Urbanisation and Slum Growth: Evidence from India

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Abstract

Slums are an integral part of urban spaces in India. Using state level nighttime light intensity as a measure of urbanization I empirically evaluate the impact of urbanization on slum growth from 1993 to 2012. In the process, I also exploit a large scale 'big-push' national policy reform in India between 2005 and 2012 to further examine if such a policy was efficient in curbing the slum growth. Combining a novel pooled cross-sectional household survey data and nighttime lights activity at state level, I find the likelihood of being a slum household is 14.2 percentage points more in states lying within the third quartile of nighttime light intensity. After the introduction of the policy the likelihood decreases for all quartiles, where the effect for the 3rd quartile is reduced by 3.9 percentage points. The results are preliminary and highlights the role of underlying social phenomenon linked to migration and middle tier urbanized spaces.

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1 Introduction

Urbanization is the process by which cities and towns grow and develop. Urbanization in the developing world is among the most important social phenomena globally. It is also characterized by the pockets of poverty and neighborhood decay, called as slums. Most of the world's largest slums are located across the developing world e.g., slums of Dharavi in Mumbai, India. In developing countries, about a third of urban inhabitants live in impoverished slums and squatter settlements (UN-Habitat, 2012 [12]). Urban poverty degrades both the physical and social environment. Slums are obstacles in the way of achieving sustainable development goals.

After the financial reforms of 1991, India has been growing at a very fast pace. The growth is driven by cities. 31.16% of India is already urbanized with four metropolitan cities namely, Delhi, Mumbai, Chennai and Kolkata and further urbanizing at a faster pace, creating mega cities like Hyderabad and Bangalore (Census, 2011). These cities provide pull factors for migrants from rural to urban spaces. The Economic Survey of India (2017) [14] estimates that the magnitude of inter-state migration in India is approximately 9 million annually between 2011 and 2016. According to Census 2011, employment opportunities itself accounted for 14.7% of the migration in the country. Rural to urban migration creates slums (Katz et al., 2001 [15]). Many low-income families gravitate to these informal settlements that proliferate in and around towns.

Roughly 13.4% of Indian population lives under international poverty line (USD1.90 at 2011 PPP per day per capita) and has a vivid income gap

between the rural and urban incomes (World Bank, 2019). The economic opportunity provided by the cities leads to the slums clusters around residential locations, major office centers, industrial areas or touristic locations (Barnhardt et al., 2017 [4]). Yet, in order to accommodate the huge inflow of people there are costs associated at the city level in the form of regional inequality that picks pace with the increased level of industrialization and urbanization (Cutler and Glaeser, 1997 [8]). The limited availability of urban land space restricts spatial planning, creates additional need for housing and puts pressure on land and stress on civic amenities like health, education, water, sanitation etc. Underdeveloped infrastructures, lack of effective policy like service provisioning and dilapidated housing for poor households, lack of tenure and market failures lead to social and economic disparities among the lives of slum residents.

The research question contributes to the field of urban economics literature by investigating the impact of urbanization on the growth of the slum dwellers over years and how is the growth impacted when the 'governance gap' void is filled by an acute governance reform at all levels of administrative functioning. I exploit a national policy intervention, the JNNURM program from year 2005-2012 to empirically estimate the above mentioned research question.

Drawing on a novel pooled cross sectional slum household survey data from National Sample Survey Organization of India and state level nighttime lights from NOOA-DMSP, I empirically investigate the above claim. The study addresses an important research gap by empirically investigating the growth in the slum dwellers as a result of urbanization. On average, increase

in nighttime light intensity over years significantly increases the probability of being a slum household. States that are categorized in the third quartile of the nighttime light intensity have the highest likelihood of having more slum households compared to non slum households at 14.2 percentage points. Such a finding reveals the importance of an underlying social phenomenon linked to urbanization. The estimated likelihood decreases, but still remains positives for all quartiles after the JNNURM policy was implemented suggesting a partial success of the policy. The remainder of this paper is organized as follows. In Section 3.2, I summarize the related literature. In Section 3.3, I present in detail the definition of institutional aspects of slums in India. In section 3.4, I present various data sources and the final dataset constructed for the purpose of analysis. In section 3.5, I present the JNNURM policy intervention framework. In Section 3.6, I present the identification strategy. Section 3.7 discusses the empirical findings. Section 3.8 concludes the paper.

2 Literature Review

Chauvin et. al., (2017) [7] empirically compares urbanization in United States to that of the developing countries at geographic units. The authors tests for Gibrat s Law and Zipf's Law in U.S., Brazil, China and India. Testing further for spatial hypothesis the authors find similarity of urbanization between U.S. and Brazil. The correlation between density and earnings is strong in China and India than in the U.S. Moreover, the authors argue for India that even though the correlation between the city size and earnings is modest but the gap between urban and rural wages is considerably large. As

compared to the U.S. the correlation between area-level skills and both earnings and area-level growth are stronger in the developing world. They find evidence of agglomeration economies and human capital externalities in all four countries. The authors advocates that the spatial equilibrium in different countries eventually evolves over time especially in developing countries like India where social linkages to home communities are strong.

The 'Modernization Theory' states the importance of urbanization in lives of the poor. The theory argues that slums represent a transitory phase in the life cycle of a rural migrant. (Marx et. al., 2013 [17]). Eventually over years, the households move into the formal housing paving way for generations to reap the benefits of a city life. Slums acts as a platform for a typical rural migrant to seize the economic opportunities of urban and economic growth by providing geographical proximity to the city.

Ooi and Phua (2007) [19] argues that even though rapid urbanization should not necessarily lead to slum formation but the evidence of large slums populations in developing countries and rapidly urbanizing regions like Asia suggests otherwise. They attribute the proliferation of the slums to the incapacity of the city authorities to cope with the diverse economic and social needs. City governments lack the planning to establish the required link between economic development, urban growth, and housing. The authors empirically examine various Asian countries to provide support to their argument.

However, the slum dwellers find themselves trapped in poverty for generations because of multiple factors. Such factors include market failures, lack of acute governance and coordination problems that not only worsens

the conditions of living for slum dwellers but also acts as an impediment to boost investment inertia to develop in social and human capital. Azariadis and Drazen (1990) [2] argues that a lack of investment inertia in the slums, gives rise to a 'low skill-low equilibrium' situation for slum inhabitants. Low skilled slum labor force often do not meet the critical threshold to compete adequately in the labor market.

In a seminal paper by Murphy et. al., (1989) [18], slum upgradation requires large private investments. The marginal returns from small upgradations are quite small. Moreover, there is a lack of general willingness on account of slum dwellers to pay for improved public goods in poor urban areas. Highly illiquid, informal property rights, lack of tenure and land titles provides disincentives for a typical slum household to improve the quality of dwellings. Such disincentives lead to decline in the quality of neighborhood around the slums.

Davis (2006) [9], using the example of Mumbai slums argues that an extreme coordination failures and a presence of 'governance gap' makes life in slums difficult. Governance mechanism are intrinsic to a slum dwellers life and often their absence is filled by private actors, bureaucratic entrepreneurs, gangs, and local agents which can lead to more entrenched tenancy rights. The non-government actors pursue a self interest of maintaining the status-quo of the slums. Slums often presents an opportunity for rent extraction. Proximity to the city life, comes at a cost of unjustified high rent premiums extracted by slum landlords, non-state actors in absence of a formal public allocation mechanism.

I contribute to the research gap at multiple levels firstly, by investigating

empirically whether urbanization leads to more slum proliferation and can the growth of the slums be curbed in the presence of an effective slum policy? For this purpose, I use a proxy measure of urbanization with the nighttime lights. Additionally, I study the effect of the nation-wide urban poor housing policy (JNNURM) of Government of India from 2005-2012. This was the largest standalone single policy framework of the decade 2000 with a national coverage for all urban areas of the country. In addition, all existing national policies were subsumed under this policy. Secondly, the advantage of such an analysis is that the unit of analysis is a slum household versus a non slum household at a finer geographic level. Investigation of urban spaces in developing countries like India are not only limited in academic understanding but also often is constrained by scarcity of the data. Therefore, the use of satellite data and the level of slum data disaggregation is an important contribution to the urban economics literature.

Barnhardt et al. (2017) [4] argue that the option of taking refuge in slums in the city is rather a choice. Demonstrating a case for public housing in the city of Ahemdabad (India) the authors argues that relocation of slums is a welfare loss that rips them off their social capital, namely informal social insurance and ties. 34% of slum dwellers continued living in public housing and the remaining part returned back to the slums after fourteen years of the housing assignment.

The JNNURM policy employed to investigate the research question addresses major hurdles to public policy intervention that negatively affects the welfare returns from the development process of the slum life. The policy overcomes the conflict of interest between central government and municipal

authorities, high transaction costs, opaque governance mechanism, enumerative hurdles of a representative slum population, genuine political commitment, legal recognition of informal/illegal slum squatters for an inclusive urban planning, encouragement of public- private partnership, enabling efficient functioning of land markets. Such factors are by definition different from market failures.

Using 2001 National Household Transportation Survey for US, Glaeser et al. (2008) [11] puts forward the linkages between the transportation networks and costs, as well as the centralization of poverty in urban areas or inner cities. The argument was also advocated by LeRoy and Sonstelie (1983) [16]. The authors argue that the income elasticity of demand for land is significantly lower for poor people than for the richer class. Hence, the authors validate the puzzle regarding the existence of urban poor in central cities. For the purpose of the study, I use a novel comprehensive national sample household survey for years 1993, 2002, 2008 and 2012 conducted by national statistical office in India. The survey covers all types of households in India at village level but the information available to researchers is restricted to district level. However, for the purpose of analysis I restrict the geographic unit at the state level. The dataset is measured on various socio-economic variables of a household. The survey explicitly states the location area of the household. I consider households living in notified and non-notified slums and other areas (non slum areas). These households constitute as a typical slum household and non-slum household for this study. The advantage of the data set is that the unit of survey is a household. Often such nation-wide repeated surveys are difficult to achieve. To the best of my knowledge, I have

not come across any empirical studies that uses the same survey data. Most of the studies uses another slum survey data which does not cover household characteristics and the unit of survey is a slum cluster instead of a household.

3 Slums in India

Slums are a global but surprisingly, an urban phenomenon. Slums in urban areas particularly, in big cities like Delhi, are a source of cheap labor supply for activities like, chauffeur, vegetable vendors, domestic help etc.

According to the Slum (Improvement and Clearance) Act of 1956 a slum is a compact settlement with a collection of poorly built tenements, mostly of temporary nature, crowded together usually with inadequate infrastructure, inadequate sanitary and drinking water facilities in unhygienic conditions in that compact area (commonly known as Jhuggi Jhopri (JJ)). These slums are segmented into various categories. The categorization of slums and minimum number of households required to be labeled as slum varies according to different agencies in India.

According to one of the national survey organization a slum pocket is defined as a cluster of minimum 20 households and is categorized as a notified or a non- notified slum . *Notified slums* are all areas subsumed under the slum act of 1956 as 'slums' or areas recognized as slums by State, UT Administration or Local Government, Housing and Slum Boards, which may have not been formally notified as slum under any act. For e.g., majority of Old Delhi (famously known as walled city) falls under this category. On the other hand, *non-notified slums* are squatter settlements called as Jhuggi

Jhopri Clusters (JJC) and are considered to be an illegal encroachment on land (DUSIB 2010). Usually, over the years the government legalizes these slums by either rehabilitating or by providing In-situ upgradation of these slums.

78% of slums are not located on private, but built on public land owned by municipal bodies (54%), railways (14%), state government, or other public entities. Approximately 64% of slums are surrounded by residential areas (Government of the National Capital Territory of Delhi 2010, UNDP 2009 [22]). Census 2001 estimated that 16.3% of population in Delhi was located in urban slums, which is higher than the national average of 14.8%. Other cities like Mumbai, Kolkata, Hyderabad, Bangalore, and Chennai are also witnessing an increase in the slum population. 66% of all statutory towns in India have slums, 17.4% of total urban households live in slums (Census of India 2011). Over a quarter of urban population is poor with consumption below poverty line (Tendulkar 2009 [21]).

4 Data

In order to analyze the impact of urbanization and JNNURM policy on slum households, I construct a comprehensive repeated cross section of households dataset for year 1993, 2002, 2008, 2012 at the state level combining multiple datasets as listed below.

4.1 Slum Household Data

National Sample Survey Office (NSSO) is an organization of the Ministry of Statistics and Program Implementation of the Government of India (MoSPI). NSSO conducts nationwide detailed household surveys on various socio-economic indicators in successive rounds for an assessment of housing stock and formulation of housing policies and programs. The collection of the data on housing condition of the dwelling units and basic housing amenities is available since 7^{th} round (October 1953 - March 1954) to the 69^{th} round (July 2012-December 2012).

The survey covers indicators of (i) household characteristics for e.g., household size, occupation, religion, social group, household type, endowments, tenurial type, dwelling location in which the dwelling unit is located, distance to work, monthly per capita consumer expenditure, etc. (ii) particulars of living facilities, such as major source of drinking water, availability of bathroom, use of latrine, type of latrine, electricity for domestic use, etc. (iii) housing characteristics and micro environment, such as plinth area of the house, plinth level, use of house, period since built, condition of structure, drainage arrangement, etc. (iv) particulars of dwelling such as number of rooms, floor area of the dwelling, ventilation of the dwelling, total number of married couples in the household, kitchen type, floor type, wall type, roof type, etc.(v) particulars of construction and repair, undertaken by the households during the last 365 days, for residential purpose.

For the purpose of the study, I extract the information on households living in notified and non notified slum areas and other areas (non slum area)

excluding the homeless and squatter population. The district-wise location of a household is only known from year 2002 onwards. Hence, this narrows the scope of the analysis period. Therefore, I take the state level location of each household which is also available for an additional year 1993.

4.2 Nighttime Light Activity Data

The official estimates for urbanization are only available as a national decadal change from year 2001-2011 which makes it harder to investigate the research question over time and at a granular geographic level. Therefore, in order to measure urbanization at granular level of states, I use a set of Nighttime Lights (NTL) as a proxy for urbanization.

The US Air Forces (USAF) Defence Meteorological Satellite Program (DMSP) operates a series of satellites, which carry sensors that detect light emission from the earth's surface at night. A value of light intensity from 0 (darkest) to 63 (bright) is for every pixel of around 1 square k.m. around the globe.

Nighttime lights is a reliable measure of not only urbanization but also for various socio-economic indicators e.g., poverty, income, spatial development, economic activity etc. (Elvidge et. al., 2012 [10]; Chakravarty and Dehejia, 2017 [6]; Henderson et. al., 2012 [13]). I create a Nighttime Light Intensity dataset for 36 states from year 1992 to year 2013 by spatial overlay of the nighttime lights with the shape files of states of India to obtain an average value of the illuminated pixels at the state level.

The matrix plot in Figure 1 shows the distribution of average nighttime

lights intensity over the period 1992-2013 separately for each state. Each grid on the horizontal axis measures the nighttime lights intensity of a particular state over different years. The vertical grid represents different states in a particular year. The value of the nighttime light intensity lies in the range of 0-63, in an increasing order. If the progression of a state is towards the yellow color category then that particular state is becoming more illuminated over years. Most of the states except for North Eastern region can be clearly seen as progressing towards brighter illumination over years. Chandigarh and Delhi are the brightest cities in the sample. I further merge both the datasets by states to construct a final dataset for the empirical investigation.

5 The JNNURM Program

The Jawaharlal Nehru National Urban Renewal Mission (JNNURM) was launched in 2005 as the single largest governance reform-driven initiative of the Government of India (GOI) for a planned development of Indian cities and towns. The mission was implemented in conjunction with Ministry of housing and Urban Poverty Alleviation (MoHUPA) along with the respective state governments, Urban Local Bodies (ULB's), city-level institutions and private partnerships.

The mission initially covered seven-year period i.e. up to March 2012 which was extended up to March 2014 for completion of the already approved projects. During March 2013, the Mission period was extended by one more year i.e. up to March 2015 to complete.

To create economically productive, efficient, equitable and responsive

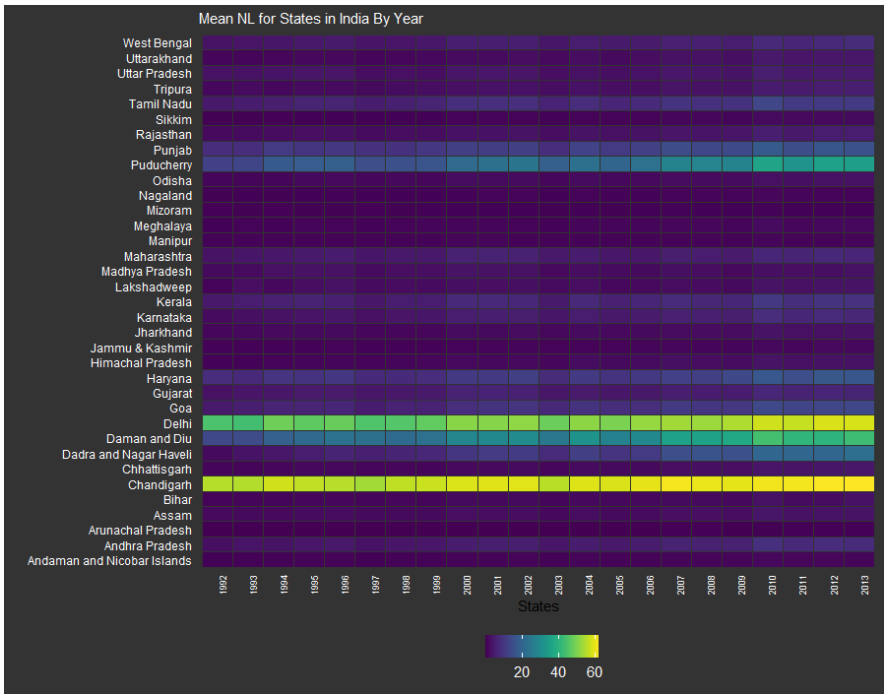

Figure 1: Nighttime Light Distribution of States in India

Source: Author's own calculation. The figure depicts the distribution of average nighttime lights intensity over the period 1992-2013 at state level. The data is retrieved from NOAA-DMSP.

cities, the Urban Renewal Mission focused on (i) improving and augmenting the economic and social infrastructure of cities; (ii) ensuring basic services to the urban poor including security of tenure at affordable prices; (iii) initiating wide-ranging urban sector reforms whose primary aim is to eliminate legal, institutional and financial constraints that have impeded investment in urban infrastructure and services; and (iv) strengthening municipal governments and their functioning in accordance with the provisions of the Constitution (seventy-fourth) Amendment Act, 1992. It provides for public disclosure of local spending decisions together with earmarking of budgetary allocations for basic services to the poor.

The mission comprised of two components e.g. Basic Services for Urban poor (BSUP) and Integrated Housing and Slum Development Program (IHSDP) which aimed at integrated development of slums through projects for providing shelter, basic services and other related civic amenities with a view to providing utilities to the urban poor with governance reform as an overarching third component. Under both the components, the participatory state governments and the ULB's were mandated to implement a set of (i) mandatory (ii) optional reforms in order to access financial help from the central ministry.

The first component i.e. BSUP was implemented in 65 Mission Cities/Urban Agglomerations with more than four million population (Census 2001). These cities are at the forefront of economic importance (E.g, Mumbai, Delhi), cultural, religious and tourist importance (Eg, Varanasi, Amritsar). The second component i.e. IHSDP covered the remaining 887 cities/urban areas/small towns, relatively less developed than the identified 65 mission cities. The two

components of JNNURM were mandated to pursue 3 key pro-poor reforms, namely (a) earmarking of 25% of municipal budget for the urban poor for provision of basic services including affordable housing to the urban poor; (b) implementation of 7- Point Charter, namely provision of land tenure, affordable housing, water, sanitation, education, health and social security to the poor in a time-bound manner ensuring convergence with other programs and (c) reservation of 25% of developed land in all housing projects, public or private, critical for slum improvement.

Under the program, the already existing pro- poor schemes like VAMBAY and NSDP were subsumed in order to implement a single comprehensive program nationwide designed to explicitly target urban slum dwellers from all sections of the society with the objective to provide a holistic slum development. Urban slum dwellers comprise of urban poor, Economically Weaker Section (EWG) and Low-Income Groups, (LIG)

The scheme applied to towns and urban areas with elected local bodies and was implemented through a State level nodal agency, as appointed by the State Government. In addition, the State government were authorized to prioritize towns and cities on the basis of their existing infrastructure, economically and socially disadvantaged sections of the slum population and difficult areas. However, the selection of the beneficiaries was made by the State level nodal agency or ULB's.

Detailed Project Reports (DPRs) were to be prepared by the implementing agencies for funding in order to access Central assistance (grant). Release of Central share to nodal agency was dependent on availability of State share and submission of utilization certificates in accordance with the provisions

of General Financial Rules (GFRs).

The sharing of funds was distributed as 80:20 between Central Government and State Government/ULB/Parasatal. The funds from the central ministry were allocated to the States on the basis of the States urban slum population to total urban slum population in the country.

States/Implementing Agencies were also allowed to raise their contribution from their own resources or from beneficiary contribution/ financial institutions. For special category States, the funding pattern between Center and the States will be in the ratio of 90:10.

The State Governments, ULBs and para-satal agencies were required to execute a Memorandum of Agreement (MoA) with the Government of India committing to implement an agenda of reform program[1] both at the state level and ULB level. MoA laid down specific milestones to be achieved for each item of reform. Signing of this tripartite MoA was a necessary condition to access Central assistance.

6 Identification Strategy

I investigate whether urbanization leads to increase in slum households over years in India and whether the exposure to JNNURM program was successful in curbing the slum growth.

In the process, I study directly the affect of the policy precisely, on the growth of slum households. First, in purview of increase in urbanization in India : *Does Urbanization leads to the growth of slums?* Second, *Did the*

[1] refer to appendix 3.9.3

JNNURM policy help in curbing the growth of the slums in the urban areas?

For identification, I exploit a linear probability model given by equation 2 to identify the parameter of interest, δ_q and γ_q that allows for the effect.

Chakravarty and Dehejia (2017) [6], the nighttime light intensity dataset is a good measure of economic activity. The level of economic activity influences. Alternatively, nighttime lights is also a good measure of urbanization. The more the light intensities, the higher is the urbanization rate. To the best of my knowledge, state wise data on level of urbanization is not available for the slum household survey years. However, the information on urbanization is available publicly only as a decadal growth between 2001-2011 for 25 states in India. Hence, this further justifies the use of nighttime lights as a proxy variable for urbanization.

A graphical visualization of relation between a decadal change in urbanization and nighttime light growth rate from 2001-2011 is illustrated in Figure 2[2]. The available data for the urban growth rate is aggregated at the state level for 25 states out of 35 as represented on the horizontal axis. The nighttime light growth rate is then calculated for the same states and represented on the vertical axis. The graph demonstrates that a higher urban growth rate is positively associated with a higher growth rate in nighttime lights of a particular state. Therefore, the positive relationship between urban growth and nighttime lights gives further support to the choice of night time lights as a proxy variable for urbanization.

[2]The descriptive figure 3.2 plots the census decadal growth rate of urbanization and night time lights for 25 states. Each dot in the graph represents a state. Since, the growth rates are decadal therefore, there are very few observations to perform the state wise regressions.

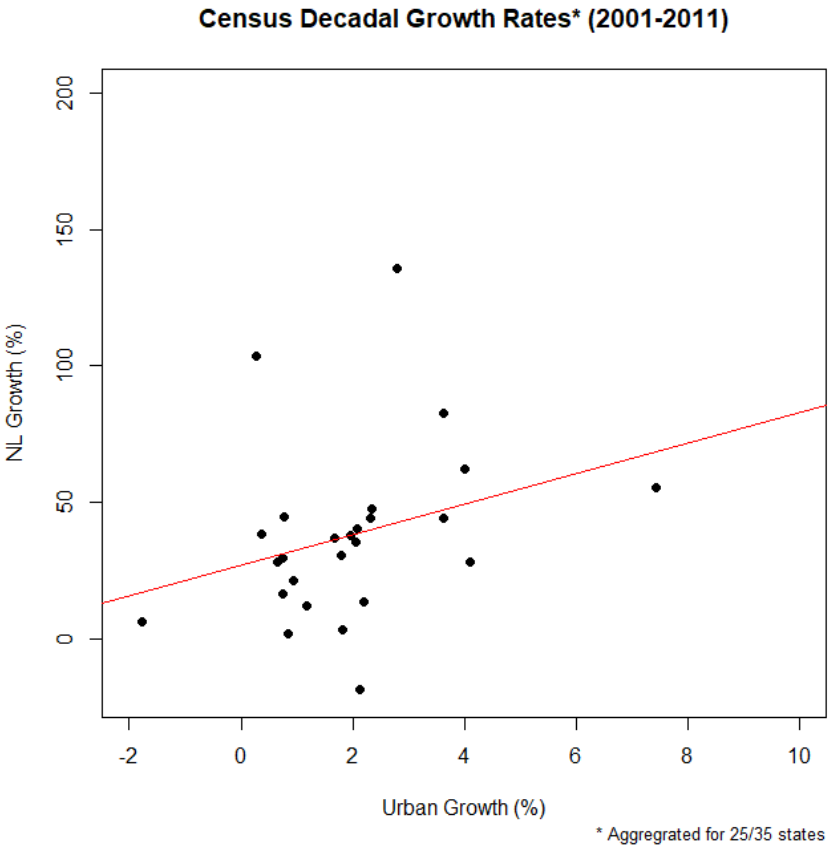

Figure 2: Urban Growth Rate and Nighttime Lights

Source: Author's own calculation. The data for urban growth rate is retrieved from the census of India and NOAA for nighttime lights. The figure depicts the relationship between decadal growth rate of urbanization and nighttime lights from 2001-2011.

I define, the Time (T) as the pre/post policy period as follows:

$$T = \begin{cases} 1 & \text{if } t = 2008, 2012 \\ 0 & \text{if } t = 1993, 2002 \end{cases} \tag{1}$$

I test the following regression equation:

$$y_{ij} = \alpha + \beta T + \gamma_q D_{qij} + \delta_q (T * D_{qij}) + \chi z_i' + \eta r_j + a_{ij} + \mu_{ij} \tag{2}$$

In equation 2, y_{ij}, is the binary outcome variable which takes the value 1 if a household i in state j is a slum household and 0 if the household is non-slum household.[3] α and μ_{ij} denotes the constant and the idiosyncratic error term, respectively. D_{qij} is a quartile q dummy of the nighttime light in state j in which individual households i are located.[4] The dummy D_{qij} takes a value between 1-4. The z_i' is a vector of household level controls. The vector r_j specifies region specific controls: GDP and a_{ij}, is the region specific effect.

The δ_q captures the intended effect of the policy i.e., if urbanization increases the probability of more slums in urban areas post policy period. The parameter could strongly suggest the success of the policy. Whereas γ_q captures the effect of urbanization on slum growth relative to the non slum growth irrespective of the policy period. Moreover, γ_q also measures

[3]The survey states explicitly if a household is located in a slum area or a non slum area. It does not state if a particular household transitioned from being a slum to a non slum household.

[4]Luminosity is a continuous variable but I categorize the luminosity data into 4 quartiles in order to capture what kind of urban areas (as measured by luminosity) are more likely to have slum formations. The time dummy is used specifically to analyze the effect of the JNNURM policy on slum growth by quartiles of luminosity. Since the policy was launched in 2005-06, therefore, I have a time dummy for pre and post policy period.

the heterogeneous effect of urbanization on slum growth i.e., the level of urbanization as indicated by nighttime lights at which the slum growth is the strongest.

The parameter γ_q can explain various underlying social phenomenon linked to urbanization in unequal and developing countries like India. Growing pace of urbanization is a result of two key factors namely, increase in population and rural to urban migration. Such a migration is often the result of pull factors like better employment opportunities, improved infrastructure, education and health along with ease of living offered by urban areas especially bigger cities. Negative spillovers from rapid migration also has a potential to create an unplanned urban sprawl putting further pressure on economic, social, infrastructure and environmental resources. Unplanned urban sprawl often leads to sub standard housing especially squatter settlements and slums, where low income migrants gravitate to.

Moreover, the pattern of rural to urban migration is not homogeneous across the country. With development and economic prosperity, different tiers of urban spaces are created. Therefore, the migrant population is unevenly distributed among these different tiers with varying levels of economic activity. As less urbanized spaces become more urbanized, the pattern of migration shifts from saturated/overburdened cities to gradually developing urban spaces, creating more slums in the lower tier urban spaces/towns. Nighttime lights are reflective of such different tiers of urbanization. Hence, the parameter γ_q can explain such a shift. The estimates can be affected by individual household level characteristics like the type of slum area, social identity of the household, migration status, electricity availability etc.

Thus, I control for some of these characteristics in the regression equation 2. Empirical test of the assumption for each state (controlling for state level characteristics e.g., population, education enrollment, socioeconomic characteristics) is left for a future investigation.

7 Empirical Results

7.1 Descriptive Results

In Table 1 and Table 2, I present the summary statistics of the important variables that helps in building the identification. The number of male and females in a typical slum household is balanced. However, according to the Census of India 2011, the gender ratio is skewed towards male, accounting for 947 females per 1000 males.

On average, the slum households incur a monthly rental expenditure of approximately 50% less than than the non slum households. The average basket of consumption for the non slums households is also higher in proportion to the average basket of goods consumed by slum households. The rationale behind such a pattern was inspected by the consumption puzzle in economics arguing a declining trend in consumption in urban India. Banerjee and Duflo (2011) [3], on the contrary attributed the decline in the trend as change in priorities of consumption good.

The slums and non slum households are both located in the urban areas. Slum households located in areas with similar economic perspectives are consuming on average less than the non slum households located in the same

area with same economic development. The consumption disparity among the urban slum and non slum households is considerably large. This consumption inequality is suggestive of the poor conditions of standard of living in a slum. The possible reasons for this disparity can be further examined with item-wise analysis of the consumption expenditure data which is out of the scope of this study.

The average floor area of a typical dwelling unit constructed is also lower for slum households compared to non slum households. Availability of land and other supply side measures influences house price dynamics (Saiz, 2010 [20]). Moreover, urban slum by definition, is a congested group of dilapidated houses/shelters either on a public or private land. Hence, the constructed floor area of the dwelling is suggestive of this.

Changes in household demographic can also explain housing dynamics (Angelini et. al., 2014 [1]; Bourassa et. al., 2015 [5]). The survey defines the household as a group of people living together under the same roof and sharing a common kitchen. Therefore, these group of people constitute as the members of the household. The descriptive statistics in the Table 1 indicates the change in the composition of the household over a period of one year both in a slum and a non slum household. The results are suggestive of the findings from many empirical and theoretical studies advocating slums as a social trap (Marx et. al., 2013 [17]). Slums act as avenues of escape from rural poverty but suffers from low equilibrium social and human capital. The slums on average stay for a lesser duration in one place than the non slum households which further aligns to the literature. On average the exposure of slum households to nighttime lights is relatively more as compared to the

non slum households. This not only corroborates with the definition of slums as an urban concept but is also suggestive of the rapid growth of slums in more urbanized spaces compared to non slum households.

Table 1: Descriptive Statistics I

	group	n	mean	median	trimmed	sd	min	max
household composition								
male	0	117769	2.4	2	2.2	1.4	0.0	22.0
male	1	18259	2.4	2	2.3	1.4	0.0	16.0
female	0	114949	2.3	2	2.2	1.4	0.0	58.0
female	1	17630	2.4	2	2.2	1.4	0.0	17.0
household expenditure *(INR)*								
nominal avg cons(monthly)	0	158090	5102.8	3500	4175.2	6003.8	0.0	1220000.0
nominal avg cons(monthly)	1	24853	3609.0	2900	3060.7	3574.7	0.0	200000.0
House Rent	0	75232.0	643.9	200.0	375.6	1272.4	0.0	35000.0
House Rent	1	11308.0	298.1	70.0	178.9	536.1	0.0	10000.0
construction								
floorarea (sqft)	0	158163	460.7	370.0	406.6	367.8	0.0	15870.0
floorarea (sqft)	1	24856	254.6	193.8	217.3	233.7	0.0	11050.0
Δhousehold composition *(last365days)*								
members moved in	0	60652	0.1	0.0	0.0	0.4	0.0	11.0
members moved in	1	9002	0.1	0.0	0.0	0.4	0.0	8.0
members moved out	0	98986	0.1	0.0	0.0	0.3	0.0	8.0
members moved out	1	15317	0.0	0.0	0.0	0.3	0.0	9.0
stayduration_presentarea	0	36833	25.2	20.0	23.3	20.8	0.0	90.0
stayduration_presentarea	1	17100	20.9	17.0	18.9	17.0	0.0	99.0
mean nighttime lights								
nl-t	0	158170	7.1	4.7	4.6	11.1	0.0	61.9
nl-t	1	24857	7.6	4.9	5.0	11.1	0.0	61.9
nl-t-1	0	158170	6.9	4.1	4.4	11.0	0.0	61.3
nl-t-1	1	24857	7.4	5.0	4.8	11.2	0.0	61.3
nl-t-2	0	120421	7.8	4.6	5.0	11.8	0.1	61.0
nl-t-2	1	18646	8.0	4.9	5.2	11.6	0.1	61.0

It could also be a cause of concern that the proportion of slum households to non-slum households can differ significantly in survey years. However, this concern is addressed in Table 2. The proportion of slum households surveyed

remains between 12%- 14% of the total households surveyed. The exposure of slum households and the non slum household to regional factors other than the policy exposure could also bias the result. Since both kind of households live in the same state the exposure to regional variations are same for both the households.

Table 2: Descriptive Statistics: NSSO

	Slum Households (%)	Non-Slum Households (%)
1993	14.1	85.8
2002	14.0	85.0
2008	13.5	86.5
2012	12.6	87.3

In Figure 3, I plot the decadal change in urban growth rate against the decadal change in slum growth rate. The graph suggests a positive relation between urban growth rate and slum growth during the years 2001-2011. This provides further support in favor of the empirical investigation. However, the relatively flatter curve is also suggestive of the fact that certain states in India have witnessed a negative growth in slums. The potential reason for this could be the differential success of the slum policy amongst states.

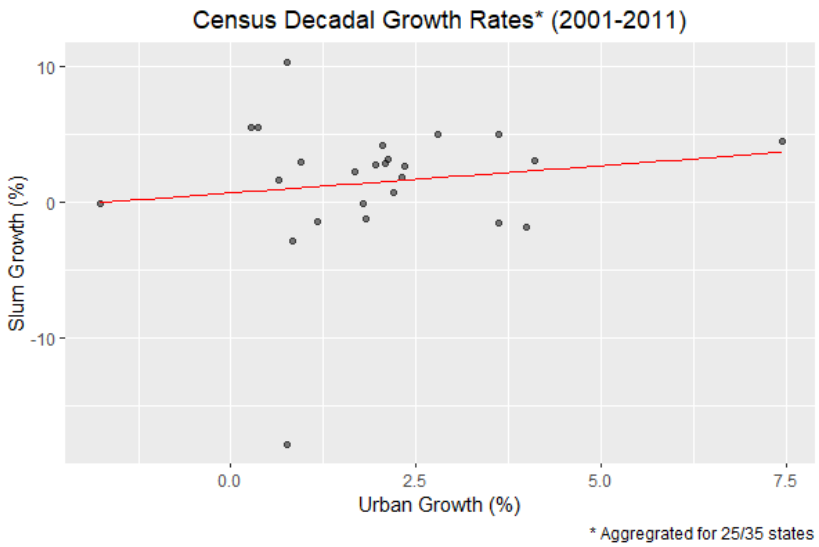

Figure 3: Urban Growth and Slum Growth

Source: Author's own calculation. The data for urban and slum growth rate is retreived from the census of India. The figure depicts the relationship between decadal growth rate of urbanisation and slums from 2001-2011.

7.2 Urbanisation and the Probability of a Slum

I estimate equation 3 with a linear probability model.

$$y_{ij} = \alpha + \beta T + \gamma_q D_{qij} + \delta_q (T * D_{qij}) + \chi z_i' + \eta r_j + a_{ij} + \mu_{ij} \tag{3}$$

In equation 3, y_{ij}, is the binary outcome variable which takes the value 1 if a household i in state j is a slum household and 0 if the household is non-slum household. α and μ_{ij} denotes the constant and the idiosyncratic error term, respectively. D_{qij} is a quartile q dummy of the nighttime light in state j in which individual households i are located. The dummy D_{qij} takes a value between 1-4. The z_i' is a vector of household level controls. The vector r_j

specifies region specific controls: GDP and a_{ij}, is the region specific effect.

The δ_q captures the intended effect of the policy i.e., whether the urbanization increases the probability of more slums in urban areas post policy period. The parameter could strongly suggest the success of the policy.

In Table 3 [5], I present the estimates of equation 3. Columns (1)-(3) are based on an unbalanced panel. The result in Table 3 suggests that nighttime lights as a proxy for urbanization significantly increases the probability of being a slum household over years. The effect is the strongest for a household in the states where the intensity of the nighttime lights is in $50^{th} - 75^{th}$ quartile. On average, a household in a state categorized in the third quartile of the intensity of the nighttime lights is 14.2 percentage points more likely to be a slum household than a non slum household.

This is suggestive of the increase in slum households in the dim lighted urban areas or small towns over the years. As urbanization begins in tier 2 or 3 towns, it is quite likely that such areas become financially lucrative for nearby villagers leading to slum formations.

However, within the policy implementation years the probability estimate reduces by 3.9 percentage points for households in the states in the third quartile of the nighttime light intensity. This is strongly suggestive of the partial success of the JNNURM policy. Decrease in the probability across all quartiles of nighttime light intensity indicates a strong possibility of benefits reaching the slum households all across the country.

Further, the results could be biased due to the affect of electricity us-

[5] I additionally mention year fixed effects in table 3. The results do not change in direction and do not vary much in magnitude after adding year fixed effects.

age in the household. An increased usage of electricity in slum households could be strongly correlated with the nighttime lights instead of urbanization. However, the estimates in Table 3 suggests otherwise. A household that is electrified is 17.6 percentage points less likely to be a slum household than a non slum household. This gives strong support to the hypothesis. The results are suggestive of the disparity in living conditions between a slum and a non slum household within the same state. The nighttime lights are being derived from the cumulative growth of urban areas and non slum households. The results of the logit model specification in Table 4 remains unchanged.

8 Concluding Remarks

Increase in nighttime light intensity over years significantly increases the probability of being a slum household. States that are categorized in the third quartile of the nighttime light intensity have the highest likelihood of having more slum households compared to other quartiles by approximately, 14 percentage points. The likelihood decreases but still remains positives for all quartiles after the JNNURM policy was implemented suggesting a partial success of the policy. Hence, the analysis provides a strong support in favor of the evidence of urbanization creating more slums.

However, the results presented are very preliminary and there are certain issues that needs to be further addressed in the empirical investigation. Stable Unit Treatment Value Assumption should be tested empirically. I would test the validity of the results by using other datasets e.g., census and panel

Table 3: Urbanization and Slum Household

	Slum Household (=1)		
	OLS	OLS	OLS
	(1)	(2)	(3)
Post Policy	0.020***	0.007***	0.194***
	(0.003)	(0.002)	(0.005)
Mean NL_{25-50q}	0.038***	0.076***	0.036***
	(0.003)	(0.003)	(0.003)
Mean NL_{50-75q}	0.142***	0.177***	0.138***
	(0.003)	(0.004)	(0.004)
Mean $NL_{75-100q}$	0.118***	0.115***	0.100***
	(0.003)	(0.003)	(0.003)
Post Policy*Mean NL_{25-50q}	-0.027***	-0.017***	0.009*
	(0.004)	(0.004)	(0.005)
Post Policy*Mean NL_{50-75q}	-0.039***	-0.031***	-0.017***
	(0.005)	(0.005)	(0.006)
Post Policy*Mean $NL_{75-100q}$	-0.036***	-0.025***	-0.039***
	(0.004)	(0.004)	(0.005)
electricity (domestic use=1)			-0.176***
			(0.004)
migrated (present area_last1year)			-0.021***
			(0.004)
Constant	0.056***	-0.005***	0.165***
	(0.002)	(0.001)	(0.004)
State Fixed Effects	N	Y	Y
Year Fixed Effects	N	Y	Y
Observations	183,027	183,027	127,264
R^2	0.020	0.192	0.211
Adjusted R^2	0.020	0.192	0.211
Residual Std. Error	0.339	0.331	0.328
F Statistic	542.548***	1,063.465***	810.932***
	(df = 7; 183019)	(df = 41; 182986)	(df = 42; 127222)

*Note:*p<0.1; **p<0.05; ***p<0.01, standard errors are clustered at the state level*

Table 4: Urbanization and Slum Household

	Slum Household (=1)	
	Logit	Logit
	(1)	(2)
Post Policy	0.336***	0.418***
	(0.044)	(0.053)
Mean NL_{25-50q}	0.565***	0.569***
	(0.043)	(0.043)
Mean NL_{50-75q}	1.429***	1.452***
	(0.039)	(0.039)
Mean $NL_{75-100q}$	1.271***	1.395***
	(0.038)	(0.038)
Post Policy*Mean NL_{25-50q}	-0.411***	-0.142**
	(0.056)	(0.069)
Post Policy*Mean NL_{50-75q}	-0.457***	-0.337***
	(0.050)	(0.062)
Post Policy*Mean $NL_{75-100q}$	-0.448***	-0.597***
	(0.049)	(0.061)
electricity		-1.146***
		(0.023)
migrated (present area_last1year)		-0.234***
		(0.047)
Constant	-2.833***	-1.931***
	(0.034)	(0.039)
Observations	183,027	127,264
Log Likelihood	-70,722.340	-48,024.750
Akaike Inf. Crit.	141,460.700	96,069.510

*Note:*p<0.1; **p<0.05; ***p<0.01, standard errors are clustered at the state level*

census IHSDS. Controlling for other state level variables like slum population, social amenities, regional proportion of social groups is an important exercise that needs to be carried out in the future. Other empirical methods like a propensity score matching, analysis of neighborhood effect can be useful for future empirical investigation. Other state level policies might effect the validity of the results. This needs to be empirically investigated. The data on town level can be merged which will allow for finer geographic analysis and more convincing results.

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9 Appendix

9.1 Variables Definition

Table 5: Definition of Variables

Variable Name	Definition	Source
Nighttime lights	Index of night time light radiation The index take a value from 0 (darkest) to 63 (brightest)	NOAA DMSP
Urban Growth	Percentage change in urbanization over a decade (2001-2011)	Census of India
Slum Growth	Percentage change in slums over a decade (2001-2011)	Census of India
Rents	Monthly rent	Housing Conditions Survey (NSSO)
Males	Household size: male	Housing Conditions Survey (NSSO)
Females	Household size: female	Housing Conditions Survey (NSSO)
Nominal avg cons	Average monthly consumer expenditure (Rs. in whole no.)	Housing Conditions Survey (NSSO)
Floor area (sqft)	Floor area of the dwelling	Housing Conditions Survey (NSSO)
Move in	No. of members who moved into the household during last 365 days	Housing Conditions Survey (NSSO)
Move out	No. of members who moved out of the household during last 365 days	Housing Conditions Survey (NSSO)
Stay duration	Duration of stay in the slum (years)	Housing Conditions Survey (NSSO)
Migrated	whether the household moved to the present area during last 365 days	Housing Conditions Survey (NSSO)
Electricity	Primary source of energy for lighting	Housing Conditions Survey (NSSO)

9.2 Survey Methods and Sample Design

NSSO adopts the similar methodology for all surveys, however, little differences might exist. The methodology of NSSOs urban slum survey can be described as follows.

Outline of sample design: A stratified multi-stage design was adopted for all surveys. The first stage units (FSUs) in the urban sector were Urban Frame Survey (UFS) blocks. For the survey of slums, there was unlike the other consumption surveys, no second stage of sampling involved for the selection of households. Nevertheless, the paragraphs that follow will refer to the sampling units for the slum survey as FSUs.

Sampling Frame for First Stage Units: For the urban sector, the list of latest updated/available Urban Frame Survey (UFS) blocks was considered as the sampling frame.

Stratification in Urban sector: Within the urban areas of a district, each town with population of 10 lakhs or more as per population census 2011 formed a separate basic stratum and the remaining urban areas of the district were together considered as another basic stratum.

Sub-Stratification: Each stratum was divided into 2 sub-strata as follows:
sub-stratum 1: all UFS blocks having area type slum area
sub-stratum 2: remaining UFS blocks

Total sample size (FSUs): A total number of 306 UFS blocks formed the state sample as against the 153 UFS blocks in the central sample.

Allocation to strata/sub-strata: Within each sector of a state/UT, the sample size was allocated to the different strata in proportion to the 12 stratum populations as per Census. Stratum allocations were distributed among the two sub strata in proportion to the number of blocks in the sub strata.

The minimum allocation for each sub strata was 2. Equal number of samples had been allotted among the two sub rounds.

Selection of UFS Blocks: The NSS urban frame survey blocks were used for all towns and cities. From each stratum/substratum (formed from UFS towns), the UFS blocks were selected using simple random sampling without replacement (SRSWOR). The FSU samples were selected in the form of two independent sub-samples and an equal number of FSU samples were allocated to the two sub-rounds. Also, an additional sample of UFS Blocks in the form of sub-sample 3, equal to the number of sample UFS blocks in each of the sub-sample 1 and 2, was allocated to the sub-stratum 1 only.

Survey on urban slums: Information on each slum, notified or non-notified, found in the entire selected FSU was collected. In case the slum was spread over more than one FSU, only the part within the selected FSU was surveyed and considered as one slum.

9.3 Urban Reforms

[6] States/ULBs will be required to implement the mandatory reforms and optional reforms within the mission period. The States/ULBs need to choose at least two optional reforms each year for implementation. The details of reforms which have already been implemented and/or proposed to be taken up should be included in the detailed project reports.

9.3.1 Mandatory Urban Reforms: Urban Local Body Reforms

(i) Adoption of modern, accrual-based double entry system of accounting in Urban Local Bodies. (ii) Introduction of system of e-governance using IT applications like GIS and MIS for various services provided by ULBs. (iii) Reform of property tax with GIS, so that it becomes major source of revenue

[6] source: Guidelines for Integrated Housing & Slum Development Programme (IHSDP), Ministry of Housing and Urban Poverty Alleviation, Government of India, December 2005.

for Urban Local Bodies (ULBs) and arrangements for its effective implementation so that collection efficiency reaches at least 85(iv) Levy of reasonable user charges by ULBs/Parastatals with the objective that full cost of operation and maintenance is collected within the Mission period. However, cities/towns in North East and other special category States may recover at least 50% of operation and maintenance charges initially. These cities/towns shouldgraduate to full O&M cost recovery in a phased manner. (v) Internal earmarking within local body budgets for basic services to the urban poor. (vi) Provision of basic services to urban poor including security of tenure at affordable prices, improved housing, water supply, sanitation and ensuring delivery of other already existing universal services of the government for education, health and social security.

9.3.2 Mandatory Urban Reforms: State Level Reforms

(i) Implementation of decentralization measures as envisaged in Seventy Fourth Constitutional Amendment. States should ensure meaningful association/engagement of ULBs in planning function of Parastatals as well as delivery of services to the citizens. (ii) Rationalisation of Stamp Duty to bring it down to no more than 5(iii) Enactment of community participation law to institutionalize citizen participation and introducing the concept of the Area Sabha in urban areas. (iv) Assigning or associating elected ULBs into city planning function over a period of five years; transferring all special agencies that deliver civic services in urban areas and creating accountability platforms for all urban civic service providers in transition.

9.3.3 Optional Reforms

(i) Repeal of Urban Land Ceiling and Regulation Act. (ii) Enactment of Public Disclosure Law to ensure preparation of medium-term fiscal plan of ULBs and release of quarterly performance information to all stakeholders. (iii) Revision of bye-laws to streamline the approval process for construction of buildings, development of sites, etc. (iv) Simplification of legal and procedural frameworks for conversion of agricultural land for non-agricultural

purposes. (v) Introduction of Property Title Certification System in ULBs. category with a system of cross subsidization. (vii) Introduction of computerized process of registration of land and property. (viii) Revision of bye-laws to make rain water harvesting mandatory in all buildings to come up in future and for adoption of water conservation measures. (ix) Bye-laws on reuse of recycled water. (x) Administrative reforms, i.e., reduction in establishment by bringing out voluntary retirement schemes, non-filling up of posts falling vacant due to retirement etc., and achieving specified milestones in this regard. (xi) Structural reforms (xii) Encouraging Public-Private partnership.