

# URBANISATION, GROWTH, AND DEVELOPMENT: EVIDENCE FROM INDIA

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## Abstract

*How does the spatial distribution of economic activity evolve as countries grow and develop, and what role does urbanisation play in this process? This paper examines these questions in the context of India, a country which, in spite of substantial economic growth, has experienced slow rates of urbanisation. We explore how India's urban hierarchy and the spatial allocation of economic activity and resources have evolved over time (1901–2011), and consider the consequences and importance of this process for growth and development. In addition, we examine and summarise the evidence on how government policies, institutions, and public investments have influenced the spatial allocation of resources, how these factors affect welfare, growth, and development and, where questions remain, propose a research agenda for the future.*

## 1 Introduction

Urbanisation is central to the development process; however, the welfare implications of urbanisation, and its impact on growth and development are little understood. What determines the allocation of resources, people, and economic activity across space? Is this allocation efficient? What role do institutions and public policy play in shaping this allocation?

Between 1950 and 2010, the world's urbanisation rate increased from just under 30% to over 50%. For the most part, this has been driven by developing countries such as China and Korea, where urbanisation has accompanied substantial increases in income growth. However, we also observe substantial increases in the urbanisation rate in other countries despite persistent poverty and limited state capacity. This relationship is commonly observed in developing economies, where changes in income correlate only weakly with changes in the rate of urbanisation. This suggests that policy and institutions may be an important driver in influencing the urbanisation process.

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This paper aims to understand the relationship between urbanisation, growth and development in the context of India, with a focus on presenting a series of stylised facts and, where questions remain, a research agenda for the future. India is a country where this relationship is somewhat different: despite rapid economic growth, and substantial reductions in poverty, it has experienced languid rates of urbanisation. Urbanisation in India is currently less than 30% of the population, having increased from 10% since independence.<sup>2</sup> What explains this slow demographic transition and what are the consequences for welfare and its continuing economic development?

India will soon have 20% of the world's working-age population – a significant economic opportunity. At present, agriculture provides employment to around 220 million of India's 500 million workforce (Census, 2001). With an expected influx of an additional 250 million workers by 2030 it seems inevitable that growth in industry and services is a necessary condition for future development (McKinsey, 2010). What are the constraints to further urbanisation and industrialisation in India, and how can these be relaxed to foster growth and take advantage of economic opportunities? Is industrialisation a necessary condition for urbanisation, or has the role of structural transformation from agriculture into manufacturing changed? How does urbanisation affect spatial growth patterns across different sectors?

Unlike most developing countries, India's urbanisation has been characterised by an unusually large number of highly-populated cities. In 2001, 27.9% of the urban population resided in 31 cities with a population of 1 million or more, compared with 9.5% of the urban population in 1911 (2 cities).<sup>3</sup> Once all major cities (> 100,000 population) have been accounted for, 62% of the urban population reside in 441 towns and cities – 8% of total urban areas. This results in a highly skewed composition of the urban population.

Are these mega-cities too large? Should policy makers focus resources on encouraging smaller cities to grow, or invest in infrastructure to allow larger cities to better support urbanisation? In asking such questions one must consider why people live in cities to begin with. While there are many explanations, two stand out as being particularly relevant: economic agents live in cities because they enjoy it, and/or they can be more productive. Consequently, a combination of amenities and productivity levels determine city size; however, as cities grow, these benefits are offset by the costs and frictions associated with increased congestion. How fast the benefits of urban amenities and productivity deteriorate as cities grow will depend on institutional capacity and the quality of governance, as well as the degree to which amenities and productivity effects are amplified by the presence of agglomeration

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<sup>2</sup>The BRICS economies had urbanisation rates at 50% by the 1960s, the exceptions being China and India, where rates were between 10 and 20%. However, urbanisation increased rapidly following the Cultural Revolution in China, reaching nearly 50% of the population in 2010.

<sup>3</sup>These 31 cities account for less than 1% of the total number of urban towns and cities (5,176).

externalities.

An additional characteristic of urbanisation in India is the degree of urban sprawl that is observed. What are the welfare implications of urban sprawl? How does this decentralisation affect economic activity? What are the costs of remoteness? It has been suggested that urban sprawl in India is linked to a number of potentially distortive land use regulations, most notably vertical limits in the form of Floor Area Ratios (Bertaud, 2002; Bertaud and Brueckner, 2005; Brueckner and Sridhar, 2012; Glaeser, 2011; Sridhar, 2010; World Bank, 2013) and the Urban Land Ceiling and Regulation Act of 1976, which is claimed to hinder intra-urban land consolidation and restrict the supply of land available for development within cities (Sridhar, 2010). Urban sprawl is argued to increase the cost of intra-urban commuting, affecting the range of jobs and services that are accessible within a city, as well as the extent to which agglomeration externalities can be realised (Bertaud, 2004; Cervaro, 2013; Harari, 2014). To the degree that this is true, the results from these studies indicate that policies to improve urban mobility, such as direct interventions in transportation infrastructure, as well as the promotion of more compact development through land use regulations, could substantially improve welfare.

However, while reducing the costs of commuting, such interventions, may increase sprawl. Investments in transportation infrastructure within and around cities will cause them to spread out, reflecting an increase in the demand for space, cheaper labour and cheaper land on the urban fringe (See Redding and Turner (2015) for a review of the literature.) Furthermore, it is unclear a priori whether the premise that commuting costs are a first-order concern, is true. In the classical monocentric city model the city is made up of a single central business district (CBD) surrounded by residential suburbs, where city dwellers must commute to the CBD to earn income; however, while this model may be relevant for certain sectors and may have been an accurate description of economic activity in the past, the spatial concentration of economic activity has evolved in response to a number of factors: explicit policies, such as environmental regulation prohibiting polluting industries within cities (Henderson, 1996; Greenstone, 2002); the life cycle of production (younger industries gain more from knowledge spillovers, which are enhanced by a greater geographic concentration of economic activity (Desmet and Rossi-Hansberg, 2009)); and technological change (improved access to transportation and information technology have substantially reduced communication costs, lowering the costs of decentralisation (Glaeser and Kahn, 2005; Duranton and Turner, 2012; Baum-Snow et al., 2014; Ghani et al., forthcoming; Khanna, 2014;)). In this respect, urban sprawl may be, in part, a standard market response. More evidence is needed to understand the economic consequences of urban sprawl and its effects on, and relevance for, the spatial distribution of economic activity, growth, and development.

In considering all of these factors, it is important to bear in mind the general equilibrium nature of urbanisation. Investments or policy interventions to attenuate scale diseconomies or amplify scale economies in one location may attract firms, workers and consumers from other locations. Similarly, the economic consequences of negative shocks in one location may be mitigated if agents are able to move away. In considering the policies that may affect the spatial allocation of resources, the larger system needs to be taken into account, i.e., one must understand how changes in one region will affect other regions within the system. Whether discussing the size or geometry of cities, or the spatial allocation of economic activity, more evidence is needed to understand the welfare consequences of urbanisation and its implications for growth and development.

The remainder of the paper is organised as follows. Section 2 briefly discusses how urbanisation is defined in India and the consequences of this on measurement and on empirical analysis more broadly. Section 3 documents the evolution of India's urbanisation between 1901 and 2011 and considers the consequences and importance of this process for growth and development. Section 4 considers the intersection between India's urbanisation and economic activity, focussing on industrial production, with a view to better understanding the relationship between urbanisation on productivity as well as the spatial distribution of production. Section 5 explores some of the drivers underlying the process of urbanisation, considering the relationship between urbanisation and migration, infrastructure, and rural-urban differences in the provision of public goods and amenities, the supply and quality of housing, and poverty. Each of these sections considers directions for future research, with a focus on improving the availability and quality of data for conducting meaningful empirical analysis on urbanisation, growth and development. Section 6 concludes.

## 2 Measuring Urbanisation in India

Before we examine recent trends in India's urbanisation, it is important to set out how India defines urban areas and the consequences of this for empirical analysis. India has a stringent definition of "urban", which was first set out during the 1961 census. Three measures are used to define an urban area: (1) a population of 5,000 or more; (2) a density of at least 1,000 persons per square mile; and (3) at least 75% of workers engaged in nonagricultural employment. Criticism of this demanding criterion gravitates around the oversimplification of this classification, with a particular focus on the complexity associated with suburban or peri-urban areas. A second criticism relates to the bureaucratic procedures associated with redrawing municipal boundaries as cities and towns expand. Local officials have to report such changes through the office of the deputy commissioner or district magistrate and then

open up the proposed changes to a period of public consideration that invariably results in delays and can even halt adjustments. Local politicians may be averse to the prospect of urban classification if they face reductions in intergovernmental transfers and public transfers. These delays can be observed during the expansion of urban status between the 2001 and 2011 census. According to a recent world bank report, while 2,774 settlements exhibited urban characteristics between the two census rounds, only 147 were granted official urban status (World Bank, 2013). The remaining settlements are urban in character only. Together, these rigidities are likely to downward bias India’s urban statistics and result in a number of measurement challenges. This is especially problematic given that peri-urbanisation – the expansion of India’s metropolitan areas – stands out as one of the most striking features associated with India’s spatial development.

One way in which we can address rural-urban classifications is to construct a continuous measure of “urbanisation” based on population density. Gollin, Kirchberger and Lagakos (2014) construct such a measure to look at rural-urban differences in well-being using sub-national data from the DHS. Another approach is to consider the use of night lights data, which can be used to reclassify and track the development of urban areas, thereby addressing the rigidities associated with urban classification, in India and around the world. Harari (2014) combines night lights with historical city maps to examine the geometry of cities and the consequences of city shape for commuting costs. Additionally, one could use remote-sensing data to directly map urban areas. This approach would likely provide a more precise measure of urbanisation but compared to the use of night lights, seems more rigid in the tracking of urban development over time. The optimal measure (in the face of present data constraints) is likely the combination of these measures, which is similar to the approach taken by Harari (2014).

### **3 The Evolution of Urbanisation in India**

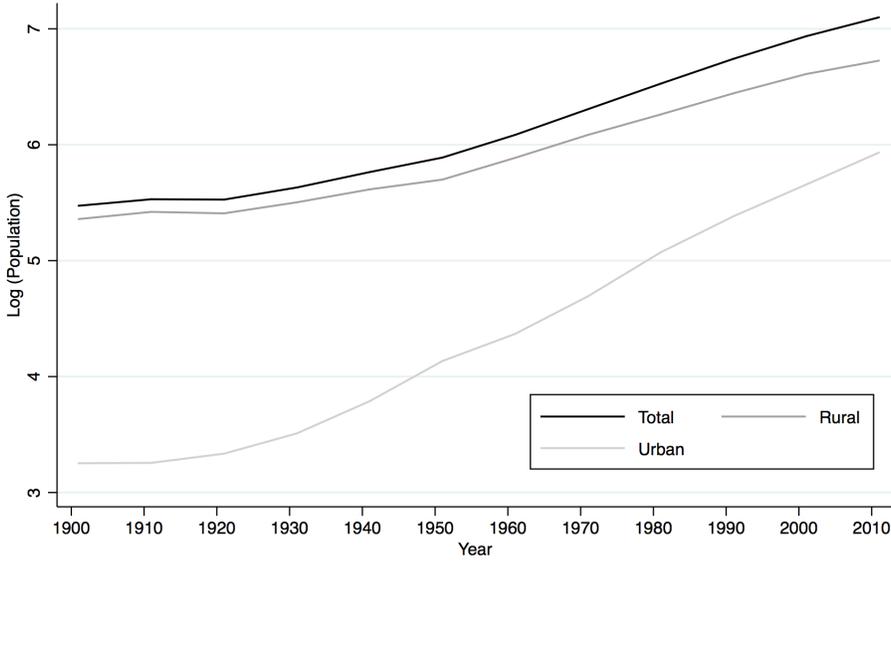
The transition from an agrarian society to a modern economy is typically described as involving three structural transformations. First, workers move from the agricultural sector into industrial production and services. Second, there is a gradual shift from the informal to the formal sector. Finally, there is an increase in urbanisation in response to the shift towards formal-sector manufacturing and services, which are likely, though not necessarily, located in urban areas. Even in cases where industry locates in or around rural areas, this results in urbanisation through the expansion, rather than the intensification, of urban areas.

Despite a significant decline in the agricultural share of GDP, the employment share of agriculture has remained very high in India. Furthermore, while there has been an expansion

in the output and employment share of industrial production and services, this is driven for the most part by the informal sector. Consequently, it is reasonable to conceive that urbanisation would have also proceeded slowly. Drawing on data from the official population census, we can track the expansion of the urban populace since the colonial era, through India’s independence in 1947 and the economic reforms of the early 1990s, until the present day. Figure 1 provides a graphical representation of India’s demographic trends since 1901.<sup>4</sup> Between 1901 and 1951 the urban population of India nearly doubled, growing by 88%. By contrast, it took the rural population until 1991 to double in size. Interestingly, we observe that the growth rate of the rural population is slowing, having peaked during the 1960s at around 20% per decade before falling to its present rate of 11% per decade. Meanwhile, the urban population growth rate peaked in the 1970s at 38% per decade before slowing to 27% per decade in 1991.

Between 2001 and 2011 the urban population growth rate increased slightly to 28%. An extrapolation based on the population growth rates observed between 2001 and 2011 for urban and rural areas indicates that the number of people living in urban-classified areas will exceed the number of people living in rural-classified areas sometime between 2040 and 2050. In reality, this demographic transition may be reached much sooner as rural areas urbanise and change in classification.

Figure 1: Population Growth in India (1901 - 2011)



Despite the significant growth observed in the urban population, the urban population’s

<sup>4</sup>This is presented in log-scale to provide growth rates based on differences.

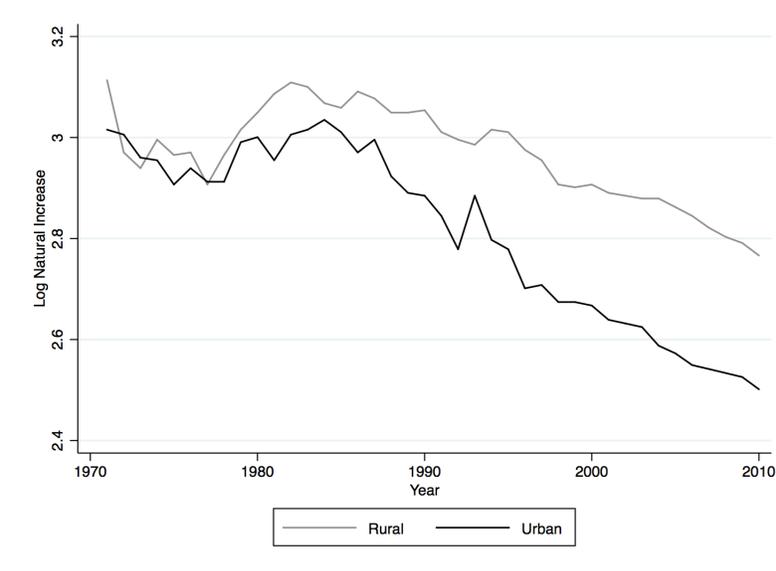
share of the total population has grown very slowly when compared to other developing and emerging economies at similar income levels. Table 1 presents the evolution of India’s urban population share. Between 1901 and 2011, the urban share of India’s population tripled from 10.84% to 31.15%. In the last 40 years India’s urbanised population share increased by less than 30%, with over one third of this change happening in the last decade. This indicates that India’s pace of urbanisation is picking up as a reflection of the economic and demographic changes that have been observed in recent decades; however, relative to other countries at similar stages of economic development, India lags behind.

Table 1: The Urban Population Share

	1901	1951	1991	2001	2011
TOTAL POPULATION (MILLIONS)	238	361	846	1,028	1,211
URBAN SHARE (%)	10.84%	17.30%	25.72%	27.71%	31.15%

When considering the drivers of urbanisation in India, there are three main channels through which urbanisation can arise. The first is the natural increase in population size. The natural increase is defined as the difference between the crude birth rate and the crude death rate. If the birth rate is greater than the death rate then the population is growing; if the death rate exceeds the birth rate then the population is shrinking. Figure 2 shows the decline in the natural increase for both rural and urban areas since the early 1970s. This might help to understand the falling growth rate in the urban population before the 21st century; however, it fails explain the expansion in the growth rate of the urban population between 2001 and 2011.

Figure 2: Natural Increase in the Rural and Urban Population (1971–2010)



This leaves two alternative explanations for the renewed urban expansion observed between 2001 and 2011. The first explanation is that the urban population growth rate increased due to a reclassification of rural areas to urban areas – a geographic change. This could be the result of increasing urban sprawl or the emergence of new urban areas. The second explanation is that there has been a shift in the rural population towards urban areas through migration, intensifying urban density – a demographic change. It is impossible to understand which of these drivers explains the recent increase in the urban growth rate with the available data and, in all likelihood, both factors complement each other, i.e., an expansion of urban areas reduces migration costs through reduced transport costs or housing costs, and consequently increases rural-urban migration on the margin. The remainder of this section analyses the demographic changes that have characterised urbanisation in India. An examination of migration and urban investments will be conducted in section 5.

## Demographic Change and Urbanisation in India

In the last decade the number of towns has increased by over 50%, driven by a substantial increase in the number of census towns classified according to the conditions set out in the 1961 census, as described in the previous section. In addition, there was a 25% increase in urban agglomerations, defined as a continuous urban spread comprising a town and its adjoining outgrowths, or two or more physically contiguous towns together, with or without outgrowths of such towns. This significant increase in towns and agglomerations has resulted in a 14.3% reduction in the average population size of towns (including cities), with

rural settlements increasing in size by around 12%. Together, these observations are indicative of substantial urban expansion in the last decade, well above the trend observed since independence.

Table 2: The Urban Population Share

	2001	2011	PERCENTAGE CHANGE (%)
<i>Number of Administrative Units</i>			
TOWNS	5,161	7,935	53.70%
STATUTORY TOWNS	3,799	4,014	6.40%
CENSUS TOWNS	1,362	3,894	185.90%
URBAN AGGLOMERATIONS	384	475	23.70%
VILLAGES	638,588	640,867	0.40%
<i>Population</i>			
URBAN (MILLIONS)	286	377	31.80%
RURAL (MILLIONS)	743	833	12.20%
<i>Average Settlement Size</i>			
URBAN (POPULATION PER TOWN)	55,439	47,524	-14.30%
RURAL (POPULATION PER TOWN)	1,163	1,300	11.80%

*Population Change on the Intensive and Extensive Margin:* Ideally we would like to decompose the population changes during this period into extensive margin changes – arising from an increase in the number of administrative units – and intensive margin changes – arising from an increase in the number of people living within an administrative unit; however, this is not possible until the town registry data from the 2011 census has been released.

Evidence of the expansion of urban areas is also shown in figure 3, which maps satellite imagery of India’s night lights in 2001 and 2011. It is clear from the substantial increase in intensity, compared to 2001, that there has been an increase in urban activity. It also appears as though there has been an expansion in economic activity during this decade. This is more evident in figure 4, which maps satellite imagery of Delhi’s night lights in 2001 and 2011.

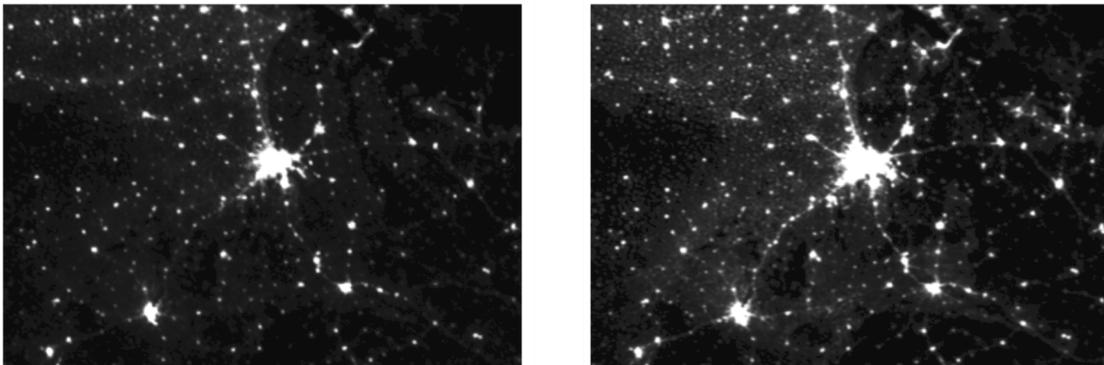
However, it is important to note the following caveat: as the intensity of night lights increases, there will be an increase in light pollution, resulting in the misattribution of urban activity to neighbouring areas. As a consequence of this, the night light images need

to be adjusted to account for overglow bias (Abrahams, Lozano-Gracia, and Oram, 2014). In the absence of this adjustment, we can consider the differences as an upper bound for the classification and reclassification of urban areas over time.

Figure 3: The Night Lights of India in 2001 and 2011



Figure 4: The Night Lights of Delhi in 2001 and 2011



Unlike most developing countries it is argued that India's urbanisation has been characterised by an unusually large number of highly-populated cities. Table 3 decomposes the urban population into different population class sizes for the period 1901–2001.

We observe that there has been an shift in the population density of class sizes since 1901, with a shift in the urban population from smaller to larger cities. In 1901, nearly 44% of the urban population were living in towns with fewer than 20,000 people. This share has fallen over time and, as of 2001, accounted for just below 11% of the urban population. This share has fallen, despite a doubling of the number of towns in this category during this period.

As the population has shifted away from smaller towns into larger cities, we have seen a significant rise in the population living in the right tail of the distribution. In 2001,

cities with a population between 100,000 and 1 million contained the largest share of the population (35%). Furthermore, this share has remained relatively constant over time, rising from 25% in 1901 (the second largest class size at this time). However, the share of the urban population living in mega cities with over 1 million people accounts for close to 37% of the urban population. In all population classes above 100,000 we have seen substantial growth in the share of the urban population since 1901, offset by a decrease in the population share for all class sizes below 100,000, most notably the share of the population living in locations with fewer than 20,000 people, where we observe a decrease in the population share by 33.29 percentage point between 1901 and 2001.

Consistent with this pattern, we observe a convergence of populations between mega cities (defined as cities with a population over 1 million people) and towns (urban areas with fewer than 1 million people) between 1901 and 2011 (Figure 5). Between 1901 and 2011 we have seen a 200% increase in the population of towns. However, this pales in significance when compared to the 500% increase in the population of mega cities.

Figure 5: Population Growth in Towns and Cities (1901–2011)

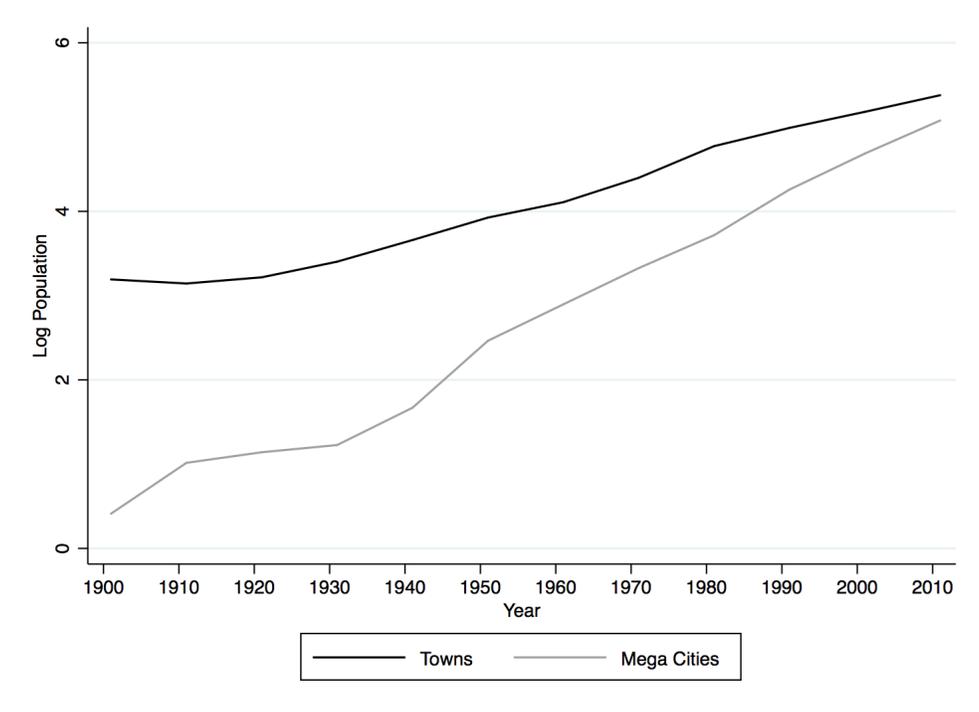


Table 3: The Urban Population Share – The Extensive Margin

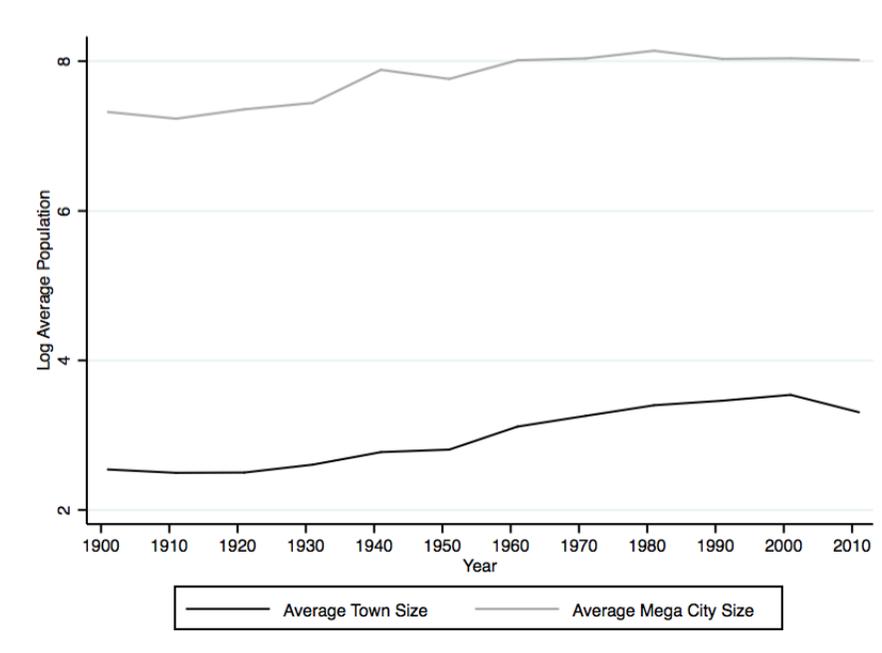
	MORE THAN 4 MILLION	1–4 Million	100,000–1 MILLION	50,000–100,000	20,000–50,000	< 20,000	TOTAL
TOTAL URBAN POPULATION (2001)	35.09	43.04	100.04	34.45	42.11	30.50	285.2
SHARE (%)	12.30%	15.08%	35.07%	12.07%	14.76%	10.69%	100%
NUMBER OF CITIES	5	26	410	496	1,388	2,604	4,929
AVERAGE CITY SIZE (millions)	7.02	1.65	0.24	0.07	0.03	0.01	0.06
TOTAL URBAN POPULATION (1951)	0.00	7.29	14.64	7.27	10.74	13.41	53.38
SHARE (%)	0.00%	13.66%	27.43%	13.62%	20.13%	25.13%	100%
NUMBER OF CITIES	0	3	66	107	363	1,308	1,847
AVERAGE CITY SIZE (millions)	0.00	2.43	0.22	0.07	0.03	0.01	0.02
TOTAL URBAN POPULATION (1901)	0.00	0.00	5.57	2.81	4.04	9.76	22.20
SHARE (%)	0.00%	0.00%	25.12%	12.66%	18.23%	43.98%	100%
NUMBER OF CITIES	0	0	24	42	131	1,101	1,208
AVERAGE CITY SIZE (millions)	0.00	0.00	0.23	0.066	0.030	0.01	0.02
SHARE CHANGE (1901–2001) (Percentage Points)	12.30	15.08	9.95	-0.59	-3.47	-33.29	–
CITY COUNT CHANGE (1901–2001)	5	26	386	454	1,257	1,503	3,721

Notes: These numbers are based on census micro data for each city. Any discrepancies between the numbers presented here and elsewhere in the paper arises from differences between the city-level data and the aggregate census data, most likely as a result of missing data points in the micro data.

There are two explanations for why city sizes have increased over time, given that size is determined by a trade-off between scale economies and diseconomies. First is the hypothesis that scale economies are increasing relative to diseconomies. Second is the hypothesis that scale diseconomies have dissipated with technological progress.

It is interesting to note that the rise in the population of towns and cities has been tempered by an increase in the number of towns and cities. Between 1901 and 2011 there has been a 75% increase in the average town size and a 70% increase in the average mega city size (Figure 6). In the case of mega cities, most of this growth occurred prior to independence, and since the 1980s the average population size of mega cities has been falling by an average of 4% per decade. For towns, growth in the average population increased more gradually over the century, peaking in 2001. However, between 2001 and 2011 we observe a 23% reduction in the average population size of towns, most likely driven by the 53% increase in the number of towns during this decade.

Figure 6: Average Town and City Size Growth (1901–2011)



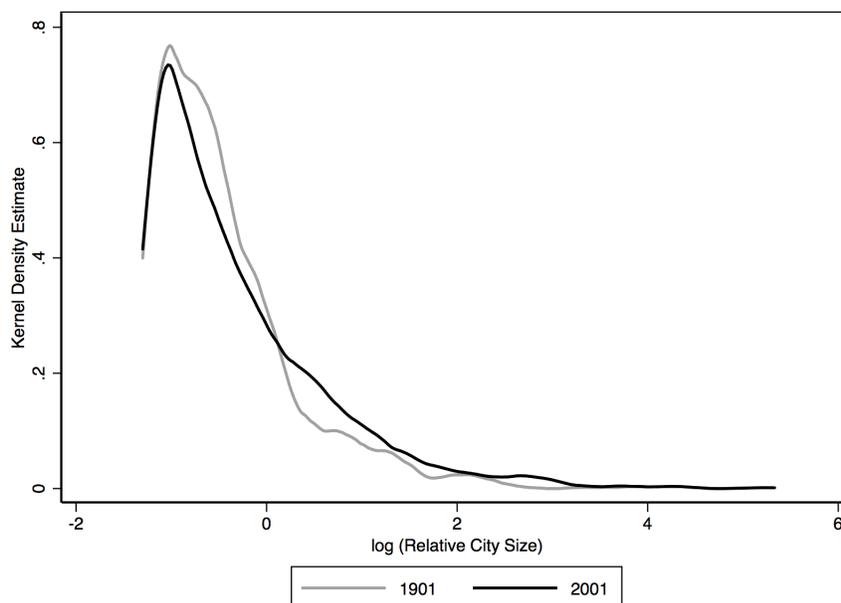
This is consistent with the evidence presented in Black and Henderson (2003), which showed that the relative city size distribution remains remarkably stable over time in the US between and 1910–2000. Henderson and Wang (2007) further support this empirical regularity, demonstrating that we rarely see massive shifts in relative urban size structure over time, even in response to changes in economic structure.

**The Relative City Size Distribution** Following the approach taken in Black and Henderson (2003) and Henderson and Wang (2007), we more formally explore the relative size distribution of cities in India between 1901 and 2001. We begin by normalising the data in two ways: (1) city sizes for each year are divided by the average city size in the decade, capturing the fact that the sizes of all cities are growing in absolute terms over time; (2) we adjust the relevant sample in each period, raising the minimum size absolute cut-off point to keep the same relative size of cities. We take the ratio between the minimum city size (5,007) and the mean city size (18,382) in 1901 and apply that ratio (0.2723) to the data in 2001. Consequently, the cut-off point is defined as the first  $s$  cities (ordered by size) such that  $s + 1$  cities would fall below the threshold, i.e., we choose  $s$  such that in time  $t$ ,

$$\min \left[ s(t); \frac{(s + 1)N_{s+1}(t)}{\sum_{i=1}^{s+1} N_i(t)} \leq 0.2723 \right]$$

where  $N_i(t)$  is the population of city  $i$  at time  $t$ . For the year 2001, out of a possible 4,929 cities in India with over 5,000 people, we have a sample of 2,889 cities with an average size of 91,641 and a minimum absolute size of 15,766. Figure 7 plots the densities of the relative city sizes for 1901 and 2001.

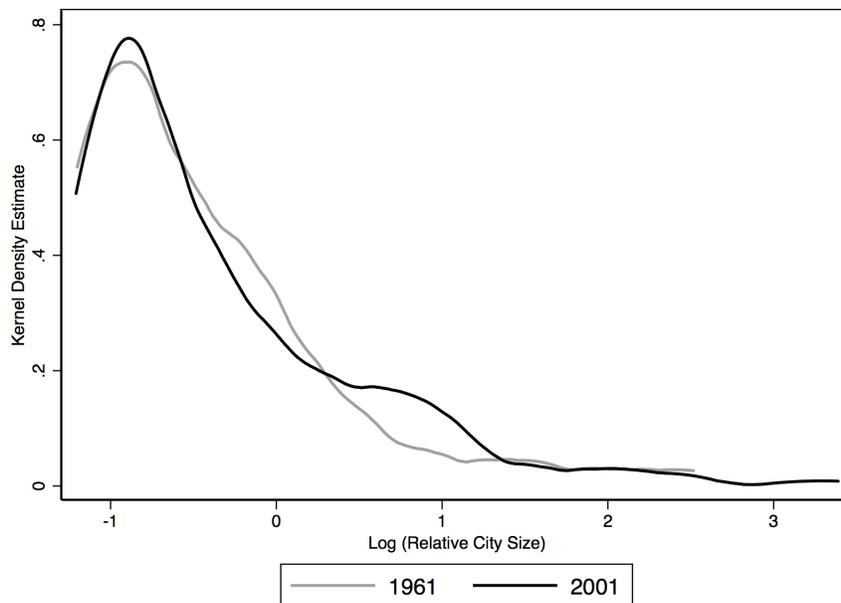
Figure 7: Relative City Size Distributions (1901–2001) – All Cities



We observe that for the full distribution of urban areas in India there is considerable overlap in the relative city size distribution between 1901 and 2001. That being said, there

is a noticeable shift in the distribution from smaller to larger cities, and a difference-in-means test between the two decades is statistically significant at the 1% level. In figure 8 we recalculate the thresholds to examine the relative size distribution for cities with 100,000 people or more between 1961 and 2001 – the sample period and absolute cut-off studied by Henderson and Wang (2007). We take the minimum city size (100,097) and the mean city size (335,143) in 1961 and apply that ratio (0.2986) to the data in 2001. For the year 2001, this provides a sample of 359 cities in 2001, with an average size of 471,510 and a minimum absolute size of 120,676.

Figure 8: Relative City Size Distributions (1961–2001) – Class 1 Cities



Again, we observe substantial overlap in the relative city size distributions between 1961 and 2001 for cities with populations greater than 100,000. However, unlike the differences in the full urban hierarchy between 1901 and 2001, any differences are less noticeable; indeed, a difference-in-means test between the two decades is statistically insignificant (p-value 0.302). This indicates that at least in recent years and for the right tail of the distribution, there has been almost no change in the relative size distributions of cities in India. This indicates that cities are not converging to a common size over time, and that the spread of relative city sizes, at least in the decades since independence, has remained constant, although there has been a shift in the tail of the distribution with an increase in the relative-size of mega cities.

**Spatial Inequality in India** An additional way to examine the spatial concentration of populations is to calculate spatial Gini coefficients, providing a measure of spatial inequality for the entire distribution. To calculate the Gini coefficient for India, we rank all cities from smallest to largest on the  $x$ -axis and on the  $y$ -axis we calculate the Lorenz curve – the cumulative share of the total sample population. If all cities were the same size, the plotted line would be equal to the  $45^\circ$  line. The Gini coefficient is calculated as the area between the  $45^\circ$  line and the plotted curve, relative to the area below the line. Spatial inequality is increasing in the size of the Gini coefficient because smaller cities account for a smaller accumulated share of the sample population. Table 4 presents estimates of the spatial Gini coefficients for India’s city size distribution.

Table 4: Spatial Gini Coefficients

CUT-OFF	5,000		100,000	
	UNBALANCED	BALANCED	UNBALANCED	BALANCED
1901	0.520	0.520	0.370	0.373
1911	0.529	0.529	0.403	0.407
1921	0.537	0.538	0.415	0.420
1931	0.542	0.541	0.412	0.418
1941	0.581	0.582	0.456	0.460
1951	0.616	0.619	0.495	0.498
1961	0.638	0.644	0.519	0.523
1971	0.661	0.668	0.538	0.541
1981	0.681	0.690	0.553	0.555
1991	0.691	0.704	0.560	0.563
2001	0.706	0.719	0.566	0.569

Notes: If cities are ranked 0 to  $n$  where  $n$  is the largest city, the  $x$ -axis goes from 0 to  $n$  and the  $y$ -axis goes from 0 to  $\sum_{i=1}^n S_i (\bar{S}n)^{-1} = 1$ , where  $\bar{S}$  is the average city size. The area under the  $45^\circ$  line is  $n/2$ . The area between the  $45^\circ$  line and the Lorenz curve is  $(n+1)/2 - (n\bar{S}^{-1} \sum_{i=1}^n (n-i+1)S_i)$ . The Gini coefficient is this area divided by  $s/2$ .

We observe that spatial inequality in India has been increasing over time, and is more pronounced when accounting for the full distribution of urban areas rather than the right tail of the distribution. Henderson and Wang (2007) report measures of the spatial Gini coefficients for 7 countries in 1960 and 2000, based on a sample of cities with populations greater than 100,000. Using their estimates as a benchmark, we compare our estimates reported in table 7. In 2001, spatial inequality in India is greater than in China (0.423), Russia (0.459), and the USA (0.538), but less than Brazil (0.653), Indonesia (0.614), and Japan (0.659). Interestingly, Henderson and Wang (2007) report that spatial inequality is

declining over time globally, and in both developed and developing countries. However, spatial inequality has increased over this time in India.

**Zipf’s Law and Primate Cities in India** The stability of the city size distributions across countries and over time have led some to argue that they are either globally (Gabaix, 1999) or locally (Eeckhout, 2004; Duranton, 2007) approximated by a Pareto distribution and thus obey Zipf’s law (Zipf, 1949). Zipf’s law states that the number of cities of size greater than  $S$  is proportional to  $1/S$ . More formally, city sizes are said to satisfy Zipf’s law if, for large sizes  $S$ , we have,

$$P(\text{Size} > S) = \frac{\alpha}{S^\zeta}$$

where  $\alpha$  is a positive constant and  $\zeta = 1$ . This relationship has been explored and shown to hold consistently – and persistently – in many countries and over long periods of time (Rosen and Resnick, 1980; Gabaix, 1999; Soo, 2005; Dobkins and Ioannides, 2000; Black and Henderson, 2003; Ioannides and Overman, 2003; Gabaix and Ioannides, 2004; Rozenfeld et al., 2011).

Following the approach in Gabaix and Ibragimov (2011), I estimate the bias-corrected Zipf regression, fitting an ordinary least squares (OLS) regression of the log rank  $i$  on the log size  $S_{(i)}$  for each decade,

$$\log(n_i - 1/2) = \alpha - \zeta_n \log S_i$$

For a sufficiently large  $n$ , the coefficient  $\zeta_n$  tends with probability 1 to the true  $\zeta$ . Under the assumption that Zipf’s law holds,  $\zeta_n$  should tend towards 1. Following Gabaix and Ibragimov (2011), asymptotically standard errors are estimated following the equation,  $(2/n)^{1/2}\zeta$ , because OLS standard errors considerably underestimate the true standard deviation of the OLS coefficient  $\zeta_n$ . Consequently, taking the OLS estimates of standard errors at face value will lead one to reject the true numerical value of  $\zeta_n$  too often.<sup>5</sup> Before evaluating the empirical evidence, it is important to keep in mind the following, discussed by Gabaix and Ioannides (2004). They argue that the focus of empirical work on Zipf’s law should be on how well the theory fits, rather than whether or not it fits perfectly, i.e., the debate of Zipf’s law should be cast in terms of how well, or poorly, it fits, rather than whether it can be rejected or not.

Table 5 presents the results of this exercise for various cut-offs in city size.

Columns 1 and 2 present estimates of  $\zeta_n$  at the national level. We observe that the

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<sup>5</sup>Results are robust to the standard OLS procedure discussed in Gabaix and Ioannides (2004).

Table 5: Statistics on the OLS coefficient  $\zeta_n$

CUT-OFF	ALL INDIA		ALL INDIA		WITHIN ZONE		WITHIN ZONE	
	(1)		(2)		(3)		(4)	
	5,000		100,000		5,000		100,000	
	$\zeta_n$	# cities	$\zeta_n$	# cities	$\zeta_{Z_n}$	# cities	$\zeta_{Z_n}$	# cities
1901	-1.350 (0.055)	1,208	-1.541 (0.444)	24	-1.316 (0.053)	1,208	-1.137 (0.328)	24
1911	-1.340 (0.055)	1,180	-1.410 (0.415)	23	-1.293 (0.053)	1,180	-1.070 (0.315)	23
1921	-1.324 (0.053)	1,237	-1.435 (0.383)	28	-1.289 (0.051)	1,236	-1.136 (0.303)	28
1931	-1.295 (0.049)	1,400	-1.445 (0.367)	31	-1.272 (0.048)	1,400	-1.220 (0.309)	31
1941	-1.223 (0.043)	1,604	-1.404 (0.289)	47	-1.214 (0.042)	1,604	-1.203 (0.248)	47
1951	-1.143 (0.038)	1,847	-1.326 (0.225)	69	-1.138 (0.037)	1,847	-1.199 (0.204)	69
1961	-1.095 (0.034)	2,066	-1.284 (0.178)	103	-1.049 (0.032)	2,066	-1.108 (0.154)	103
1971	-1.044 (0.030)	2,415	-1.249 (0.144)	149	-0.995 (0.029)	2,413	-1.152 (0.133)	149
1981	-1.004 (0.025)	3,117	-1.218 (0.116)	220	-0.989 (0.025)	3,117	-1.113 (0.106)	220
1991	-0.979 (0.022)	3,787	-1.206 (0.095)	319	-0.961 (0.022)	3,787	-1.119 (0.088)	319
2001	-0.957 (0.019)	4,929	-1.203 (0.081)	441	-0.934 (0.018)	4,929	-1.138 (0.076)	441

Notes: Asymptotic standard errors are estimated following Gabaix and Ibragimov (2011).

coefficient on  $\zeta_n$  is substantially larger than 1 for most cut-offs. These values are substantially larger than the values recorded in the US. For example, in the United States, Gabaix (1999) shows that the  $\zeta_n$  coefficient is 1.005 for the 135 largest Metropolitan areas. By contrast, the coefficient in India for the 135 largest urban areas is 1.29 in 2001 and 1.49 in 1901. From the results in table 5, we see that the coefficient estimates decrease in size over time, presumably driven, at least in part, by an increase in the sample size. However, when looking at the right tail of the city size distribution, we observe that none of the coefficient estimates fall within even generous bounds – as reported in Gabaix and Ionides (2004),  $[0.8, 1.2]$  – of true  $\zeta$ .

Surprisingly, zip’s law can better explain the data when accounting for all urban areas, i.e., towns and cities with over 5,000 people. However, even when an upper bound of 1.2 is

applied, this is only the case after independence in 1947. The performance of zip’s law in the full distribution but not in the tail of the distribution – where arguably one might expect a better fit – is surprising and indicates that the city size distribution is not very dispersed in the upper tail. Lower slope coefficients imply greater spatial inequality in the city size distribution – a given change in rank corresponds to a larger change in city sizes. However, in the right tail of the distribution, a change in rank results in a much smaller change in city sizes, consistent with the premise that India’s urban hierarchy is characterised by a large number of highly populated cities. The decreasing trend in the  $\zeta_n$  coefficient is consistent with the evidence presented on spatial inequality above where estimates of the spatial Gini coefficient by year indicated an increase in spatial inequality over time, with less inequality observed in the upper tail of the distribution.

One reason for this compression in the right tail could be India’s lack of a primate city, which is often associated with the rank-size power law. Indeed, Mark Jefferson’s Law of Primate City written in 1939 – predating George Zipf’s 1949 formalisation of the Rank Size Rule – states that,

*“The primate city is commonly at least as twice as large as the next largest city and more than twice as significant.”* – Mark Jefferson (1939)

Primate cities are often, but not always, the capital cities in a country and exist when a system of cities is dominated by one large city. Applying this concept to India, we observe that there is no primate city at the national level. Four nodal cities developed during colonial rule - Mumbai, Kolkata, Chennai and Delhi, characterise the urban hubs of India. Mumbai, Kolkata, and Chennai were, and remain, port cities, while Delhi was the capital of British India and continues to be the central economic hub for northern India.

In 1956 the States Reorganisation Act grouped Indian States into six zones, each having an Advisory Council to *“develop the habit of cooperative working.”* Each of the four nodal cities discussed above are present in a separate zone, with two other historic cities, Guwahati and Jaipur, set as the primate cities for the remaining two zones. The zones are Eastern, Southern, Western, and Northern India, with the Northern zone split further into Northern, Northern-Central, and Northern-Eastern (Table 6).

Columns (3) and (4) present the estimates of  $\zeta_n$  within each zone. We note that Zipf’s law performs much better in fitting the data when estimated within these historical zones. With the same sample of cities in columns (1) and (2) our estimates of  $\zeta_n$  are much closer to 1, with the biggest improvement observed in the right tail of the city size distribution. In the colonial decades, the coefficient is still substantially larger but only slightly outside of the maximum bound set at 1.2, and may be a statistical artefact of the small sample size rather

Table 6: The Zones of India

NORTHERN	NORTHERN-CENTRAL	NORTHERN-EASTERN
HARYANA	BIHAR	ASSAM
HIMACHAL PRADESH	MADHYA PRADESH	ARUNACHAL PRADESH
JAMMU & KASHMIR	UTTAR PRADESH	MANIPUR
PUNJAB	UTTARANCHAL	MEGHALAYA
RAJASTHAN	DELHI	MIZORAM
CHANDIGARH		NAGALAND
		TRIPURA
EASTERN	SOUTHERN	WESTERN
CHHATISGARH	GOA	ANDHRA PRADESH
JHARKHAND	GUJARA	KARNATAKA
ORISSA	MAHARASHTRA	KERALA
SIKKIM	DADRA & NAGAR HAVELI	TAMIL NADU
WEST BENGAL	DAMAN & DIU	LAKSHADWEEP
ANDAMAN & NICOBAR ISLANDS		PONDICHERRY

than anything fundamentally associated with the urban hierarchy in colonial times. That being said, the coefficient converges to 1 very quickly in the decades following independence for the full city size distribution and falls well within the maximum bound for the upper tail of the distribution. In addition, the coefficient remains very stable in the decades following independence.

**Gibrat’s Law and Big(ger) City Bias** Given the instability of Zipf’s law at the national level, it is interesting to explore the validity of Gibrat’s law (from which Zipf’s law emerges) which states that city growth rates are orthogonal to city size. We estimate a simple model of city size growth,

$$\Delta \ln(S_{it}) = \beta \ln S_{it-1} + \alpha_i + \alpha_t + \epsilon_{it}$$

where we are testing the hypothesis that  $\beta = 0$ . Table 7 presents the results from this analysis.

Table 7: An Empirical test of Gibrat’s Law

	(1)	(2)	(3)	(4)	(5)	(6)
CUT-OFF	5,000	100,000	5,000	100,000	5,000	100,000
$\log S_{(i)}$	0.051*** (0.002)	0.016 (0.009)	0.113*** (0.004)	0.0264 (0.025)	0.232*** (0.018)	0.401*** (0.132)
YEAR FIXED EFFECTS	YES	YES	NO	NO	YES	YES
CITY FIXED EFFECTS	NO	NO	YES	YES	YES	YES
OBSERVATIONS	19,284	1,403	19,284	1,403	19,284	1,403
# CITIES	3,806	435	3,806	435	3,806	435
ADJUSTED R <sup>2</sup>	0.197	0.032	0.277	0.405	0.384	0.542

Notes: Robust standard errors are clustered at the city level.

The data rejects Gibrat’s law when looking at the entire distribution of urban locations, consistent with the evidence presented in Holmes and Lee (2010). We are unable to reject the null hypothesis in columns (2) and (4) when focussing upon the right tail of the city size distribution, consistent with Eeckhout (2004); however, once we control for both city fixed effects and a country-level time trend, we reject the null hypothesis for both the entire distribution and the right tail of the city size distribution. These results are interesting in so far as they imply that, on average, larger cities grow faster than smaller cities in the urbanisation process. This result is in direct contrast to the results presented in Henderson and Wang (2007), who estimate significant negative coefficients consistent with a theory of mean reversion, using the same model for 2,684 cities with more than 100,000 people in 137 countries, between 1960 and 2000. However, it is consistent with Michaels et al. (2012) and Desmet and Rappaport (2013), who find positive growth effects for medium-sized locations, relating their observations to either the declining share of land in production as agricultural areas transition into industry, or to increasing agglomeration economies arising from the introduction of new technologies.

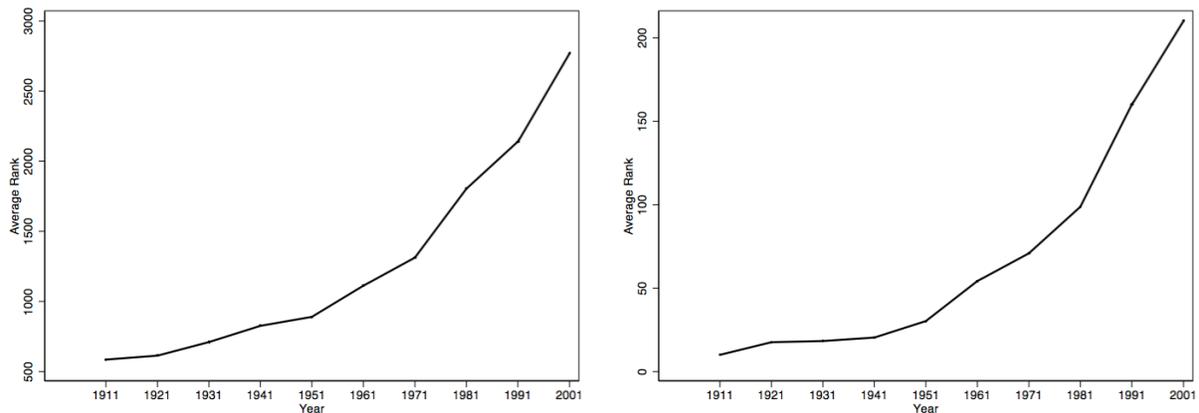
Why might larger cities grow more quickly than smaller cities? As discussed above, larger cities might grow faster than smaller cities if the ratio of scale economies to scale diseconomies is increasing at a faster rate in larger cities than in smaller cities. This may occur if scale economies are increasing relative to diseconomies, or if scale diseconomies have dissipated with technological progress. The speed at which cities grow is likely to depend on their stage in the development process. Henderson and Venables (2009) present a theory of dynamic city formation in which cities form and grow sequentially, with the largest cities being the first to grow until they reach a critical size, resulting in the next city growing, and so continues the sequence. Cuberes (2011) provides an empirical analysis of the evolution of

city growth between 1800–2000, asking which part of the city size distribution the fastest-growing cities fall in each decade. We replicate this analysis for India, asking, for a given decade, whether large or small cities grow the fastest, and whether this pattern changes over time.

We begin by ranking each city in terms of population for each decade, with the largest city ranked 1st. Next, we calculate the 75th percentile of cities’ growth rates and restrict the sample of cities to those whose growth rate is greater than or equal to this threshold. Finally, we calculate the average rank for those cities to answer whether larger or smaller cities grow faster and whether, on average, this pattern changes over time. Earlier in the development process we should expect that larger cities grow faster, due to the benefits of economies of scale; however, as these cities grow larger, diseconomies of scale become more important for these larger cities, creating an advantage for smaller cities.

Figure 9 presents the results of this exercise for both the entire distribution of cities, as well as the right tail of the distribution between 1901 and 2001. We observe that in the early stages of urbanisation, larger Indian cities grow the fastest (the average rank is 585 for the entire distribution and 10 for the right tail of the distribution); however, eventually the medium and small cities are the ones that attract greater growth, as the average rank increases.

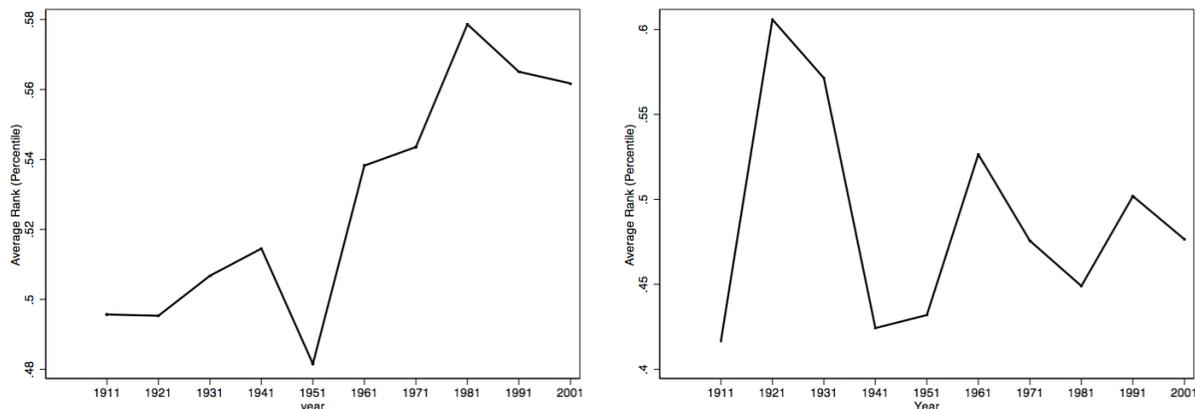
Figure 9: The Evolution of the Average Rank of the Fastest-Growing Cities in India



However, a concern with this approach is that the average rank will increase over time mechanically, distorting our interpretation of the facts. As the number of cities increases, the interpretation of the rank changes, e.g., an average rank of 10 has a completely different interpretation when there are 20 cities, compared to when there are 2,000 cities. Consequently, we normalise the average rank by dividing by the number of cities. This provides an interpretation of the average rank in terms of city size percentiles. Figure 10 presents the

outcome of this adjustment.

Figure 10: The Evolution of the Average Rank of the Fastest-Growing Cities in India



By adjusting the average rank to account for the number of cities we observe an entirely different picture to the empirical support for sequential growth presented by Cuberes (2011). When looking at the entire distribution of cities, we observe that while there is an increasing trend over time, the dispersion is very limited, with all adjustment within 10 percentage points of the city size distribution, and a difference of 6 percentage points between 1911 and 2001. Moreover, the average rank in terms of city size percentiles across this period is the 54th percentile, far removed from the largest or smallest cities. When we restrict our attention to cities with 100,000 people or more – the right tail of the city size distribution – we see a substantially different pattern. There appears to be a cyclicity of growth, with higher ranked cities growing faster, followed by lower ranked cities, and so on. In the beginning of this time period, this dispersion in average rank is greater than that observed in the entire distribution, ranging 20 percentage points between the 40th and 60th percentile; however, as urbanisation progresses, this dispersion falls such that between during the last cycle 1971–2001 the range is 5 percentage points. In fact, the dispersion appears to have a half-life of 30–40 years. As with the entire city size distribution, the average rank in terms of city size percentiles between 1911 and 2001 is around the median of the city size distribution, the 48th percentile – far removed from the smallest or largest cities. This is consistent with the findings of Michaels, Redding and Rauch (2012), who in analyzing population density and growth in the US between 1880–2000 observe a U-shaped relationship that becomes flat for high-density locations. They estimate that low-density locations exhibit a negative relationship between 1880 density and growth over the 1880–2000 period, and that high-density locations have an orthogonal relationship between 1880 density and population growth. It is in the medium-density locations that the relationship between initial density

and growth is positive, consistent with our findings. Michaels et al. (2012) relate this finding to structural transformation, arguing that divergent growth is most prominent in areas that are transitioning from agriculture into manufacturing. By contrast, Desmet and Rappaport (2013), who observe a similar pattern of positive growth in medium-sized US locations, argue in favour of an explanation associated with increasing agglomeration economies due to the introduction of new technologies, as in Desmet and Rossi-Hansberg (2009).

The historical record of urbanisation in India, as portrayed by the data presented here, suggests slow yet steady progress over the last century; however, there is increasing evidence that the pace of urbanisation has been increasing more recently, driven by India's changing demographic and geographic landscape. The following sections explore how recent urbanisation has tied into the spatial distribution of economic activity, alongside a discussion of the evidence on population mobility and migration, and investments in urban amenities and infrastructure.

***Too Big, Too Small, Or Just Right?*** The evidence presented in this section indicates that, while slow, urbanisation is starting to take off in India. This process of urbanisation has been characterised by: substantial growth in the size of large cities (the right tail of the city size distribution), resulting in an increase in spatial inequality over time; substantial growth in the number of large cities, resulting in the absence of a national primate city and the rejection of Zipf's law at the national level; and the expansion of large cities into suburban and peri-urban areas. Furthermore, we observe that cities in the middle of the distribution are growing faster than larger or smaller cities, which indicates an increase in the number of large cities in the future.

A number of questions remain. First, what are the drivers, and consequences, of these factors in shaping the spatial allocation of resources, people, and economic activity? Is a focus on larger cities efficient? What are the welfare consequences of having an urban system that is skewed towards larger cities? Should policy makers focus resources on encouraging smaller cities to grow, or invest in infrastructure to allow larger cities to better support urbanisation? Future research should aim to better understand these questions; however, the absence of city-level data in India creates a number of difficulties. Unlike China, Brazil, and the United States, India does not collect data systematically at the city level. Without data on economic output, prices and wages it is very difficult to understand the economic consequences of urbanisation in India. Furthermore, economic activity is mainly identified at the district level, limiting the degree to which we can understand the spatial distribution of industry and its relationship to urbanisation.

One source of data that may provide an avenue for future research on urbanisation in India is the economic census, collected every 8-10 years (1977, 1980, 1990, 1998, 2005, 2013). The economic census is a complete enumeration of all establishments except those engaged in crop production and plantation; there is no minimum firm size, and both formal and informal establishments are included. However, the most interesting characteristic of the data is the detail provided on spatial location and industrial sector, available at the village level for rural areas and ward-block level for urban areas – subdivisions of a town or city (see Asher and Novosad (2013) for more detail). The combination of this data with data on price indices and wages at the district level from the National Sample Survey (hereafter, NSS) would provide a rich dataset to better understand what determines the spatial allocation of resources, people and economic activity, and the impacts of urbanisation on growth and development. Combined with data on night lights, alternative measures of urban classification can be developed to explore the effects of urbanisation within and between rural and urban areas.

## 4 Urbanisation and the Spatial Distribution of Economic Activity

While India’s urban development has followed a gradual yet unabated rise since independence, economic development has taken much longer to get started. Post independence in 1947, India set out on a period of centrally planned industrialisation. The theoretical argument was that massive state investment would help kick-start development and that state coordination of economic activities would ensure the rapid and sustained growth of domestic industries (Rosenstein-Rodan, 1943; 1961; Rostow, 1952).

The focal point of the planning regime was the Industries Act of 1951, which introduced a system of industrial licensing that regulated and restricted the entry of new firms as well as the expansion of existing ones. This system of industrial regulation that controlled the pace and pattern of industrial development became commonly known as the “license raj”. The emphasis on central planning is most clearly demonstrated by the Industries Act of 1951, which states that *‘it is expedient and in the public interest that the Union should take under its control the industries in First Schedule.’*<sup>6</sup>

While the intention of such policies was to kick-start development, in practice this period of central planning stifled innovation and reduced production and investment. It also reduced efficiency, due to the elimination of competition, both internationally and through barriers to

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<sup>6</sup>Union refers to the central government. The First Schedule lists all key manufacturing industries in 1951 and is subsequently revised to encompass new products. The central planning act effectively brings all key industries under central government control via licensing (Malik, 1997).

entry for new firms. Furthermore, the bureaucratic nature of the licensing process imposed a substantial administrative burden on firms, with paper work expected every 6 months and additional applications required for additional changes in production.

In addition, there was considerable uncertainty as to whether license applications would even be approved and, if they were, when the approval would be granted. Hazari (1966) notes that 35% of license applications were rejected in 1959 and 1960, with the rejected applications accounting for nearly 50% of the total investment value among the applicant pool. This, of course, does not even take into account the investments that did not reach the license application stage.

The result of this inward-oriented, centrally planned industrialisation was three decades of low and stagnant growth (3.5% per year between 1950 and 1980). By contrast, the East Asian economies of Hong Kong, Singapore, South Korea, and Taiwan experienced extraordinarily high growth rates of around 10% per year over the same period. The fundamental difference in these economies is that the investments made were productive and that production was outward-oriented, resulting in imports of equipment that resulted in technological change and further productivity increases.

To the degree that the model of urbanisation discussed in the previous section is reasonable – i.e., that the transition from an agrarian society to a modern economy begins with the movement of workers from the agricultural sector into industrial production and services –, it is unsurprising that the pace of urbanisation during this period could be described as slow compared to other developing countries at similar stages of development.

Recognition of the issues associated with the centrally planned industrialisation strategy – namely, the persistent stagnation of the Indian economy – prompted the government to undertake a set of liberalisation reforms in the 1980s and more forcefully in the early 1990s. In 1980, Indira Gandhi made the 1980 Statement on Industrial Policy, signalling a renewed emphasis on economic growth (Government of India, 1980). However, it was not until Rajiv Gandhi unexpectedly came to power, following his mother’s assassination in 1984, that large-scale reform entered the political agenda. About a third of three-digit industries were exempted from industrial licensing or de-licensed in 1985 (with few extensions in 1986 and 1987). However, on the 21st of May 1991, Rajiv Gandhi was assassinated in the midst of an election campaign. Narasimha Rao was appointed as his successor, who in turn appointed Manmohan Singh as finance minister. Alongside this political turmoil, rising external debt, exacerbated by a spike in oil prices as a result of the Gulf War, led to a macroeconomic crisis for India, resulting in external support from the International Monetary Fund (IMF) that was conditional on the implementation of a structural adjustment program.

This tipping point resulted in the large-scale liberalisation of the Indian economy and the

end of the “license raj”. Industrial license was abolished, additional industries were removed from the First Schedule, and both tariff and non-tariff barriers were slashed, reducing barriers to trade.

Given the relative increase in urbanisation during the post-liberalisation period, it is of interest to examine the rural-urban differences in industrial production at this time to understand the degree to which industrialisation and urbanisation go hand in hand. It is common for the biggest cities in developing countries to start off as manufacturing centres. The main economic consideration for such observations is the presence of agglomeration economies or increasing returns to scale. Public services, capital markets, the allocation of licenses, knowledge and ideas may all be biased towards these urban centres, creating attractive environments for production.

However, as development proceeds, industrial production decentralises. This decentralisation arises in two stages, first towards peri-urban or suburban areas, then towards metropolitan regions, small cities, and rural areas. Henderson (2012) presents this process for the Republic of Korea and Japan. The World Bank (2013) also examines the case of Korea, linking decentralisation to the widespread transport and communications infrastructure investments made in the early 1980s. Such investments increase access to agglomeration externalities associated with urban centres, reducing the need for urban intensification, and consequently reducing the magnitude of negative externalities such as congestion, crime, and pollution.

This process of decentralisation is also one that is observed in India, although questions remain as to whether the process of centralisation really began. Two recent studies explore recent patterns of production in India and how the patterns of production differ between rural and urban areas. Desmet et al. (forthcoming) study manufacturing employment growth in districts where manufacturing is already concentrated and in districts where it is not. They conduct the same exercise for the services sector. Figure 11 presents the key results from their study.

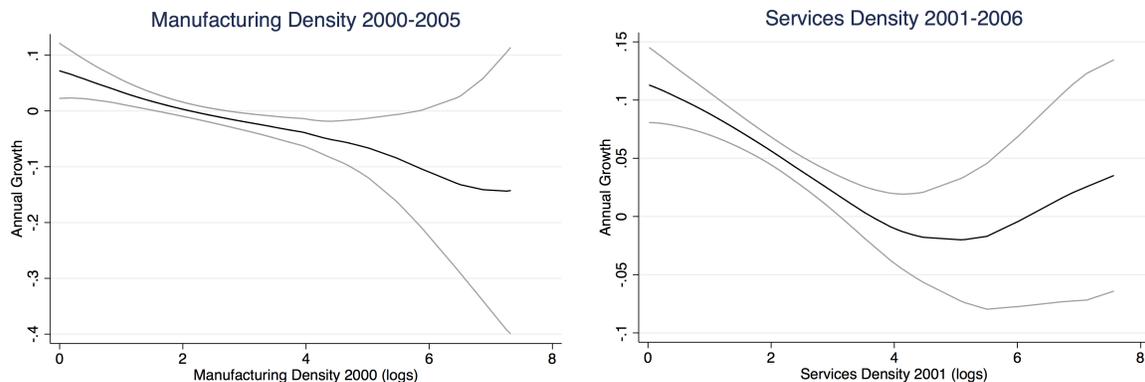


Figure 11: Annual Manufacturing and Services Employment Growth as a function of initial employment density (logs). Manufacturing results based on NSS and ASI, 2000–2005. Services Results based on NSS, 2001–2006

Between 2000 and 2005, districts with higher concentrations of manufacturing employment grow much more slowly than districts with lower concentrations. In fact, on average, high-concentration districts have negative growth rates and actually lose employment. By contrast, the services sector shows increasing growth in districts with higher concentrations. This is suggestive of decentralisation in the manufacturing sector, with the services sector concentrating even more in high-intensity districts. Ghani et al. (2012) look more specifically at manufacturing and document its movement away from cities to rural areas, comparing the formal and informal sectors. The authors argue that the organised sector is becoming more rural. However, in practice, a lot of this movement may be suburbanisation – the first stage of decentralisation, in which firms move to the outskirts of major cities, with vastly cheaper land and somewhat cheaper labor. They observe that, while the urban share of employment in the formal sector declined, the urban share of employment in the informal sector rose. This may indicate that the scale economies are of greater importance for smaller firms, while larger firms can break off from centralised locations. For example, a firm with multiple plants can benefit from scale economies if its headquarters are based in urban areas with additional production plants exploiting cost reductions in suburban areas.

One of the attractive features of the Annual Survey of Industries is that it distinguishes between establishments in rural and urban areas. This is a feature that has not been exploited in the exploration of decentralisation in formal sector manufacturing. Arguably, a comparison between formal sector firms and informal sector firms does not provide a suitable counterfactual; by contrast, a comparison between formal sector firms in rural and urban areas may provide more insight into the decentralisation of formal sector manufacturing. We follow Desmet et al. (forthcoming) and run nonlinear kernel regressions of the form,

$$\Delta L_i(\ell, t + 1) = \phi(L_i(\ell, \underline{t})) + \epsilon(\ell, t)$$

where  $L_i(\ell, \underline{t})$  is the log of sectoral employment density in initial year  $\underline{t}$ , district  $\ell$  and sector  $i$ . In figure 12 we plot annual employment growth as a function of initial log employment density in the same industry. A negative slope indicates geographic dispersion and a positive slope indicates geographic concentration.

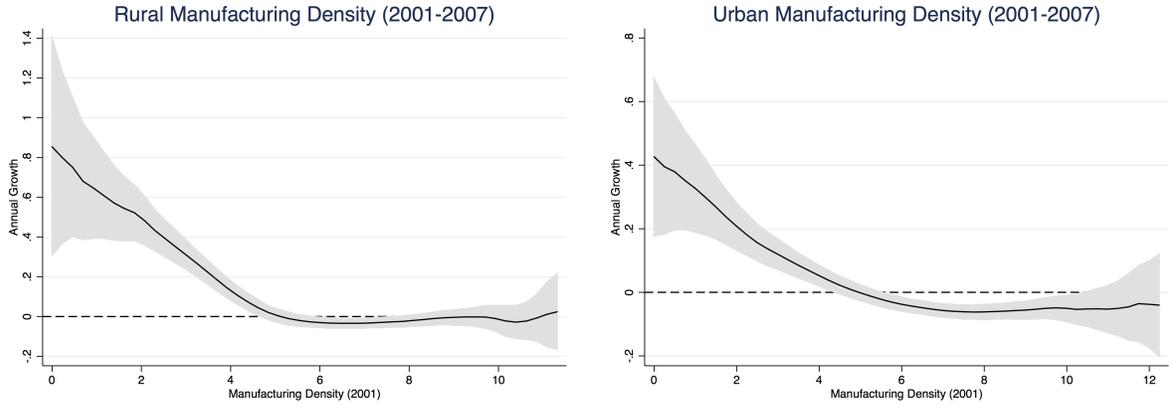


Figure 12: Annual Manufacturing and Services Employment Growth as a function of initial employment density (logs), based on ASI, 2001–2007.

Consistent with the results from Desmet et al.(forthcoming) presented in figure 11, we observe that manufacturing in both rural and urban areas is dispersing through space. Low-density areas are growing faster than higher-density areas. However, we observe that low-density rural areas are also growing much faster than low-density urban areas. Furthermore, we observe that higher-density areas in urban areas have negative growth rates and actually lose employment, while in higher-density rural areas the negative growth rates are less severe. Finally, we observe that the 95% confidence intervals are extremely large in the upper tail, suggesting a weaker relationship between scale and growth in high-density locations.

These results complement Ghani et al.(2012), providing suggestive evidence that the formal manufacturing sector is moving from urban to rural areas. However, as mentioned in section 2, there are substantial rigidities associated with the reassignment of rural areas to urban areas and, consequently, it is unclear as to whether we are observing a ruralisation or suburbanisation of economic activity (although the observation of high growth rates in low density rural areas may be suggestive of ruralisation). Either way, it is clear that a decentralisation of industry is occurring. These results are consistent with the expansion of urban activity based on the night lights data, in addition to the observed expansion of towns and urban agglomerations in the population data. However, further research in this area is

needed to understand the consequences of this on welfare and manufacturing productivity.

With the decentralisation of industry from urban to rural areas, one might conjecture whether, as the development process continues, we will see a shift towards consumer cities as discussed by Glaeser et al. (2001) and Glaeser and Gottlieb (2006). That is, an exploitation of scale economies by consumers. If so, this may offset concerns that the decentralisation of economic activity in developing countries, particularly in India, is premature. The following section explores the returns to urban living, particularly looking at trends in public investments, urban amenities, and poverty in recent times.

## 5 Urbanisation, Migration, and Amenities

Ultimately, the degree to which scale economies can be exploited depends on the way in which urbanisation is managed. From an economic efficiency perspective, we want to maximise the productivity and utility benefits of scale economies; however, policy distortions may offset these benefits, reducing scale economies relative to diseconomies. For example, Bertaud and Brueckner (2005) argue that land market regulations limiting floor-area ratios in Mumbai have exacerbated urban sprawl, resulting in inefficiently low densities near the city centre. Such policies may constrict the social benefits associated with urbanisation. Furthermore, it is of interest from an equity perspective to understand whether the benefits of urbanisation are spread geographically.

To better understand these questions, we explore the degree to which urbanisation has affected local standards of living and the provision of public goods and urban amenities. While urbanisation can enhance productivity, it can have deleterious consequences if poorly managed. In densely populated areas, the inability to provide local public goods such as clean water and proper sanitation can result in a public health disaster. Limited transport networks can increase commuting costs substantially, forcing workers to live in substandard housing and slums in order to be close to jobs. Finally, we want to understand whether the economic gains associated with agglomeration externalities result in poverty reduction and increased standards of living. An important issue is whether spatial misallocation results in an increase in spatial income inequality.

*The Network Structure of Cities* A major limitation of previous work in this literature has been the focus on individual cities as case studies. An important consideration is the general equilibrium nature of urbanisation, which has largely been missed in the empirical literature, despite the theoretical focus on cities as systems. Investments or policy interventions to attenuate scale diseconomies or amplify scale economies in one location may attract firms, workers and consumers from other location. Similarly, the economic consequences of negative shocks in one location may be mitigated if agents are able to move away (Notowidigdo, 2013; Colmer, 2015). In considering the policies that may affect the spatial allocation of resources, the wider system needs to be taken into account, i.e., one must understand how changes to one region will affect other regions within the system. Whether discussing the size or geometry of cities, or the spatial allocation of economic activity, more evidence is needed to understand the welfare consequences of urbanisation and its implications for growth and development.

Future work aims to examine the degree to which localised productivity shocks or policy interventions propagate through the “system of cities” in order to explore how the spatial structure of the economy affects aggregate, rather than local, welfare, growth, and productivity. By explicitly estimating the network structure of cities through, for example, transportation infrastructure, migration flows, inter-sectoral linkages, or intra-national trade networks, we can understand whether shocks to individual cities or locations wash out on aggregate, or whether idiosyncratic shocks affect other locations as well as amplifying, or attenuating, the localised effect.

## Migration and Transportation Infrastructure

**Migration** To begin, we examine the patterns of rural-urban migration in recent years to get a clearer idea of the demand for urban living. Migration is a complex phenomenon, yet it has long been thought to play a central role in the efficient allocation of resources. As arbitrage opportunities arise, marginal migrants move, encouraging equilibrium. However, our understanding of this process has long been constrained by a lack of reliable micro-level data on migration. The data we do have indicates that population mobility in India is low. However, in recent decades, internal migration has been on the rise. In the 2001 census, 98 million (9.5% of the population) were reported to have migrated in the last decade, based on the change in residence concept, an average of 0.9% per year.<sup>7</sup> This is an increase of 20% compared to the decadal migration rate reported in the 1991 census (82 million, or 9.7% of the population). To provide some context, roughly 10% of the households are reported to

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<sup>7</sup>Unfortunately, data on migration from the 2011 census has not yet been released.

migrate internally within the United States every year, highlighting the incredibly low levels of internal migration observed in India over the course of a decade.

In the 2001 census, 82% migrated within the same state, and 60% migrated within the same district, highlighting the limited mobility of migrants across space in India. More recently, round 64 of the NSS (2007–2008) reported that 2.67% of the sample migrated in the last year, of which 77% was within-state, and 50.13% was within-district.

Of relevance for the process of urbanisation is the degree to which employment acts as a driver of migration for work. In the 2001 census, 14.7% of migrants reported employment as the reason for migration; however, this number was driven by men, who reported work as the reason 37.6% of the time. In the NSS, employment is reported as the primary reason for migration 80% of the time.

Of more explicit relevance for urbanisation is the share of migration between rural and urban areas. 21.1% of census migrants moved from rural to urban areas between 1991 and 2001, the largest category after rural-rural migration, which comprised 54% of total migration.

The difficulty with analysing migration patterns is that so much of migration in developing countries is seasonal and therefore very difficult to measure, as the likelihood of surveying a seasonal migrant depends on the time of year the survey is conducted. This also highlights one of the difficulties associated with the classification of employment in developing countries. Given the seasonality of work, the composition of employment in the economy will vary substantially. Consequently, within-year variation in employment likely varies considerably in developing countries, although we have little understanding of the numbers or consequences of this. Colmer (2015) estimates that year-to-year changes in agricultural productivity, driven by weather variation, results in substantial labour reallocation between agriculture and the manufacturing sector, highlighting this churn in employment across sectors.

Round 64 of the NSS has a special schedule on seasonal migration, in which seasonal migrants are defined as members of the household that are away from the home for more than 1 month but less than 6 months at a time. In 2007, 14% of households reportedly sent out a member of the family as a seasonal migrant – more than 5 times than the proportion of households that migrated non-seasonally in the previous year. Of these households, 83% were from rural areas, 60% migrated within State, 23% migrated within District; and 87% migrated for work.

This data, while insightful, only provides a snapshot of migration in India. It says nothing about the subtleties associated with temporary and repeat migration necessary to understand the consequences of internal migration. Joshua Blumenstock has made considerable progress

along this dimension by applying methods in computational statistics to high-resolution digital trace data. Through the use of mobile phones, Blumenstock (2012) collects data on the phone records of 1.5 million Rwandans over four years. For each phone-based transaction routed through a mobile phone tower, we know the closest tower to the subscriber at the time of the transaction, allowing us to approximately infer the location and trajectory of 1.5 million phone users over time and space. While there are limits to this approach, such as when users go long periods of time without using their phone, and the selection bias associated with using a mobile phone (Blumenstock and Eagle, 2012), the use of ICTs to infer internal migration has the potential to play a major role in future research on migration.

Why is population mobility so low in India? One hypothesis is that local risk-sharing networks restrict mobility (Munshi and Rosenzweig, 2009; Morten, 2013). Munshi and Rosenzweig (2009) find evidence that caste-based insurance networks, which have helped households smooth consumption for centuries, limits out-migration. Morten (2013) explores the joint determination of migration and informal risk sharing to understand the welfare effects of migration on income and the endogenous structure of insurance. She then explores how risk sharing alters the returns to migration. She finds that risk sharing reduces migration by 60%, migration reduces risk sharing by 23%, and that when contrasting endogenous risk sharing with exogenous risk share, the consumption equivalent-gain from migration is 7% lower.

Other factors may include low investments in transportation infrastructure (discussed below), uncertainty about the likelihood of gaining employment in destination markets (Bryan et al., 2014), or other direct costs. More work is needed to better understand the adjustment costs that migrants face, and the consequent misallocation that arises, and whether the decision to not migrate is rational and the result of sorting.

Using the available data, we have shown that population mobility in India is low and mainly restricted within-district (23–60%) or within-state (60%–82%). Furthermore, the majority of migration is between rural areas, with only 21% of migration occurring between rural and urban areas. However, as previously discussed, the classification of rural and urban areas makes it difficult to interpret these shares. If the destination areas of rural–rural migration are suburban or peri-urban areas where we observe decentralised manufacturing is decentralising towards this will understate the contribution of migration to the urbanisation process. Irrespective of classification, it is clear that population mobility is low. This has implications for the general equilibrium considerations of urbanisation, since investments or policy interventions implemented to attenuate scale diseconomies or amplify scale economies in one location may have little impact on attracting firms, workers and consumers from other locations. More importantly, the economic consequences of negative shocks in one location

are likely to be greater if agents are unable to move away (Notowidigdo, 2013; Colmer, 2015). If labour is inelastic, the economic consequences of negative shocks may be amplified if local wages fall further in response to the oversupply of workers (Jayachandran, 2006).

**Transportation Infrastructure** As discussed, transportation infrastructure may be one of the factors that explains the limited population mobility observed in India; however, transportation plays a much broader role in the process of urbanisation. Indeed, the transportation of goods and people plays a vital role in the spatial organisation of economic activity (see Turner and Redding (2015) for a recent review of this literature). Historically, transportation technologies have played a major role in the development process, reshaping the economic activity connected to them as they themselves have undergone significant changes over time.

Donaldson (forthcoming) considers some of the earliest investments in Indian transportation infrastructure, examining the effect of railroads on economic activity in colonial-era India. Exploiting the evolution of India’s railroad network between 1860 and 1930 (see figure figure:raj), he finds that districts with access to railroads report 17% higher real agricultural income than districts without railroads. This is a substantial effect considering that, over the course of the 1870–1930 study period, real agricultural incomes rose by only around 22%. Consequently, a rail connection was equivalent to more than 40 years of economic growth.

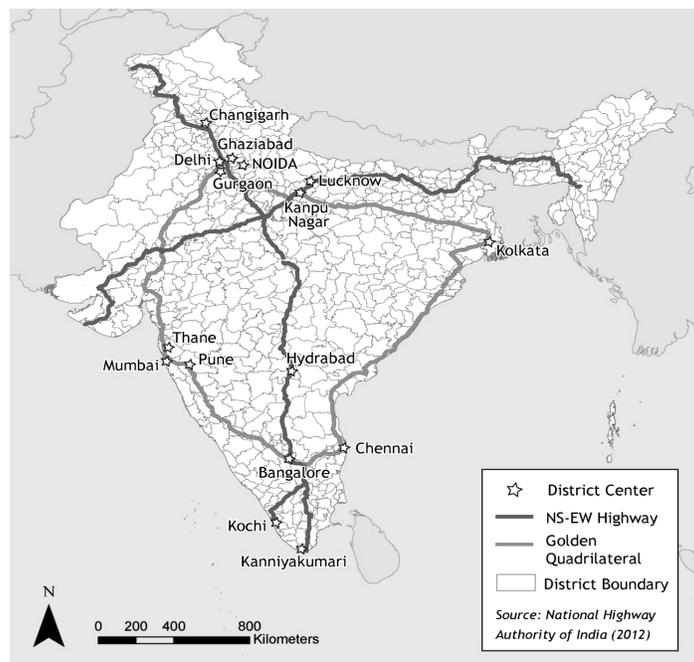
Figure 13: The Evolution of India’s Railroad Network: 1860–1930



More recently, Ghani et al. (forthcoming) estimate the effect of the Golden Quadrilateral project, which upgraded the quality and width of 5,866km of highways in India, presented in figure 14. They find that the project resulted in a significant increase in economic activity and productivity in non-nodal districts within 10km of the Golden Quadrilateral, but no effects beyond this distance. Khanna (2014) also explores the effects of the Golden Quadrilateral

upgrades, examining changes in night-time luminosity around the project. He finds evidence for a spreading-out of economic development, consistent with our discussion surrounding urban sprawl and decentralisation in India.

Figure 14: The Golden Quadrilateral and North-South East-West Highway Systems



There has been a strong focus on the effects of large-scale highway and railroads projects on urbanisation and economic activity in recent years across many countries (Banerjee et al., 2012; Baum-Snow et al., 2014; Donaldson and Hornbeck, 2013; Duration and Turner, 2012; Faber, forthcoming; Garcia-Lopez et al., 2013; Hsu and Zhang, 2012; Storeygard, 2012). However, there has been very little work on the effects of smaller scale transportation investments, such as those in rural areas where the returns may be greater. Asher and Novosad (2014) are an exception. They examine the effects of the Pradhan Mantri Gram Sadak Yojana (hereafter, PMGSY) project – a nationwide plan to provide good all-weather road connectivity to unconnected villages in rural India–, finding that the provision of a new paved village approach road produces significantly faster employment growth and a corresponding reduction in unemployment. Understanding the effects of rural connections on rural–urban migration may help to understand part of the reason behind the low levels of population mobility if transportation costs are reduced, e.g., all-weather roads don’t wash away during the monsoon. In addition, it would be interesting to examine the spillover effects of rural road connections on agricultural markets, wages, and prices.

An obvious caveat relates to the interpretation of the results across this literature. It is difficult to know whether the observed effects are the results of growth, or from the

reorganisation of economic activity. As discussed in the box above, by estimating the network structure of cities, we can estimate the aggregate welfare effects of local investments, rather than simply estimating the localised effects.

## Housing: Quality and Constraints

A key consideration in any discussion on urbanisation is the supply of housing. As developing countries grow and develop and urbanisation increases, will the stock of housing be able to keep pace, or will it deteriorate, reducing the gains from urban living, and ultimately slowing progress?

We begin by exploring changes in housing quality in the last decade, a period in which we have observed an increase in the pace of urbanisation and migration. A concern might be that investments in urban infrastructure have been insufficient to maintain living conditions; however, during this period we observe that housing conditions in urban areas improved substantially. We observe a 4.2 percentage point increase in the share of good housing, corresponding to a 3.6 percentage point reduction in the share of liveable housing and a 0.6 percentage point reduction in the share of dilapidated housing. By contrast, rural areas saw a 1.1 percentage point increase in the share of good housing, but also a 0.2 percentage point increase in the share of dilapidated housing, corresponding to a 1.3 percentage point reduction in the share of liveable housing. These changes are summarised in table 8.

Table 8: Changes in the Quality of the Rural and Urban Housing Stock (2001-2011)

CONDITION	2001 (%)		2011 (%)		DIFFERENCE		% CHANGE	
	RURAL	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL	URBAN
GOOD	44.8%	64.2%	45.9%	68.4%	1.1	4.2	2.46%	6.54%
LIVEABLE	48.9%	32.3%	47.6%	28.7%	-1.3	-3.6	-2.66%	-11.15%
DILAPIDATED	6.3%	3.5%	6.5%	2.9%	0.2	-0.6	3.17%	-17.14%
TOTAL	100%	100%	100%	100%	0	0	-	-

While, on the face of it, this seems like good news, this data is unlikely to capture living standards when there are constraints in access to housing. Urban planning systems in India make it hard to expand and redevelop urban areas (see World Bank, 2013 for an overview of India’s urban planning system). Mumbai, for example, has stringent land regulations. Indeed, two key features of the land regulation environment in Mumbai stand out. First, it has an FSI ratio – the ratio of the gross floor area of a building divided by the area of that lot – of around 1.0-1.5, increasing the incentive for urban sprawl as developers are unable to

make efficient use of the lot space if they want to build several stories. For example, with an FSI ratio of 1:1, this means that the total lot space can be used for a one-story building or 50% of the lot space can be used for a two-story building. Such restrictions generate sprawl as development is forced to the periphery, consistent with the expansion of urban night lights in figures 3 and 4.

Such stringent land regulations reduce the housing supply and make it less affordable. In light of this, housing shortages may be a more appropriate measure of living standards. The World Bank (2013) reports that housing shortages in urban India shot up from 3.0 million units in 1971 to 24.7 million in 2007, and that urban areas require an additional 1.8 million units annually to accommodate new households. The Report of the Working Group for the 11th Five-Year plan estimated that there were 66.3 million urban households and an urban housing stock of 58.83 million, a shortage of 7.47 million units. Furthermore, the working group found that more than 19% of urban households lived in congested conditions and estimated that 4.6 million units (8%) were either obsolescent or needed to be upgraded from a dilapidated to a liveable condition. While there has been considerable progress in estimating the welfare effects of land use regulation in developed economies (Turner et al., 2014) more work is needed to evaluate the welfare consequences in developing economies.

This is indicative that the housing market in India is not keeping pace with the formation of urban households. This will result in inflated housing costs, which will ultimately harm low-income groups the most, where housing costs form a larger share of total expenses. The development of informal settlements – slums – has been a natural consequence of the limited housing stock.

**Slums** Between 2001 and 2011, the population census of India reported an increase in the slum population from 52.371 million people to 65.494 million people, an increase of 13.123 million. However, the slum population's share of urban population decreased over this period from 18.3% to 17.4%. Measurement error is a major concern here as the number of towns reporting slums increased by 870. This is likely to have been driven by a reduction in the number of states and union territories not reporting slums. This may explain why other sources report a reduction in India's slum population. Marx, Stoker and Suri (2013) report a 10% reduction in the slum population between 1990 and 2007. While these periods are not comparable, it is important to note that using the same data between 1990 and 2001 we observe a 20% increase in the slum population, implying that between 2001 and 2007 there was a 25% reduction in the slum population to result in a slum population that was 10% below 1990 levels.

Some economists (Frankenhoff, 1967; Turner, 1969; Glaeser, 2011) have suggested that

slums are a transitory phenomenon in fast-growing economies that will progressively evolve into formal housing as societies approach the later stages of development. Marx, Stoker and Suri (2013) argue that, even if slum populations are stable in the short or medium run, this argument still holds, as slum living only represents a transitory phase in the life cycle of rural migrants – slum dwellers or their children eventually move into formal housing within the city. In this respect, slum populations may remain constant but with substantial turnover in the households that reside in these areas. Indeed, rural–urban migration is prominent in India, so urban productivity must be rising relative to rural productivity, due to either capital accumulation and technological progress (Asher and Novosad, 2012; Bustos et al., 2014; Marden, 2014) or declines in rural productivity (Colmer, 2015; Henderson et al. 2014). Furthermore, Bryan et al. (2014) show that seasonal urban migration in Bangladesh can generate welfare improvements for families of migrants. Ultimately, it could be argued, based on revealed preference, that urban poverty is preferable to rural poverty (Glaeser, 2011).

However, this says nothing about the nature of poverty in slums and whether it can be escaped. An expanding literature explores the degree to which slums may arise as the result of government policy. Cai (2006) explores the provision of local services for urban villages in China, finding that these “slums” do not receive central water or sewerage services, nor the collection of rubbish from the city. Furthermore, children living in these areas are excluded from state schools. This raises the cost and lowers the quality of access to such services for rural–urban migrants living in slums, increasing the cost of migration to urban areas. Feler and Henderson (2011) estimate the effects of service denial on the population growth for low-skilled workers in Brazil. In the 1980s, Brazilian localities were not required to service areas that were not part of the formal sector. The results of this analysis indicate that in some contexts the emergence of slum populations may reflect, at least in part, the strategic decisions of local governments to restrict in-migration, especially in favoured cities.

Empirical research in this area is limited due to data collection constraints, such as safety issues and difficulties in the ability to track respondents over time – if the members of targeted households can be found in the first place. However, there have been a number of more recent studies exploring economic behaviour in, and the characteristics of, Indian slums (Banerjee et al., 2011; Banerjee, Duflo, Glennerster and Kinnan, 2014; Marx, Stoker and Suri, 2013). Understanding the welfare consequences of slums is a topic that warrants greater attention. Indeed, the greatest returns are likely to arise from the systematic collection of data – the most binding constraint to research in this area. In addition, the development of methods to track individuals and households as they enter and exit slums will provide much insight into the micro-dynamics of urbanisation and the welfare consequences thereof.

*Measuring Mobility with Mobiles* A question of economic and policy importance is the degree to which slum living represents a transitory phase in the life cycle of its dwellers. However, given data constraints, it is impossible to explore whether this claim is true or whether slum living is persistent. One opportunity for future research that is of particular interest builds on the recent work by Blumenstock (2012) and Blumenstock et al. (2014), who exploit large-scale digital trace data to study the mobility and migration patterns of individuals in developing countries. As access to mobile technologies increase in developing countries, and methods in computational statistics further develop, opportunities to track and explore the mobility patterns of slum dwellers at a higher geographic resolution will become available. Access to such data will help us to understand more about the nature of poverty in slums and whether it can be escaped.

## Amenities and Public Services

Another factor under consideration is the difference in access to public services and basic amenities between rural and urban areas. Greater access to public goods and basic amenities may well be sufficient to offset the adverse conditions in urban areas associated with congestion. Scale economies increase the social benefit of public investment, especially those with network characteristics such as access to electricity.

Table 9: Access to Public Goods and Basic Amenities in Rural and Urban Areas (1991-2011)

	IMPROVED SANITATION		IMPROVED WATER SOURCE		ACCESS TO ELECTRICITY	
	RURAL	URBAN	RURAL	URBAN	RURAL	URBAN
1991	6.6%	50.1%	65.2%	89.1%	–	–
2001	15.3%	54.9%	77.3%	92.7%	45.53%	87.58%
2011	23.9%	59.7%	89.5%	96.3 %	55.30%	92.70%

**Energy** In table 9 we observe that there has been a steady increase in access to electricity in both rural and urban areas between 2001 and 2011; however, there is a stark difference in access between the two. Access to electricity in urban areas is almost complete, whereas in rural areas only 55% of households have access to electricity. On the other hand, being connected to the grid tells us very little about the quality of access to electricity. On the 30th of July 2012, India’s electricity grid faltered, meaning that an area with more than half of the country’s population went dark – the largest power failure in history. However, in

spite of this blackout, most of the population didn't feel the outage because they were never connected to the grid to begin with. The states in northern and eastern India that bore the brunt of the blackout have the lowest rates of electrification in India. Uttar Pradesh, the largest state and one of those that lost power, connects only 24% of rural households. However, even in urban areas, access to electricity is characterised by persistent imbalances. Peak demand exceeded supply by 18% in 1997, 13% in 2002 and 13% in 2011, resulting in widespread rationing (Thakur et al., 2005; Central Electricity Authority, 2011). This is a concern, since the main driver of growth in developing countries is likely to arise from increases in income among the poor. Consequently, energy demand is likely to increase substantially in the future as demand for goods, require both energy to use and energy to produce, increases (Wolfram et al., 2012).

The peak generation in India of 110 GW on a capacity of 187 GW in 2010, which serves approximately 900 million grid-connected customers out of a population of 1.2 billion, is comparable to the 127 GW peak generation on 167 GW capacity in the Pennsylvania–New Jersey–Maryland electricity market, which serves only 51 million people (Ryan, 2014). Underprovision of infrastructure is a key impediment to economic growth. Access to electricity has been shown to allow households to allocate more time to the labor market (Dinkelman, 2011) and has positive and persistent effects on development indicators (Lipscomb et al., 2013). More broadly, Calderon et al. (2011) estimate that a 10% increase in “infrastructure provision” – the combination of investments in telecommunications, power, and transport – is associated with a 1% increase in output.

Ryan (2014) explores the effects of transmission constraints on the competitiveness of electricity markets in India. In the frequently constrained Northern region of India, transmission constraints result in price increases that are 39% higher than in the rest of the grid. An increase in the integration of these markets would improve efficiency through a reduction in costs or local market power. Ryan finds that the surplus gains from simulated transmission expansions are large, and mainly the result of reductions in market power. The effects on market power are especially important in developing countries. In developed countries there is an extensive literature showing that the exercise of market power affects productive efficiency, but not allocative efficiency (Joskow, 2008; Borenstein, Bushnell, and Wolak, 2002). When capacity is withheld in order to raise prices, less efficient plants are called upon to make up the difference in supply, and consumers are served at a higher price. However, in developing countries, withholding power may affect allocative efficiency, increasing unmet demand. Allcott et al. (2014) examine the effect of scarce, unreliable power supply on the productivity of firms in India. They find that shortages reduce average output by about five percent, but because most inputs can be stored during outages, productivity losses are much

smaller. Consistent with the hypothesis of unmet demand, plants without generators have much larger losses; however, because of economies of scale in generator capacity, shortages are more costly to small plants. Together, these papers highlight the welfare costs of poor energy infrastructure in India.

**Sanitation and Health** Other public goods relate to health capital. A wide literature has documented the importance of health for income and of early-life investments in health for later-life outcomes (see Lopez-Casasnovas et al. 2005; Bleakley, 2010; and Currie and Vogl, 2013 for good reviews of the literature). There are large returns to health improvements as well as strong complementarities between child health and child education (Miguel and Kremer, 2004). As a consequence, differences in human capital and limited infrastructure available to make investments may lead to reduced social mobility across generations. Access to improved sanitation and improved water sources are associated with combating a broad range of public health issues, such as exposure to bacterial agents and contaminated drinking water. Drawing on data from the world development indicators, we observe that there have been improving trends in both rural and urban areas over time. The greatest progress has been seen in access to improved water sources. Since 1991, access in rural areas has increased by around 25 percentage points from 65% to nearly 90%. Urban areas have shown modest improvements as well, but have started from an already high level, improving from 90% in 1991 to 96% in 2011. A major concern in both rural and urban India relates to access to improved sanitation infrastructure. Access is very low in rural areas, reaching only 24% of the population in 2011. However, even in urban areas, only 60% of the urban population has access to improved sanitation infrastructure. While this is a substantial improvement on rural outcomes, it is still low by international standards.

Based on data from the 2005–2006 National Family Health Survey, the percentage of slum households with access to private latrines, open defecation and private water sources paint a similar urban picture, outperforming rural areas. 75% of households have access to a private water source, 32% have access to a private latrine, and 51% engage in open defecation or use a pit toilet. While the measures are not comparable with the WDI indicators, a consistent pattern emerges, namely that access to improved water sources is much more prevalent than access to improved sanitation infrastructure. However, even based on the more restrictive definition of improved sanitation in the slum population, sanitation investments are superior to rural sanitation.

Historically, open defecation has been a major public health issue in India and little has changed since Mahatma Gandhi famously asserted in 1925, ‘Sanitation is more important than independence.’ This is an issue especially for urban areas, since the health externalities

associated with public defecation are disastrous when practiced by groups in close contact with each other. There are also public safety concerns, highlighted by a recent story in May 2014, when two teenage girls were raped and murdered after leaving their homes after dark to relieve themselves. Similar attacks are distressingly common. However, there are concerns that reducing open defecation cannot simply be solved by the construction of toilets. It is widely believed that open defecation in India is in part the result of cultural practices. Hindu tradition, seen in the “Laws of Manu”, encourages open defecation to avoid ritual impurity. Caste structures are another factor, since only the lowliest in society are expected to clear human waste.

**Pollution and Environmental Regulation** A common concern associated with urbanisation and industrialisation in developing countries is the associated increase in pollution and environmental degradation. It is estimated that every day 1,000 additional vehicles are added to an already constrained transportation infrastructure, increasing congestion and air pollution. Water pollution is a major source of pollution as well, driven in part by pressures on the sanitation and energy infrastructure needed to process sewage, as well as the diversion of river water for industry and agriculture and the associated flow of industrial and agricultural effluents. The Ganges, the 3rd largest river in the world by discharge ( $38,129 \text{ m}^3/\text{s}$ ), provides a clear example of the water pollution problems that India faces. The Ganges is the most sacred river to Hindus, with thousands of devotees performing ablutions in the river each day. Water containing more than 500 faecal coliform bacteria per 100 ml is considered unsafe for bathing. Upstream, the Ganges contains 60,000 bacteria per 100ml. Downstream, where streams of raw sewage empty into the Ganges – and where daily ablutions are performed – this figure rises to 1.5 million. These figures provide a clear indication of the potential health consequences associated with environmental pollution.

However, in spite of these environmental concerns, India has a relatively extensive set of environmental regulations to improve air and water quality. Environmental policy related to air and water pollution is rooted in the Air Act of 1981 and the Water Act of 1974. These acts resulted in the creation of the Central Pollution Control Board (CPCB) and the State Pollution Control Boards (SPCBs).

Greenstone and Hanna (2014) provide a more structured analysis of environmental regulation in India, examining the effects of the key environmental regulations on air and water pollution. They estimate that environmental regulations to address air pollution have been reasonably successful in reducing ambient concentrations of air pollution, particularly the introduction of catalytic convertor policies. However, regulation to address water pollution has had little effect. Consistent with this evidence, we observe a decreasing trend in particulate

Figure 15: Air Pollution Trends In India (1985–2007)

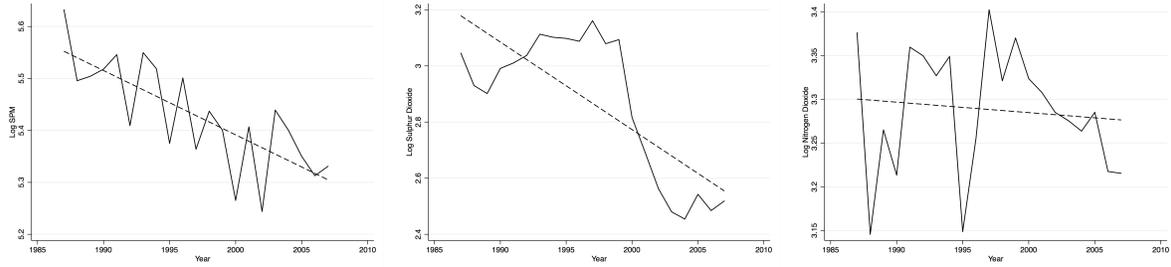
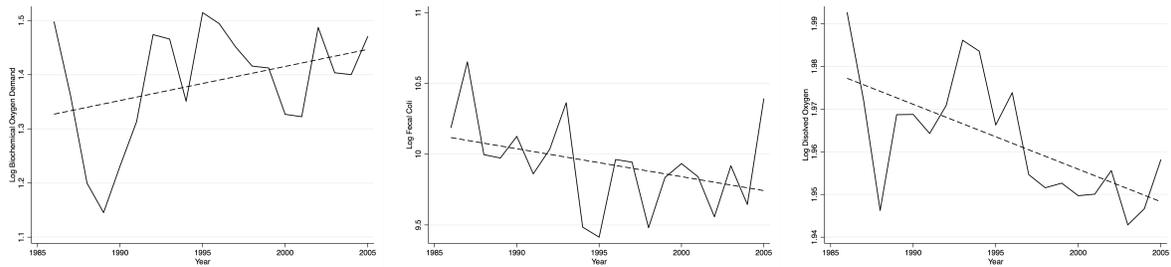


Figure 16: Water Pollution Trends In India (1986–2005)



matter and sulfur dioxide emissions, but very little change in nitrogen dioxide emissions. In addition, we see little change in water pollution over the last couple of decades. If anything we observe small increases in biochemical oxygen demand, and reductions in dissolved oxygen, indicating greater pollution as water-borne pollution hinders the mixing of water with the surrounding air, and hampers oxygen production from aquatic plant photosynthesis.

A remaining question of interest is whether environmental regulation shapes the pattern of urbanisation and industrialisation. Particularly, whether environmental regulation within cities encourages decentralisation.

**Poverty** In addition to examining impacts on the housing supply and on the provision of public goods and basic amenities, we also want to understand how urbanisation during the last few decades may have affected living standard more broadly, namely through poverty rates. The effects of urbanisation on poverty are ambiguous. On the one hand, scale economies should reduce poverty through increased access to markets and employment opportunities, as well as improvements in access to public services. However, if urbanisation is managed poorly, then scale diseconomies could increase poverty, offsetting the benefits associated with urban living.

Using data from 1983 from the NSS, Panagariya and Mukim (2013) and Panagariya and More (2014) provide a comprehensive overview of poverty in India. The focus of this research is to compare poverty rates between social groups and examine how poverty rates

have changed since the introduction of the Tendulkar poverty lines in 2004; however, the data also includes differences in rural and urban poverty trends.

In the early 1970s, the Lakdawala committee defined all-India poverty lines for rural and urban areas based on per-capita total consumption expenditures in 1973-74 market prices. The poverty-line consumption baskets were anchored in per-capita calorie norms of 2400 and 2100 in rural and urban areas, and provided for the consumption of basic goods and services. The Lakdawala lines served as the official poverty lines until 2004.

In 2004, the Lakdawala poverty lines were adapted to account for three deficiencies, noted by the Tendulkar committee (Planning Commission, 2009). First, the Lakdawala line baskets had remained tied to consumption patterns in 1973-74, while consumption baskets have shifted substantially since then, even for the poor. Secondly, the consumer price index for agricultural workers understated the true price increase. This meant that, over time, the estimated poverty ratios understated rural poverty. Finally, the assumption that health and education would be largely provided by the government no longer holds. Private expenditures on these services has risen substantially, even for the poor. These critiques saw the dawn of the newly revised Tendulkar poverty lines. The urban poverty line changed to the 25.7 percentile of the national distribution of per capita expenditures. The consumption basket associated with the national urban poverty line is the same as the rural poverty line consumption basket. This entailed the translation of the new urban poverty line using the appropriate price index to obtain the nationwide rural poverty lines. Using this approach, rural and urban poverty lines became fully aligned. The new rural poverty line yielded a rural poverty ratio of 41.8% in 2004 compared with 28.3% under the Lakdawala methodology.

Table 10 presents the rural, urban and combined poverty ratios for each social group in India between 1993 and 2011, reported in Panagariya and Mukim (2013) and Panagariya and More (2014). We observe that, over this time, poverty in both rural and urban areas has fallen substantially. Most surprisingly, it has fallen for the scheduled tribe and scheduled caste groups, though unsurprisingly by less than for non-scheduled groups. This is a significant break with past trends, since it indicates that socially disadvantaged groups have caught up substantially with the better-off groups. Poverty rates have fallen by noticeably more in urban areas than in rural areas across all social groups, to the degree that urban poverty ratios are half that of rural poverty ratios.

This indicates that the increasing trends in urbanisation observed during this period have corresponded with increases in living standards across the board, relative to rural areas. However, it is clear that there is still much to be gained from better management of urbanisation in India to encourage further growth and maximise the returns to agglomeration externalities and mitigate costs.

Table 10: Tendulkar Poverty Rates in India (1993–2011)

RURAL				
SOCIAL GROUP	1993–94	2004–05	2009–10	2011–12
SCHEDULED TRIBE	65.9%	62.3%	47.4%	45.3%
SCHEDULED CASTE	62.4%	53.5%	42.3%	31.5%
NON-SCHEDULED CASTE	44.0%	35.1%	28.0%	20.3 %
ALL GROUPS	50.3%	41.8%	33.3%	25.4%
URBAN				
SOCIAL GROUP	1993–94	2004–05	2009–10	2011–12
SCHEDULED TRIBE	41.1%	35.5%	30.4%	24.1%
SCHEDULED CASTE	51.7%	40.6%	34.1%	21.7%
NON-SCHEDULED CASTE	28.2%	22.6%	18.0%	11.8 %
ALL GROUPS	31.9%	25.7%	20.9%	13.7%

## 6 Discussion and Policy Implications

Urbanisation in India has been steadily increasing since independence; however, the rate of urbanisation has been far slower than other countries at similar stages of development. Most of the growth in urbanisation has occurred recently in the post-liberalisation period during the early 1990’s and the high-growth periods that have followed. In characterising India’s urbanisation we observe three stylised facts: first, there has been substantive growth in the number of urban areas in a demographic sense, yet the relative city size distribution has remained relatively stable (at least in the tail of the distribution) consistent with evidence across countries (Black and Henderson, 2003; Henderson and Wang, 2007).

Second, India’s urbanisation has been characterised by an unusually large number of highly-populated cities, with spatial inequality increasing over time. This is supported by the violation of Zipf’s law and Gibrat’s law at the national level, which we argue arises from the absence of a primate city. This is supported by the observance of Zipf’s law within the 6 zones of India, each recognised by its own primate city. Questions remain about what this implies for growth and development in India. Should policy makers focus resources on encouraging smaller cities to grow, or should they invest in infrastructure to allow larger cities to better support urbanisation? Future research must focus on understanding the drivers, and consequences, of city growth in shaping the spatial allocation of resources, people, and economic activity.

Finally, India’s urbanisation has been characterised in a geographic sense by an increase in urban sprawl, with an expansion of peri-urban areas. This is supported by evidence of decentralisation in the manufacturing sector, with higher growth rates in low-density areas of “rural” areas. The implications of decentralisation on welfare are ambiguous. On the one hand decentralisation reduces the magnitude of agglomeration externalities. On the other hand, decentralisation also reduces costs and increases rural–urban migration due to reductions in transport costs. In addition, we do not have a clear understanding about the degree to which firms can exploit agglomeration externalities. If the headquarters of firms are based in centralised areas, do the fringe plants benefit? Research to better understand the intersection between production and urban hierarchies should shed light on this question.

In recent years, urbanisation appears to have improved the standard of living in urban areas, with improvements in housing quality (non-slum) and significant improvements in access to public services. However, there are questions as to whether such improvements are homogenous across income and social groups, as access and quality reflect different outcomes. That being said, significant reductions in poverty have also been observed in urban areas, even for the most socially disadvantaged groups.

What are the implications for policy? Urbanisation is complex and, given its spatial nature, invites discussion on regional policies. However, we simply do not know enough about what is efficient and how costly market inefficiency is compared with the costs of policy mistakes.

In the absence of credible evidence, India, as well as other developing countries, should focus on leveling the playing field. This means that policy should focus on eliminating spatial biases and, where possible, avoid targeting specific cities with favourable economic conditions. This will allow new cities to form and industries to decline and emerge in a way that reflects underlying market forces, and will more likely approximate a reasonably efficient outcome, relative to an outcome that is the result of “picking winners”.

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