, implying the relatively slow and piecemeal process of metropolitanization in India.

The 1990s economic reforms underlain by globalization, liberalization and privatization marked the beginning of a new era of rapid metropolitan development in India, adding 11 new metros to the existing list, almost doubling their number from the 1981 Census and incorporating 28 million additional people (Table 3). These were, Patna from the eastern region, Ludhiana and Varanasi from the northern region, Bhopal and Indore from the central region, Surat and Vadodara from the west and Coimbatore, Visakhapatnam (GVMC), Kochi and Madurai from the south. This spatial pattern has two unique trends that either these cities occupy coastal locations or they follow the prime east to north-west great plains alignment, with the central tracts, excepting the location of Nagpur, Hyderabad and Bangalore holding little allure for metropolitan development. The north-eastern region is dotted with only small- to medium-size towns, apart from the single instance of Guwahati, regarded as the gateway to the north-east. Another conceivable inference is that investment patterns which markedly affect urban growth, through emergence of industrial and expanding commercial centres, have been very skewed, creating select urban islands, bypassing vast rural tracts and thereby precipitating considerable rural–urban disparities and imbalances.

However, during the 1991–2011 period, the earlier trend was altered slightly. In 2001, as many as 12 new metro cities emerged (Asansol, Dhanbad and Jamshedpur from the eastern region; Jabalpur from the central region; Nashik and Rajkot from the western region; Vijayawada from the southern region; and Agra, Allahabad, Amritsar, Faridabad and Meerut from the northern region). Another 17 new metros joined this team in the last census (Ranchi from the eastern region; Gwalior, Durg-Bhilai Nagar and Raipur from the central part; Aurangabad, Vasai-Virar City from the western region; Kannur, Kollam, Kozhikode, Malappuram, Thiruvananthapuram, Thrissur and Tiruchirappalli from the southern region; Ghaziabad, Jodhpur, Kota and Srinagar from the north). It is noticeable that though the central tract and the extreme northern part of India encountered some metropolitan development during these two decades, overall the entire north-eastern as well as south-eastern region (primarily Orissa) has lacked such growth so far.

If we examine the trends of metro population growth rate across the various urban regions, a conspicuous picture is uncovered. The demographic growth rate of metro cities in the northern, southern and western metro regions was significantly higher, over the decades, as compared to the eastern region (Table 4). However, the central metro region has recorded a stunningly rapid growth rate in the last two decades, hovering around 6–7% per annum. Similarly, the northern and southern regions report relatively higher metro growth during the last census mainly because of the addition of a large number of new metro cities. It is also observed that nearly 57% of the urbanites of the western region are living in only 10 of its metro cities, followed by 43.26%, 39% and 37% in 15 southern, 15 northern and 6 eastern metro cities, respectively. By and large, what emerges is that although the first metropolitan development was initiated in the eastern region, subsequently it had experienced sluggish growth, especially in the last couple of decades. Contrastingly, the northern, southern and western regions have retained their robust pace.

The reasons underlying such a stark inter-regional growth differentials in metro city development, as discussed earlier, could be explained with the help of some regional attributes (see Tables 5 and 6). Historically, the majority of these metropolitan cities have emerged only in a few relatively socioeconomically well-off states/UTs, for instance in the northern region (Uttar Pradesh, Delhi, Punjab and Haryana), western region (Maharashtra and Gujarat) and southern part (Tamil Nadu, Kerala, Andhra Pradesh and Karnataka). As depicted in Tables 5 and 6, the higher concentration of urban population in these regions is brought about by the cluster of diverse economic activities (manufacturing employment) therein, greater resource mobilization and growing foreign direct investments,

Table 4. Trends and patterns of metropolitan growth across different regions since 1901.

Census year	Regional divisions									
	Northern		Eastern		Central		Western		Southern	
	No. of metro city	AEGR of population	No. of metro city	AEGR of population	No. of metro city	AEGR of population	No. of metro city	AEGR of population	No. of metro city	AEGR of population
1901	–	–	1	–	–	–	–	–	–	–
1911	–	–	1	1.44	–	–	1	–	–	–
1921	–	–	1	0.64	–	–	1	2.06	–	–
1931	–	–	1	1.25	–	–	1	0.24	–	–
1941	–	–	1	5.27	–	–	1	2.83	–	–
1951	1	–	1	2.64	–	–	1	6.10	2	–
1961	1	4.96	1	2.47	–	–	2	5.76	3	4.98
1971	2	7.35	1	2.14	–	–	3	5.06	3	4.06
1981	4	6.49	1	2.13	–	–	4	4.52	3	3.91
1991	6	5.14	2	2.82	2	–	6	4.22	7	6.20
2001	11	5.88	5	3.98	3	6.29	8	3.81	8	2.97
2011	15	3.69	6	1.47	6	7.49	10	2.80	15	6.08
[a]	38.95		37.47		33.13		56.66		43.26	

Note: [a]% share of urbanites living in metro city.
Source: Same as Table 2.

Table 5. Some basic facts of metro regions.

Aspects	Regional divisions					
	North	North-east	East	Central	West	South
Percent share of India's urban population 2011	27.94	2.19	14.87	6.90	20.63	27.47
Percent share of India's urban population 2001	28.36	2.11	14.96	7.04	21.25	26.28
Level of urbanization 2011	28.57	18.27	20.67	26.49	44.50	41.02
Level of urbanization 2001	26.37	15.73	18.78	24.82	40.74	33.52
Urban growth rate (%)	2.61	3.14	2.70	2.55	2.47	3.20
Tempo of urbanization (2001–2011)	−12.75	1.50	0.96	0.65	0.88	2.02
JnNURM funds released by State and Union Territories(Rs. crore) (as on 31December 2010)[a]	6061.40	892.00	3143.30	1617.40	8543.00	8328.20
Amount of investment in urban region, 1995–2010 (Rs. Crore)[b]	1,455,328 (24.81 %)	N.A.	483,697 (8.25 %)	206,517 (3.52 %)	2,018,266 (34.41 %)	1,701,658 (29.01 %)
Inter-state urban migration rate 2007–2008 (NSSO-64th round)	5.29	1.04	2.23	3.04	4.32	3.79
Percent share of employment in manufacturing sector to total employment (main workers) 2001	23.70	10.25	22.02	20.32	27.63	22.92
NSDP per capita (at constant 2004–2005 price) 2011–2012 (Rs. in lakh)	54,632	33,934	33,765	25,218	82,436	47,487

Notes: N.A. denotes not available since north-eastern region does not have metro city.

[a]JnNURM stands for the Jawaharlal Nehru National Urban Renewal Mission. Under the JnNURM umbrella, there are four sub-components, namely Urban Infrastructure and Governance (UIG), Urban Infrastructure Development Scheme for Small and Medium Towns (UIDSSMT), Basic Services to the Urban Poor (BSUP), and Integrated Housing and Slum Development Programme.

[b]Shaw (2012) (Table 1), figure in the parentheses shows share of total investment of concerned region.

Sources: Authors own based on Census of India 2001 and 2011, Ministry of Urban Development and National Sample Survey Organization (NSSO), Govt. of India.

whereas the comparatively backward regions (especially Orissa, the north-eastern states and Uttarakhand) remain devoid of such inputs and facilities, leading to their sluggish metropolitan development over the decades. Table 6 offers a good picture of the investment in large projects received by major metro cities and their adjoining districts across the various urban regions. Here, it is seen that the three prime locations of the country, namely, the western, southern and northern urban corridor, have been the largest investment destinations, receiving 34.41%, 29.01% and 24.81% of total investment, respectively, during 1995–2010. While, the eastern and central regions have benefitted far less in this regard, the north-eastern region scarcely obtained any benefit at all. Funds released by the state/UTs towards implementing the JnNURM project across these urban regions also showcase a similar disparity in allocation (Table 5). The economic liberalization of the 1990s heralded changes in India's metro cities, which are reflected in the type and pattern of investment they experienced, which facilitated the development of economically

Table 6. Amount of investment in select metro cities and its adjoining districts, 1995–2010 (Rs. Crore).

	Investment in-			
Region/City		Adjoining districts		Total
Northern region				**1,455,328**
Delhi	378,409	Faridabad, Gurgaon, Ghaziabad and Noida	682,175	1,060,234
Ludhiana and Jalandar	100,598	–	–	100,598
Jaipur	128,796	–	–	128,796
Chandigarh	47,818	–	–	47,818
Varanasi	18,857	–	–	18,857
Lucknow	75,128	–	–	75,128
Kanpur	23,897	–	–	23,897
Central region				**206,517**
Bhopal	69,326	–	–	69,326
Indore	46,521	–	–	46,521
Nagpur	90,670	–	–	90,670
Eastern region				**483,697**
Kolkata	181,470	North 24 Parganas, South 24 Parganas, Howrah and Hooghly	136,709	318,179
Patna	67,041	–	–	67,041
Dhanbad	98,477	–	–	98,477
Western region				**2,018,266**
Ahmadabad	335,060	–	–	335,060
Surat	289,641	–	–	289,641
Vadodara	99,091	–	–	99,091
Mumbai	500,459	Thane and Raigarh	522,806	1,023,265
Pune	271,209	–	–	271,209
Southern region				**1,701,658**
Chennai	289,641	Tiruvallur and Kanchipuram	233,018	522,659
Bangalore	345,583	Bangalore Rural	48,283	393,866
Hyderabad	266,991	Rangareddy	103,108	370,099
GVMC	248,773	–	–	248,773
Kochi (Ernakulum)	121,990	–	–	121,990
Coimbatore	44,271	–	–	44,271

Source: Compiled from Shaw (2012:50) (Table 1).

vibrant urban regions of growth in some areas of the country and new urban clusters elsewhere. Yet, huge tracts of India are still bereft of such dynamic metro development, being trapped into old industrial bases with high unemployment and thus resort to exporting their skilled and unskilled manpower to the economically vibrant urban regions. The migration trends during 2001–2011 reflects this further, as people gravitate towards already populous states, where a significant volume of investments, financial activities, resources and thereby jobs are concentrated in their urban centres (Clark 2012). Uttar Pradesh is the most favoured destination of inter-state migrants, followed by Delhi, West Bengal, Maharashtra (the leading in-migrating state), Tamil Nadu, Kerala and Rajasthan. Delhi, obviously, is the most appealing destination for both net rural-to-urban and urban-to-urban migrants.

The metro cities are fairly uniformly distributed, aside from in the hilly and desert regions, across the nation, which is evidence of the expansive populace of India as well as the extensive distribution of populace amassment and low man–land ratio. Unlike most developing nations where a single city dominates, housing a lopsidedly substantial part of the populace and economic activities in relation to its second biggest city, India's urban structure is spatially scattered and not distinguished by primacy (Mathur 2005).

4.3. Demographic growth dynamics of individual metro cities – a core–periphery approach

Since our paper deals with the expansion of metropolises, in terms of both their number and population, it is therefore pertinent to also examine the dynamics of population growth in these cities over the decades. Analysis of the trends of growth rate in terms of the entire city (1901–2011) as well as its core vis-a-vis the periphery (1991–2011) of 52 metro cities/ UAs (Appendix 2 and Table 7) elicits some interesting results. For instance, many of the cities/UAs of older origin have remarkably displayed either a fast declining growth rate or lower values of positive growth, leading to an overall decline of their average growth rate to 3.88% in 2011, compared to it being 4.95% in 1991 in the metro cities. This is basically due to the higher propensity of population drift from the core city to adjoining areas, what has appropriately termed as 'peripheralization' (Maia 2013). This study makes it further evident that about 77% of metro cities have encountered lower than average growth rates and among them, nearly 18% of cities have indicated exceptionally low ones (< 2%) during 2001–2011 (e.g. Mumbai, Kolkata, Kanpur, Ludhiana, Nagpur, Madurai, Varanasi, Amritsar, among others) (figure 2). Contrastingly, most cities of younger origin have experienced a higher than average growth rate ranging from 4% to 24% per annum during the recent decade (places like Malappuram, Thrissur, Kollam, Kannur, Vasai-Virar City, Kozhiokode, Bangalore, Ghaziabad, Raipur, among others). Barring Bangalore, most of them are, however, the secondary metros and seem to have benefitted by the economic forces unleashed during recent decades. The growing congestion and overcrowding of the age-old metro cities (Mumbai, Delhi, Kolkata and Chennai) were an additional advantage to them as well. For instance, the rapidly growing metros of Ghaziabad, Faridabad and Meerut have come up in the vicinity of Delhi. Surat, Pune and Vasai-Virar City are also growing at a higher pace, being adjacent to Mumbai. Adjacent to Kochi city, six new metros have also followed the same pattern during the last census. Consequently, three distinct clusters of metropolitan dominance are clearly visible in the northern, western and southern regions of India's urbanscapes.

Many of the metro cities are actually multi-municipal agglomerations, comprising of a large 'mother city' in the core, with smaller towns along the periphery. Therefore,

Table 7. Demographic growth dynamics of metro cities (core vis-a-vis periphery)[a.]

City [b]	Population (in millions) 2011	AEGR of population (%)					
		Entire city		Core area		Peripheral area	
		1991–2001	2001–2011	1991–2001	2001–2011	1991–2001	2001–2011
1. **Declining core, declining periphery**							
GREATER MUMBAI	18.39	2.62	1.17	1.83	0.43	5.12	2.9
DELHI	16.35	4.25	2.39	3.15	1.11	9.05	5.73
KOLKATA	14.06	1.82	0.62	0.39	−0.17	2.66	1.01
Lucknow	2.9	3.06	2.47	3	2.54	4.81	0.58
Nagpur	2.5	2.44	1.63	2.33	1.59	6.02	2.52
Patna	2.05	4.4	1.82	3.99	2.09	6.26	0.68
Vadodara	1.82	2.81	2	2.36	2.46	6.68	−2.07
Nashik	1.56	4.63	3.04	4.94	3.22	0.93	0.09
Allahabad	1.21	2.17	1.44	2.07	1.32	3.61	2.97
Aurangabad	1.19	4.09	2.9	4.21	2.97	−0.14	−0.6
Durg-Bhilainagar	1.06	2.75	1.37	2.28	1.26	5.93	2
Tiruchirappalli	1.02	1.98	1.66	1.53	1.19	5.58	4.27
2. **Declining core, growing periphery**							
CHENNAI	8.65	1.7	2.98	1.23	0.67	2.75	6.55
PUNE	5.06	4.09	2.98	4.83	2.07	2.71	4.64
Kanpur	2.92	2.82	0.82	3.08	0.81	−1.11	1.09
Indore	2.17	3.91	2.81	3.81	2.07	8.73	16.01
Coimbatore	2.14	2.73	3.91	1.31	1.21	5.94	7.46
Kochi	2.12	1.73	4.47	0.53	0.11	2.77	6.92
Kozhikode	2.03	2.61	8.35	0.39	−0.12	5.41	12.81
Bhopal*	1.89	3.16	2.57	3	2.26	–	12.76
Thrissur	1.86	0.78	17.3	1	−0.05	−3.55	48.1
Agra	1.76	3.32	2.87	3.58	2.18	−1.96	13.28
Malappuram	1.7	1.81	23	1.74	1.56	1.88	29.49
Thiruvananthapuram	1.68	1.15	6.36	3.52	0.56	−6.19	18.19
Kannur	1.64	0.36	11.92	−0.22	−1.16	0.45	12.94
Varanasi	1.43	1.62	1.67	1.61	0.93	1.65	6.68
Meerut	1.42	3.18	1.97	3.49	2	0.27	1.58

(*Continued*)

Table 7. (*Continued*).

Rajkot	1.39	4.26	3.28	4.57	2.85	−1.92	10.98
Jamshedpur	1.34	2.87	1.93	2.19	0.97	3.66	2.87
Jabalpur	1.27	2.11	1.45	2.14	1.24	1.94	2.54
Asansol	1.24	1.36	1.53	5.95	1.71	−1.23	1.38
Amritsar*	1.18	3.48	1.65	3.1	1.58	–	3.23
Jodhpur*	1.14	2.56	2.79	2.45	1.94	–	23.71
Ranchi	1.13	3.4	2.66	3.46	2.37	0.57	11.78
Kollam	1.11	1.48	10.72	1.46	−0.36	1.84	37.17
3. **Growing core, declining periphery**							
BANGALORE	8.52	3.2	4.04	4.81	6.74	−0.59	−28.93
HYDERABAD	7.68	2.42	3.27	1.98	6.22	3.31	−7.09
AHMADABAD	6.36	3.11	3.41	2.02	4.6	8.3	−2.48
Surat	4.59	6.16	4.9	4.85	6.07	29.32	−11.18
GVMC*	1.73	2.54	2.5	2.02	5.06	4.56	–
Madurai	1.47	0.95	2.04	−0.13	0.91	6.07	5.22
Srinagar**	1.26	–	2.4	–	2.73	–	−1.63
Dhanbad	1.2	2.67	1.17	2.72	17.64	2.66	−32.44
Raipur	1.12	4.14	4.73	2.81	5.12	29	1.81
Gwalior	1.1	1.87	2.42	1.8	2.43	3.55	2.3
4. **Growing core, growing periphery**							
Vijayawada	1.48	1.79	3.79	1.93	1.95	1.05	10.18
5. **Others**							
Vasai Virar City*	1.22	–	–	–	23.3	–	–
Kota*	1	2.69	3.54	2.56	3.67	–	–
Jaipur*	3.05	4.25	2.71	4.65	2.71	–	–
Ghaziabad*	2.38	6.38	8.98	7.57	5.32	–	–
Ludhiana*	1.62	2.94	1.46	–	–	–	–
Faridabad*	1.41	5.35	2.93	–	–	–	–

Notes:

[a] Entire population includes population of 'Cities/ UAs' and core refers to main city's population. Population of periphery has been computed by deducting the core city population from City/UAs.

[b] City in 'UPPERCASE' indicates Mega City with population 5 million and greater (see Premi 2010: 35).

*It has no peripheral population since its constituent parts either has been merged with M Corp. in respective censuses or it did not have UAs.

**1991 Census was not conducted in Jammu and Kashmir.

Source: Same as Table 2.

analysing the growth patterns of these metro cities in terms of their core versus periphery, for the last two consecutive decades, should provide clearer insights regarding the dynamics at play. Table 7 reports the findings, using which four prominent classifications may be done of the urban areas, following their respective traits. These are a 'declining core–declining periphery', a 'declining core–growing periphery', a 'growing core–declining periphery' and a 'growing core–growing periphery'. We find that 67% of the total metros, including some mega cities (e.g. Greater Mumbai, Delhi, Kolkata, Chennai, Pune) have encountered a remarkably declining core with simultaneously accelerated peripheral growth and that Kolkata has even registered a negative growth in the 2011 Census, implying a marked short-distance outmigration from the core city to its adjoining areas (Das and Bhusan 2014; Kundu 2013a). Furthermore, the Mumbai UA has displayed seven-times higher growth rate in its peripheral areas than within its core city, while Kolkata (six times), Delhi (five times) and Chennai (ten times) have also displayed a similar character during the 2001–2011 period. This trend also holds true in case of Kanpur, Pune, Bhopal, Nagpur, Allahabad, Indore, Varanasi and other metro cities.

Basically these cities, which were some of the first to attain metro status, have reached saturation level with respect to population and available residential areas, their plight further accentuated by a severe shortfall of infrastructure and amenities, rising cost of living and restrictive land-use policies, which may have diminished the potentiality of the core region of these cities to absorb further population growth. Inhabitants thus seek spaces in and around the main city, fuelling the escalating growth of UAs through its peripheries. Besides this, the 1990's economic reforms marked the beginning of a neoliberal economic regime characterized by easy import and export, de-licensing, disinvestment in public sectors, a higher chunk of privatization and a liberalization of the foreign policy. Corresponding to these macroeconomic reforms, India has adopted *SAPs* which led to the reduction of the government's expenditure on welfare activities (Joshi 2006). Thus, cities, which are the 'engines of economic growth', have come under and felt the effect of market forces. Private investments have increased more as compared to public ones (Shaw 2012b, 41). The nature of government investments in cities has also become more selective, and these are primarily occurring in the urban infrastructure sector to benefit private as well as global agencies (Kundu and Samanta 2011). The economy of these cities has gradually transformed into that of a highly capital-intensive, knowledge-based, high technology-oriented production system. The service sector is emerging in a greater way (Harris 2007, 17–22), while the manufacturing sector is diminishing at a higher rate (Kundu, A. 2003). Large-scale manufacturing activities are being moved away from the core to the peripheral areas of the city (Ghani et al. 2012; Harris 2007, 15; Shaw 1999) to make place for private investments (both international and national), which have a comparatively greater economic output (Kundu, A 2003). Furthermore, peripheral areas are also encountering a real-estate boom to fulfil the escalating housing demands of the rising middle-class population. Apart from this, *Special Economic Zones* and integrated townships are now being developed in the peri-urban areas of the metro cities (Mukhopadhyay 2009, 50). All this has led to a tremendous peripheral growth around many metro areas. Such contemporary urban growth and restructuring are noticeable in many of the larger metropolises, and there are colossal differentials in the effect of global forces on the discussed dynamics (Shaw and Satish 2007). Even though a knowledge-based economy is recently emerging in the metro cities, the major chunk of the workforce is still involved in the informal sector, with very low productivity (Shaw 2012b, 51). This typical form of recent urbanization fundamentally designates an 'agglomerated trend' (Sivaramakrishnan, Kundu, and Singh 2005). However, Bangalore, Hyderabad,

Ahmadabad and Surat, among others, showcase a reverse trend, that is, the core area is growing faster than the periphery. The relatively higher population growth here has been conducive to sizable areal growth along with a higher proportion of investment within the city proper than in its outlying districts, which has led to the swift rise of high-tech, electronic industries, drawing in many skilled and unskilled workers (see Table 6).

Even Jamshedpur, Durg-Bhilai Nagar and Dhanbad too have all exhibited declining growth trends in the last decade (Appendix 2), affecting the nature of the overall regional development. The role of such regional metros becomes more relevant in terms of the urban–rural linkages for planning and governance. A tendency of corridor developments is also discernible from the growth pattern of such metropolises. The proximity of cities, for example, Kolkata–Asansol–Dhanbad–Jamshedpur, Varanasi–Allahabad–Kanpur–Lucknow, Amritsar–Jalandhar–Ludhiana or Vadodara–Ahmedabad–Surat, highlights the spatial concentration of population along these urban corridors. Such kind of regional development is also becoming prominent in other parts of India (Chandan and Sharma 2012). It is apparent thus that a majority of urbanites, residing in metropolitan regions, which form agglomerations having many municipal boundaries, will become a visibly typical character of the Indian urban landscape.

4.4. Regression results – determinants of metro city growth

We next come to the core analytical issues of our paper, that is, the determinants of metro city growth. Table 8 reports the estimated OLS regression results from two different equations with robust standard errors (to control for heteroskedasticity) in parentheses taking care of the multicollinearity problems. The models are estimated with three different specifications and a different number of observations. Given the multicollinearity issues among some control variables, we run three models in each equation and provide results from the best-fit models with respect to expected signs, level of significance and goodness of fit of the regressions, in accordance with the different number of observations of variables of interest. The significant values of F statistics for all the models indicate that the overall model is statistically significant. Furthermore, the higher values of R^2 (except one model) indicate that the regressions explain a good proportion of total variation in the dependent indicator. The test of normality, that is, that the residuals are normally distributed, is also performed by considering the Shapiro–Wilk test for normality (non-graphical). The multicollinearity issues do not seem to be problematic, as we have mean variance inflation factors (VIF) values less than 10 for all the models. Following are the detailed estimation results.

4.4.1. Equation 1: dependent variable – log (city population t–1)

Here the first model includes all variables for a maximum number of available observations. This model explains 97% of the total variation in the dependent variable. Here, among our four regional dummy variables, north, east and southern regions appear to be the most favourable locations for metro city growth in India. A city's market size proxy variable has a significant positive impact on metro city size growth. In particular, a 10% increase in share of state urbanites living in a city is associated with 0.19% increase in the population size of city. The positive impact of the market size on the metro city's size growth supports Krugman's hypothesis (1991). The transportation costs control variable, that is, state expenditure on transport or length of rail network, flagged statistically significant positive effect on the metro city size growth. However, this finding does not

Table 8. Determinants of metro city growth in India.

	Dependent variables:					
	Ln city population 2011			Growth rate of city population (2001–2011)		
Explanatory variables	(1)	(2)	(3)	(1)	(2)	(3)
Geographical factors						
Northern region	0.165 (0.050)***			3.805 (1.150)***		
Eastern region	0.168 (0.073)**			3.877 (1.685)**		
Western region	0.082 (0.060)			1.893 (1.386)		
Southern region	0.091 (0.045)*			2.095 (1.039)*		
City located in a river bank dummy	0.011 (0.023)	0.099 (0.042)**	0.010 (0.028)	0.250 (0.541)	0.653 (0.619)	0.163 (0.548)
Climatic factors						
City-wise rainfall	0.00003 (0.00002)	0.0001 (0.00003)***		0.001 (0.001)	0.002 (0.001)**	
City temperature differences	−0.002 (0.002)	−0.002 (0.003)	−0.004 (0.002)**	−0.035 (0.038)	−0.030 (0.036)	−0.089 (0.036)**
Spatial interaction						
Distance to state head quarter	0.00001 (0.00009)	0.0001 (0.0001)		0.0003 (0.002)		−0.003 (0.001)**
Distance to nearest Class-I city	−0.0003 (0.0002)	−0.011 (0.001)*	−0.00008 (0.0003)	−0.009 (0.005)	−0.010 (0.008)	−0.001 (0.007)
Market size						
% of state's urban population living in metro city	0.019 (0.006)**	0.023 (0.002)***	0.008 (0.003)**	0.435 (0.144)**	0.158 (0.072)**	
Transportation costs						
State expenditure on transport	0.0003 (0.00009)***	0.0004 (0.00005)***	0.0001 (0.00003)***	0.007 (0.002)***	0.004 (0.001)***	
Rail network per lakh population in the state	0.050 (0.018)**	0.087 (0.015)***	0.012 (0.008)	1.142 (0.416)**		
Quality of public services						
Pucca road/sq km of the city	−0.0003 (0.002)	0.008 (0.003)**	0.001 (0.001)	−0.009 (0.050)	0.030 (0.040)	−0.004 (0.022)
Number of school per 1000 population in the city	0.005 (0.003)*	0.008 (0.005)*	0.005 (0.003)	0.121 (0.070)*	0.106 (0.073)	0.048 (0.075)
Centre of political power						
State capital city dummy	0.047 (0.046)	0.196 (0.076)**	0.038 (0.038)	1.075 (1.057)	1.723 (0.958)*	
Industrial development						
Industrial structure dummy	0.049 (0.037)	0.102 (0.053)*	0.027 (0.054)	1.135 (0.841)	1.177 (1.207)	0.258 (1.099)
Degree of urbanization						
States' level of urbanization	0.019 (0.007)**			0.446 (0.159)**		
Ln (city population) (t-1)	0.357 (0.192)*		0.645 (0.133)***	−14.800 (4.417)***	−9.124 (3.181)**	−3.612 (1.634)**
Economic strength						

(*Continued*)

Table 8. (Continued).

	Dependent variables:					
	Ln city population 2011			Growth rate of city population (2001–2011)		
Explanatory variables	(1)	(2)	(3)	(1)	(2)	(3)
Ln (NSDP per capita of the state)	−0.458 (0.166)*	−0.134 (0.058)**		−10.552 (3.819)**		1.235 (0.554)**
Political instability						
City crime rate	0.00003 (0.00004)	0.0001 (0.00009)	−0.00004 (0.00008)	0.001 (0.001)	−0.001 (0.002)	
Land use control policy						
Existence of ULCRA dummy	−0.110 (0.045)**	−0.176 (0.054)***	−0.065 (0.020)***	−2.525 (1.028)**	−1.850 (0.624)**	
Constant	7.366 (2.397)**	6.323 (0.623)***	2.164 (0.772)**	169.601 (55.186)**	49.400 (17.398)**	15.117 (10.049)
No. of observation	49	49	50	49	49	51
F statistics	86.63***	66.61***	152.95***	16.7***	6.69***	3.37***
R^2	0.972	0.891	0.941	0.819	0.678	0.465
Root MSE	0.067	0.121	0.086	1.564	1.861	2.195
Mean VIF	9.06	2.42	2.30	9.06	2.50	1.52
Shapiro–Wilk test for normality	0.904***	0.987	0.924***	0.904***	0.923***	0.878***

Notes: Figure in the parentheses indicates robust standard errors. Level of significance: *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.
Source: Authors calculations.

correspond to the submission of Tripathi (2013). The number of schools/1000 population for measuring the quality of public services shows the expected association, implying that greater is the number of schools, larger is the city in size. The state's level of urbanization and initial city population show significant positive effect on metro city size growth at 5% and 10% level of significance, respectively. The coefficient 0.357 indicates that a 10% increase in city's initial population increases city population size by 3.5%. In regression 1, quite unexpectedly, the log NSDP per capita has a negative effect on metro city size growth and it is significant at 10% level. The most crucial finding in model 1 is the negative effect of a land-use control act such as the ULCRA on metro city size growth. This implies that wherever the ULCRA is present, it restrains the growth of those cities by regulating land markets unnecessarily, and this particular finding is consistent with what Kundu (2006) has argued. In particular, metro cities in states that have not yet revoked the ULCRA have reduced in population size by nearly 1.1% point per annum than cities in those states that have repealed it, despite controlling for other factors in the regression.

In Regression 2, we exclude the region dummy and the degree of urbanization variables due to multicollinearity issues (see Table 8). This model explains 89% of the sample variance in the dependent variable. We find that the dummy of city located in a riverbank has a positive and significant (at 5% level) impact on city size growth. The positive impact of a river on population concentration in large cities supports Krugman (1993) and Tripathi (2013) but differs from the finding of Cali (2007). City rainfall shows a statistically significant and positive effect on city size growth as well. In contrast, city temperature difference does show the expected association but is statistically insignificant. The market potential, measured by proximity to the nearest city (with population one lakh and more), causes cities to be larger. It indicates that a large city promotes other cities to grow within a certain vicinity. Basically, the degree of the estimate on this factor shows that for each 1 km that the city is closer to a larger city with one lakh or greater population, its own population increases by 1% (Table 8). Contrastingly, the reverse would also true in the sense that the farther a city is from a large metro, it would remain small, possibly because of the absence of agglomeration effects. This particular finding is consistent with Sridhar (2010) and Krugman (1991). Recording larger coefficient values, market size and transportation costs variables retained their significantly higher positive effect on city size growth. Along with the number of schools, *pucca* road lengths report a statistically significant positive impact on metro city size growth. In regression 2, the positive and significant coefficient of capital city dummy shows that metro cities are 19.6% larger if they also happen to be a capital cities. In particular, it implies that power allures population or indicates that state capitals are located in large cities. This finding corresponds to that of Ades and Glaeser (1995) and Tripathi (2013). On the other hand, the dummy industrial structure variable has a positive effect on metro city size growth and it is significant at 10% level. The log NSDP per capita retained its negative influence on the dependent variable with lower coefficient values (see Table 8). The highly significant (at 1% level) negative impact of the ULCRA on metro city size growth is increased by 7% in regression 2.

In regression 3, we drop again the region dummy, city rainfall, distance to state head quarter, followed by the state's level of urbanization and log NSDP but add log (city population t–1). We find that the city's temperature difference has a statistically significant negative effect on metro city size growth, implying that temperature extremes result in cities being smaller. Market size and state expenditure on transport (i.e. proxy for transportation costs) retained their positive effect on city size growth but coefficient values have reduced as compared to regressions 1 and 2. On the contrary, the effects of

dummy city located in a riverbank, distance to nearest Class-I city, rail network, quality of public services, capital city and industrial dummy do not survive in regression 3. The significant positive effect of initial city population on metro city size growth has improved reasonably (see Table 8). As usual, the ULCRA retained it negative impact on city size growth in model 3; however, the value of coefficient decreased by 50% than what it was in regression 2.

4.4.2. Equation 2: dependent variable – growth rate of metro city population (t–1, t)

In regression 1, we include all the variables, and this model explains 82% of the variation in the dependent variable. It is found that the north, east and south are the three urban regions most favourable to metropolitan growth, basically due to the various region-specific factors, as per what we have already discussed in the preceding section. Apart from this, the percentage share of state's urban population living in a metro city, the state expenditure on transport and length of rail network (measures of transportation costs), which is followed by schools/1000 population and the state's level of urbanization, have a positive effect on the growth rate of the metro city population. The coefficient indicates that a 10% increase in the number of schools/1000 population (or state level of urbanization), is associated with an increase of 1.2% (or 4.46%) in metro city population growth rate. On the contrary, unlike the city size growth equation, a huge initial size of a metro city discourages its further population growth by 14.8% per annum, and it is significant at 1% level. This implies that a large initial size may stimulate growth at low initial level but discourages further city growth starting at initial population somewhat below one million, suggesting some conditional convergence in population growth across cities. This result is supportive to that stated by Mills and Becker (1986). The existence of ULCRA flagged a highly significant negative impact on the population growth rate of its metro cities as well.

In regression 2, we exclude the following variables: region dummy, distance to state head quarter, length of rail network, % state level of urbanization and log NDSP. We find that a city located on a riverbank, *pucca* roads/sq km, schools/1000 population, industrial dummy have a positive impact on the metro city growth. However, none of the indicators are found to be statistically significant. In model 2, city rainfall, market size of city, state expenditure on transport and capital city dummy show significant positive effect on population growth rate of metro city. In particular, capital metro cities are likely to grow at a 1.72% higher rate than a non-capital metro city (see Table 8). Being a proxy of the presence of huge public sectors and the centre of administrative and political power, the state capital has a positive impact on metro growth. More skilled workers and higher educated people from rural and other smaller–medium towns are likely to concentrate here to meet the demand for skill and knowledge-based jobs and activities, giving added impetus to the growth of capital metros. Initial population size and ULCRA retained their negative effect on growth of population in metro cities.

In model 3, we drop the region dummy, city rainfall, market size and transportation costs, capital city dummy and percent state level of urbanization, followed by crime rate and ULCRA. However, distance to the state head quarter and log NSDP were added in model 3 again. The significant and negative effects of city temperature difference, distance to state capital city and initial city population have been noticed on the growth rate of metro city population. Model 3 further shows that the coefficient of log NSDP has a positive sign, as should be expected. It implies that cities grow faster in higher income states than in lower income states. The higher per capita income fosters urbanization and whatever escalates urbanization results in cities being larger. This implies that the

economically better-off states have enjoyed a greater propensity for generating a higher number of metro cities, for example, Kerala, Maharashtra and Gujarat. We do not find any significant effect of city crime rate (proxy for political instability) on metro city growth in both the equations.

5. Conclusions

This paper sought to examine the trends, patterns and determinants of metropolitan city growth in India over the decades using census data of various years. It confirms that India is in the middle of a transformation, changing from a primarily rural into an increasingly urban society, amidst an increasing population concentration in its cities. We further find that India is presently passing through a steady pace of urbanization with a 'top-heavy' urban structure, displaying increasingly escalating disparities and inequalities in urban population distribution. Class-I cities are the paramount manifestations of an urbanization character, leading to the faster emergence of metro cities over the decades. Indeed, the post-economic reforms period has marked the beginning of a phase of rapid metropolitan development in India, with the growth of such metro cities, in terms of both their number and garnered share of urban population, accelerating, and currently housing more than two-fifth urbanities of the country. Contemporary urbanization in India has merely sustained to a large degree the pattern manifested during the nation's 200-year-long colonial legacy, marked by sharp 'metropolitan dominance' or urban growth in a few pockets. Thus most metros are either in coastal locations or situated along the east to north-west axial alignment within the northern plains, avoiding the country's central tracts and its entire north-eastern region. The recent two decades have, however, witnessed relatively more dispersed metropolitan growth, as compared to earlier times. Still, the almost the entire north-east region along with select other states have hardly showed any metropolitan development till date, highlighting the exclusionary urban growth and unbalanced investment patterns arising from skewed industrial and commercial developments in India, thereby creating select urban enclaves and barring vast rural tracts. This manifests zones of backwardness in such rural regions and creates sharper rural–urban disparities of large magnitude. The southern, northern and western urban regions have experienced a relatively higher metropolitan growth over the decades due to heavy resource mobilization and investment.

Most of the older metro cities have registered a faster decelerated pace of growth, primarily due to a higher propensity of population drift away from the core city towards its adjoining areas, through the process of 'peripheralization', while new entrants have exhibited higher than average growth rates during 2001–2011. This is probably indicative of giant cities getting saturated by dint of their large base population, encumbered with either congested or higher real estate costs and having little residual open space, being thus unable to absorb any additional numbers. Consequently, people have tended to move towards the city periphery, leading to an 'agglomerated trend' in the metropolitan development.

We also observe that the accelerated emergence of metro cities in the last couple of decades is likely to have been determined by some important city- and state-specific characteristics. These are dummy cities located in northern, eastern and southern region and in a riverbank, city rainfall, share of state's urban population living in a metro city, state expenditure on transport, length of rail network, road per square kilometres, school/1000 population, capital city dummy, industrial structure dummy and state level of urbanization, which positively and significantly affect the metro city growth. On the

contrary, city temperature differences, distance to nearest large city, initial city size and strong land-use control policy (ULCRA) negatively and significantly affect the metro city growth in India. The association between the per capita income of a state and its metro city growth, however, seems to be blended. Political instability measured by city crime rate does not have any significant impact on metro city growth as discerned in this study.

By and large, the growth of metro cities has escalated. It is estimated that 19 new cities/UAs are poised to join in the existing list of million plus cities, giving 71 metros by 2021 (see Appendix 3, Map A and Map B). This lopsided growth in urban population arises from the concentration of economic activities in a handful of cities. Such massive scale metropolitan growth seems to create several challenges. Many cities encountering over-urbanization have reached saturation point (for example, Kolkata, Mumbai). The high concentration of people in these big cities has precipitated a haphazard urban sprawl, exceeding the city's municipal limits, leading to further unplanned peripheralizations. City councils thus struggle to provide adequate and quality civic amenities and services, constrained by creaking infrastructure, due to huge scarcity and deficits in budgets, in the face of the ever escalating demand for services.

In this circumstance, the sustainability of a balanced metropolitan growth and development is very much the need of the hour and requires an inclusive and holistic development strategy. Now the obvious question arises is that how that may be possible or executed? Are the existing urban development policies (such as, Urban Infrastructure Development Scheme for Small and Medium Towns (UIDSSMT), Jawaharlal Nehru National Urban Renewal Mission (JnNURM), Atal Mission for Rejuvenation and Urban Transformation (AMRUT) or even so-called Smart City) enough to address these issues? The answer tends towards the negative. For example, some recent studies (Khan 2013; Kundu 2014), analysing the effectiveness of the existing urban development policies, JnNURM in particular, revealed a polarized urban development and an inbuilt big city bias in the context of taking advantages of the JnNURM mission and improving their infrastructural needs. The smaller towns and poorer states have enjoyed scant advantages from these programmes due to their less population share, limited capacity to implement reforms, prepare city development plans and detailed projects reports that are basic for getting grants.

Therefore, policymakers should accord top priority to the backward regions as well as to the small- and medium-sized towns/Class-I cities by paying serious attention to urban governance reforms, building capabilities at the urban local body level and developing professional management capabilities of city governments in them for strengthening their infrastructure and economic base, in order that these urban areas are able to offer employment at a satisfactory level of productivity and livelihood and earnings for the increasing labour force, ensure access to basic amenities for all residents and finally support an adequate population, all of which would lessen congestion in the core city area and reinforce a balanced metropolitan growth. For doing so, efforts should be taken to make provisions for specialized financial grants for their infrastructure needs, until the time they develop the capacity to get project funding and self-sustenance. It would certainly help make the growth process more inclusive and ensure equitable and sustainable balanced metropolitan growth in India.

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Notes

1. According to Indian Census, an urban centre with a population of 100,000 or more is called a City.
2. Even though the urban growth rate during the recent census is marginally higher than that of the preceding census, the pace of India's urbanization is not rapid at present as the urban growth rate has declined gradually since the 1970s (See Table 2, column 6). Actually, India is currently experiencing a *steady urbanization* state and not a rapid one.
3. We have divided India into six urban regions: northern (Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Punjab, Haryana, Rajasthan, Delhi, Uttar Pradesh), central (Madhya Pradesh, Chhattisgarh), western (Gujarat, Maharashtra, Goa, Daman and Diu), southern (Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Lakshadweep, Pondicherry), eastern (Orissa, West Bengal, Andaman and Nicobar, Jharkhand, Bihar and Sikkim), northeastern region (Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura).

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Appendix 1. Correlation coefficient of determinants of metro city growth

Variables	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13
X1	1.00												
X2	−0.12	1.00											
X3	−0.21	−0.24	1.00										
X4	0.04	−0.20	−0.20	1.00									
X5	0.25	0.00	−0.30	−0.17	1.00								
X6	0.10	0.42	−0.40	−0.22	−0.34	1.00							
X7	0.28	−0.29	0.08	−0.05	0.03	0.00	1.00						
X8	0.12	0.54	−0.43	0.01	−0.02	0.52	−0.32	1.00					
X9	−0.05	−0.57	0.56	0.26	0.05	−0.75	0.28	−0.71	1.00				
X10	−0.31	0.05	−0.02	−0.26	0.05	0.21	−0.10	0.02	−0.14	1.00			
X11	−0.17	−0.23	0.41	−0.17	0.19	−0.47	0.12	−0.30	0.44	0.11	1.00		
X12	0.69	−0.12	−0.13	0.32	−0.06	0.00	0.09	0.12	0.04	−0.54	−0.27	1.00	
X13	0.23	0.07	−0.25	−0.33	0.63	0.05	0.07	0.07	−0.13	0.27	0.07	−0.28	1.00
X14	0.01	−0.30	0.10	−0.05	0.27	−0.38	0.05	−0.53	0.41	−0.01	0.37	−0.09	−0.20
X15	0.11	−0.30	0.23	0.37	−0.25	−0.09	0.15	−0.06	0.21	−0.07	0.06	0.10	−0.19
X16	−0.07	0.06	−0.17	0.27	−0.05	0.01	−0.13	0.04	0.03	−0.04	−0.29	0.06	−0.15
X17	0.48	−0.13	−0.05	0.26	−0.19	0.00	0.08	−0.04	0.10	−0.64	−0.10	0.64	−0.16
X18	0.25	−0.18	0.17	−0.36	0.11	−0.03	0.13	−0.28	0.11	0.24	0.19	−0.04	0.15
X19	0.22	0.40	−0.49	−0.39	0.43	0.58	−0.12	0.51	−0.67	0.24	−0.28	−0.03	0.38
X20	0.94	−0.46	−0.10	0.11	0.22	−0.06	0.35	−0.08	0.15	−0.29	−0.07	0.66	0.18
X21	0.19	0.32	−0.40	−0.35	0.51	0.42	−0.16	0.35	−0.50	0.16	−0.21	0.10	0.34
X22	−0.18	0.00	−0.13	−0.10	−0.11	−0.02	0.01	−0.06	−0.06	−0.04	0.13	−0.19	−0.17
X23	0.16	−0.19	−0.22	0.48	0.30	−0.18	−0.13	−0.08	0.27	−0.04	−0.07	0.15	0.41

Variables	X14	X15	X16	X17	X18	X19	X20	X21	X22	X23
X14	1.00									
X15	−0.11	1.00								
X16	0.11	−0.07	1.00							
X17	−0.17	−0.01	−0.09	1.00						
X18	0.32	0.11	−0.38	−0.19	1.00					
X19	−0.12	−0.22	0.04	−0.23	0.07	1.00				

(*Continued*)

(Continued)

Variables	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13
X20	0.12	0.20	−0.09	0.47	0.29	0.05	1.00						
X21	0.02	−0.30	0.08	−0.18	0.07	0.92	0.06	1.00					
X22	0.21	−0.25	−0.02	0.06	−0.03	−0.19	−0.16	−0.21	1.00				
X23	0.05	0.12	0.32	0.07	−0.12	−0.01	0.21	0.10	−0.31	1.00			

Notes: Table 1 provides the full descriptions of indicators. The correlation coefficients are based on 52 metro cities.
Source: Authors calculations.

Appendix 2. Trends of population growth rate in metro city since 1901

City (2011)	1901–1911	1911–1921	1921–1931	1931–1941	1941–1951	1951–1961	1961–1971	1971–1981	1981–1991	1991–2001	2001–2011
Greater Mumbai UA	2.20	2.06	0.24	2.83	6.10	3.39	3.79	3.57	2.90	2.66	1.13
Delhi UA	1.06	2.46	3.85	4.41	7.26	4.96	4.36	4.57	3.84	4.20	2.39
Kolkata UA	1.44	0.64	1.25	5.27	2.64	2.47	2.14	2.13	1.83	1.79	0.63
Chennai UA	0.16	0.39	2.10	1.83	5.05	2.32	4.76	3.03	2.31	2.06	2.77
Bangalore UA	1.50	2.37	2.55	2.83	6.49	4.28	3.21	5.63	3.48	3.21	4.02
Hyderabad UA	1.13	−2.13	1.41	4.59	4.25	0.99	3.70	3.62	5.11	2.82	2.90
Ahmadabad UA	1.54	2.34	1.36	6.40	3.88	3.18	3.79	3.73	2.74	2.96	3.40
Pune UA	0.52	1.38	2.31	2.59	6.30	2.62	3.61	4.17	3.70	4.11	2.96
Surat UA	−0.34	0.25	−1.37	5.15	2.37	2.91	4.40	6.35	4.87	6.19	4.90
Jaipur (M Corp.)	−1.56	−1.01	1.83	1.96	5.20	2.99	4.39	4.66	4.03	4.25	2.71
Kanpur UA	−1.27	1.92	1.19	6.93	3.70	3.20	2.73	2.51	2.14	2.91	0.73
Lucknow UA	−0.16	−0.47	1.33	3.43	2.49	2.77	2.16	2.13	5.05	2.97	2.57
Nagpur UA	−2.31	3.59	3.93	3.39	3.97	3.60	2.97	3.42	3.11	2.47	1.60
Ghaziabad UA	0.03	0.88	4.22	2.36	6.07	4.76	6.65	7.40	5.78	6.38	8.98
Indore UA	−5.91	6.65	3.03	3.57	4.23	2.39	3.51	3.91	2.91	3.13	3.58
Coimbatore UA	−1.22	4.74	3.58	5.63	4.16	4.45	4.88	2.24	1.78	2.92	3.80
Kochi UA	1.63	0.52	3.66	2.18	2.49	4.55	5.30	4.00	2.71	2.01	4.47
Patna UA	−0.19	−1.11	2.43	1.96	3.32	2.42	2.79	5.04	1.79	3.98	1.88
Kozhikode UA	0.18	0.49	1.87	2.89	2.95	4.78	3.81	2.61	2.17	2.61	8.35
Bhopal UA	−3.15	−2.20	3.03	2.09	3.08	7.79	5.46	5.56	4.60	3.16	2.57
Thrissur UA	4.14	1.68	4.93	3.14	1.87	−0.31	3.36	9.55	1.40	0.78	17.30
Vadodara UA	−0.44	−0.48	1.75	3.06	3.21	3.82	4.35	4.84	3.74	2.79	2.01
Agra UA	−0.14	0.00	2.14	2.12	2.79	3.03	2.21	1.63	2.38	3.40	2.79
GVMC	0.60	0.29	2.48	2.04	4.31	6.70	5.43	5.07	5.48	2.54	2.50
Malappuram UA	N.A.	N.A.	N.A	N.A	6.24	1.70	13.58	6.75	4.17	1.81	23.00

(*Continued*)

(Continued)

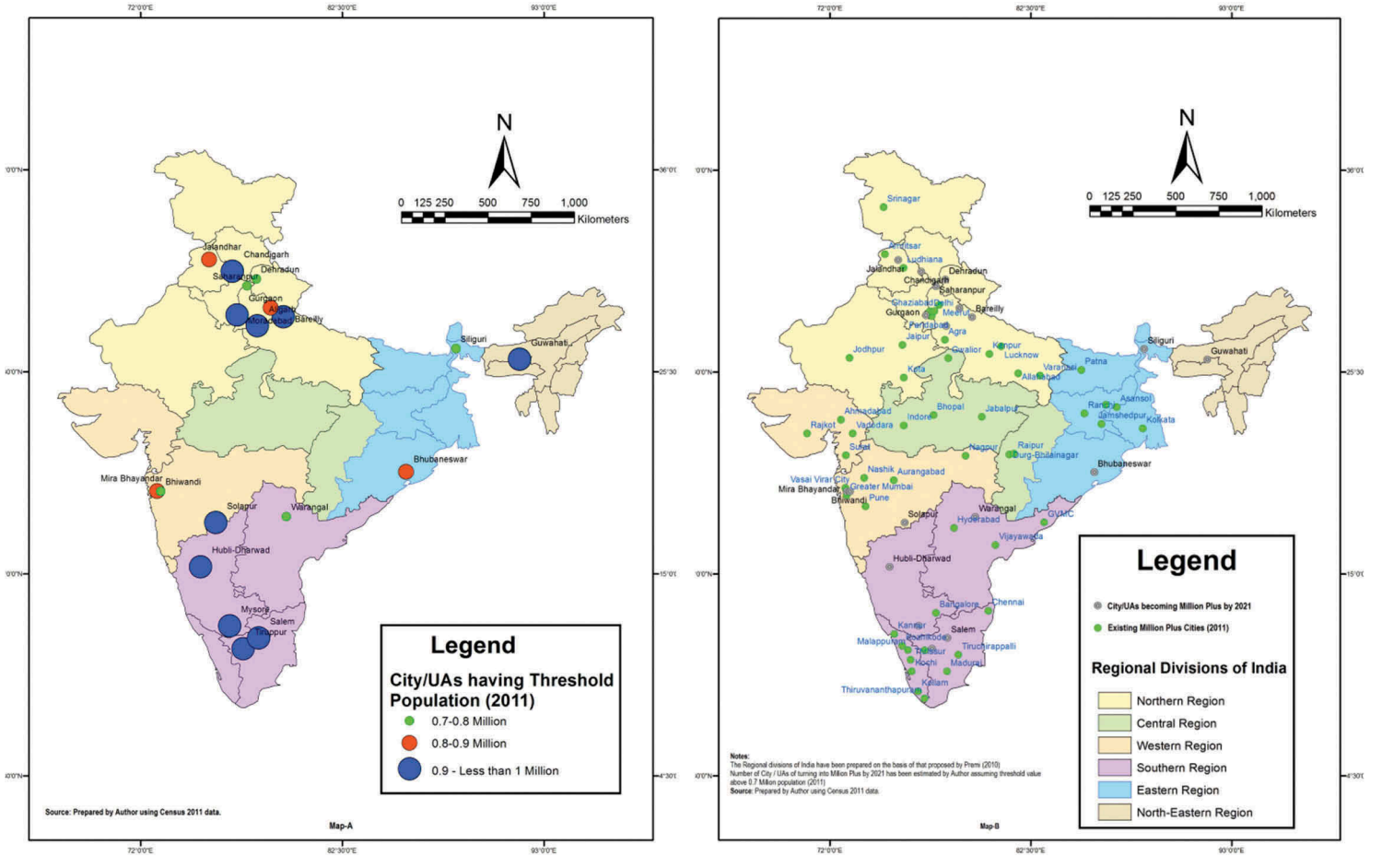
City (2011)	1901–1911	1911–1921	1921–1931	1931–1941	1941–1951	1951–1961	1961–1971	1971–1981	1981–1991	1991–2001	2001–2011
Thiruvananthapuram UA	0.94	1.35	2.77	2.90	3.99	4.42	3.80	1.78	4.21	1.15	6.36
Kannur UA	0.44	−0.52	1.56	0.94	1.50	7.19	−2.19	11.56	1.06	0.36	11.92
Ludhiana (M Corp.)	−0.97	1.61	2.79	4.87	3.20	4.62	4.97	4.14	5.41	2.94	1.46
Nashik UA	2.70	5.80	0.06	2.57	7.49	3.18	2.31	4.89	4.93	4.63	3.04
Vijayawada UA	2.65	2.62	2.77	3.32	5.86	3.61	3.86	4.45	2.95	2.73	3.51
Madurai UA	2.36	0.72	2.64	2.65	4.15	2.81	3.58	2.48	1.80	1.11	1.97
Varanasi UA	−0.41	−0.29	0.44	2.37	2.82	3.13	2.27	2.27	2.57	1.55	1.74
Meerut UA	−0.14	0.39	1.26	2.35	2.80	1.84	2.62	3.49	4.48	3.13	2.01
Faridabad (M Corp.)	−1.39	−0.58	1.43	2.11	11.81	4.57	7.32	9.91	6.24	5.36	2.92
Rajkot UA	−0.56	2.93	2.54	1.16	6.88	3.85	4.37	3.92	3.86	4.27	3.27
Jamshedpur UA	N.A.	23.14	4.77	5.82	2.77	4.08	2.95	4.34	1.98	2.87	1.93
Jabalpur UA	1.08	0.78	1.34	3.60	3.65	3.56	3.77	3.48	1.60	2.11	1.45
Srinagar UA	0.56	1.13	2.05	1.83	1.78	1.51	3.73	3.57	N.A.	N.A	2.40
Asansol UA	1.96	0.92	4.60	6.26	4.05	4.53	2.58	5.28	3.93	1.36	1.53
Vasai-Virar City (M Corp.)	−1.09	0.77	2.02	0.96	6.54	3.37	4.26	2.73	6.24	7.30	14.27
Allahabad UA	−0.02	−0.88	1.57	3.49	2.43	2.59	1.75	2.37	2.62	2.10	1.51
Dhanbad UA	N.A.	N.A.	3.12	8.80	6.24	11.12	7.12	4.13	1.83	2.52	1.16
Aurangabad UA	−0.54	0.55	0.00	3.23	2.69	3.83	5.26	6.50	6.28	4.09	2.90
Amritsar UA	−0.61	0.48	5.03	3.90	−1.51	1.49	1.54	2.68	1.75	3.48	1.65
Jodhpur UA	0.08	−0.82	2.54	2.92	3.54	2.18	3.46	4.66	2.74	2.56	2.79
Ranchi UA	2.39	1.83	2.43	2.14	5.35	2.72	6.42	6.35	2.01	3.40	2.66
Raipur UA	0.96	0.82	1.69	3.35	3.47	4.43	3.88	4.96	3.13	4.14	4.73
Kollam UA	1.83	2.88	2.94	3.83	2.90	6.23	2.98	2.41	4.40	1.48	10.72
Gwalior UA	−4.95	2.97	1.10	3.63	2.80	2.19	3.01	3.14	2.56	1.87	2.42
Durg-Bhilainagar UA	N.A.	4.70	1.56	2.41	1.89	18.84	6.10	7.12	3.45	2.75	1.37
Tiruchirappalli UA	1.49	−0.32	2.34	1.11	3.73	1.41	2.89	2.70	1.82	1.98	1.66
Kota (M Corp.)	−0.27	−0.32	1.78	2.23	3.19	6.14	5.71	5.20	4.05	2.69	3.54

Note: GVMC denotes Greater Visakhapatnam Municipal Corporation.
Source: Computed by the authors from Census 2001 (A −4:Towns and Urban Agglomerations (UAs) classified by population size class in 2001 with variation since 1901) and Towns/UAs PCA 2011data..

Appendix 3. UAs/cities on the threshold population of turning into a million plus city by 2021

States	City/UAs	Population		AEGR (2001–2011)	Projected population 2021[a]	
		2001	2011		Absolute	In million
Andhra Pradesh	Warangal UA	530,636	753,438	3.51	1,069,789	1.07
Assam	Guwahati UA	818,809	962,334	1.62	1,131,017	1.13
Chandigarh	Chandigarh UA	808,515	970,602	1.83	1,165,183	1.17
Haryana	Gurgaon UA	228,820	902,112	13.72	3,556,534	3.56
Karnataka	Mysore UA	799,228	990,900	2.15	1,228,539	1.23
Karnataka	Hubli-Dharwad (M Corp.)	786,195	943,788	1.83	1,132,971	1.13
Maharashtra	Mira Bhayandar (M corp.)	520,388	809,378	4.42	1,258,854	1.26
Maharashtra	Bhiwandi UA	621,427	735,681	1.69	870,941.5	0.87
Maharashtra	Solapur (M Corp.)	872,478	951,558	0.87	1,037,806	1.04
Orissa	Bhubaneswar UA	658,220	885,363	2.96	1,190,890	1.19
Punjab	Jalandhar UA	714,077	874,412	2.03	1,070,748	1.07
Tamil Nadu	Tiruppur UA	550,826	963,173	5.59	1,684,202	1.68
Tamil Nadu	Salem UA	751,438	917,414	2.00	1,120,050	1.12
Uttar Pradesh	Bareilly UA	748,353	985,752	2.76	1,298,461	1.30
Uttar Pradesh	Aligarh UA	669,087	911,223	3.09	1,240,986	1.24
Uttar Pradesh	Moradabad (M Corp.)	641,583	887,871	3.25	1,228,703	1.23
Uttar Pradesh	Saharanpur (M Corp.)	455,754	705,478	4.37	1,092,035	1.09
Uttarakhand	Dehradun UA	530,263	706,124	2.86	940,309.1	0.94
West Bengal	Siliguri UA	472,374	705,579	4.01	1,053,914	1.05

Notes: Authors assuming the threshold value above 0.7 and less than 1 million populations (2011) has estimated the number of city/UAs of turning into million plus by 2021.
[a]Projection has been done using following formula: $Pt = Po\ (\exp^{rt})$, where Po, r and t denote population of the base year, rate of change and time, respectively.
Source: Same as Table 2.



Map A. Cities/UAs on the threshold of turning into million plus city by 2021. Map B. Regional distributional patterns of existing and future million plus cities in India.