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Precarious gains: Social mobility and volatility in urban slums

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ABSTRACT

Nearly one sixth of the global population lives in urban "slums" – areas characterized by inadequate infrastructure and tenure security. This figure continues to grow as developing countries rapidly urbanize. Yet, the implications of these trends for urban poverty and social mobility are not well understood. While some argue slums provide temporary housing for rural migrants as they accumulate savings and eventually move to middle class neighborhoods, others argue slum residents are stuck in poverty traps. Deficits in longitudinal data on slums make it difficult to analyze the extent of social mobility. We iterate between satellite analysis and field knowledge to build an original sample of more than 9000 slum households across more than 200 slums from three Indian cities. To address the limitations inherent in cross-sectional data, we employ multiple methods and triangulate findings across household survey data, neighborhood focus group data, longitudinal satellite data, and in-depth qualitative interviews. While no one analysis is definitive on its own, all of these results point to the same conclusion: slum residents are neither stuck in poverty traps nor are they on a steady trajectory to joining the middle class. Movement out of neighborhoods, particularly to non-slum neighborhoods, is rare. Most households experience upward mobility within their neighborhoods, but the extent of improvement is capped at a low level, and, as opportunities increase, volatility increases in parallel. Plateauing and volatility are features present in low-end, and even more, in high-end slums. Engendering better livelihood opportunities requires reducing downward mobility while addressing the causes of plateauing upward mobility.

1. Introduction

Nearly a billion residents of the world's cities live in slums – neighborhoods that lack adequate water, sanitation, and housing (United Nations, 2014). This figure is expected to grow substantially as developing countries continue to rapidly urbanize. In the world's ten poorest countries alone, the urban population is expected to increase by 130 percent in the next fifteen years. Most of this population growth will accrue to slums.[1]

What will these trends mean for the wellbeing of those living in, and moving to, slum areas? Will conditions improve over time? Do neighborhoods improve overall? Do households eventually move out to other non-slum areas? At present, the long-term implications for social mobility in slums are not well understood.

While some studies describe slums as temporary places for urban migrants on their path to the middle class, others contend slum residents are likely to remain trapped in poverty. Slums vary considerably in terms of infrastructure and service provision, average education and wealth levels, and many other characteristics. Thus, we need to probe the variety of living conditions across slums. The extent and antecedents of slum upgrading and within-slum household socio-economic mobility[2] should be assessed empirically, but there is currently an "astonishing lack of data" on slums (Mitlin & Satterthwaite, 2013).

To overcome these data deficiencies, we collect several sources of original data on a wide range of slums in three diverse Indian cities and employ multiple methods. Though no one analysis is definitive on its own, all the results point to the same conclusions: slum residents, for the most part, are neither trapped in poverty nor on a steady trajectory to the middle class. Slums are zones of high risk and high downward mobility. The multiple informalities that characterize slum residents' lives and livelihoods – informal jobs, informal dwellings, and in many cases, informal (i.e., undocumented) identities – cumulate to result in a high degree of precarity. As long as one remains in a slum, the potential level of upward mobility is likely to be capped and compromised by the prospect of a downward slide.

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[1] Author calculation. Urbanization estimates are from World Urbanization Prospects; countries identified from GDP per capita estimates from the World Bank.

[2] We thank one of the anonymous reviewers for suggesting this phrasing.

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This set of analyses offers the most rigorous empirical evidence to date on social mobility in urban slums, with important implications for policy. Interventions should help connect slum dwellers to institutions that mitigate against risks and allow them to move beyond plateaus. Progressively formalizing the diverse aspects of informality in their lives would help reduce the intensity of precarity, attenuating the downward tugs that slum residents frequently experience. In the following sections, we review the existing theories and empirical evidence on long-run mobility in slums, present our original data and methods, and describe and discuss our results.

2. Background

UN-Habitat, the leading international authority on slums, identifies slum neighborhoods as those facing at least one of the following deprivations: inadequate access to safe water, inadequate access to sanitation, poor structural quality of housing, overcrowding, or insecure residential status. This definition allows for substantial subjectivity, reflecting important challenges – slums are a relative concept and local variations make it difficult to define universal criteria (UN Habitat, 2003). However, this working definition highlights an intuitive understanding that "[t]he defining characteristics of these areas – now often called slums in the international literature – are their precarious legality and almost non-existent level of services" (UN-Habitat, 2016).

Scholars debate how slums and their residents progress over time.[3] Some contend slums are a necessary and temporary part of economic development: as urbanization fuels greater economic growth, slums will either develop into or residents will move out to non-slum neighborhoods (Frankenhoff, 1967; Turner, 1969; World Bank, 2009). According to this view, slums provide sites of affordable housing near employment opportunities, allowing recent urban migrants to gain a foothold in the city, save, invest, and move up; the presence of slums today bodes well for economic growth tomorrow (Glaeser, 2011).

Others adopt a less sanguine view. Fox (2014) argues contemporary urbanization trends, whereby urban population growth often outpaces economic and institutional growth, has resulted in higher incidence and persistence of urban slums. Scholars writing in this vein posit that residents will remain excluded from labor and housing opportunities without substantial government intervention (Davis, 2004; UN Habitat, 2003), as "the very nature of life in the slums makes it difficult to achieve improvements in standards of living through marginal investments in housing, health, or infrastructure alone" (Marx, Stoker, & Suri, 2013).

Whether slum residents experience upward mobility over time or not has important consequences for policy. Yet, there are few empirical studies on social mobility in slums on account of severe data limitations. Not only do most developing countries lack longitudinal data that are typically used to investigate social mobility (Iversen, Krishna, & Sen, 2018), but official data on slums are also frequently patchy and deficient, and it is often not clear how many people live in slums (Bhan & Jana, 2013; Mitlin & Satterthwaite, 2013). In India, for example, estimates range from 44 million to 104 million.[4] Even within the same city, various government agencies maintain disparate lists of slum settlements (Krishna, Rains, & Wibbels, 2020). The slum neighborhoods that are listed in government records tend to be the most well-off slum areas; thus relying on government records alone risks omitting the worst-off neighborhoods (Bhan & Jana, 2013; Krishna, Sriram, & Prakash, 2014).

In light of these data challenges, most of the existing work on social mobility in slums draws on a small number of cases. A landmark longitudinal study following residents from three favelas over four decades in Brazil finds those more likely to experience upward mobility first moved out of the favela to formal housing, while many of those remaining in the favelas experienced *downward* mobility over time (Perlman, 2006). Another multi-decade ethnographic study of families from one slum in Ecuador documents intergenerational struggles with poverty even as the neighborhood gradually becomes more infrastructurally developed (Moser, 2009). Longitudinal survey data from two slums in Kenya reveals slum residents face severe human capital constraints due to health risks and exclusion from educational and labor force opportunities (Zulu et al., 2011). Furthermore, a substantial portion of residents (51%) have lived in these neighborhoods for more than ten years. These studies are particularly compelling, but it is difficult to generalize the findings beyond the small number of cases examined.

Empirical studies based on larger datasets are scarce and limited to crude measures of mobility. One study based on cross sectional data from 30,000 South African households compares employment rates and job types in urban formal, urban informal (slum), and rural areas as a "preliminary attempt to assess the relative significance of informal settlements as pathways or cul-de-sacs" (Turok & Borel-Saladin, 2018). The authors find urban slum residents face better labor market outcomes than rural residents, but worse labor market outcomes than other urban residents. They note, however, that their findings are "necessarily suggestive" given they are unable to compare employment outcomes for the same household over time.

Others have conducted original surveys that ask respondents about both current economic outcomes and self-reports of past outcomes. Mitra (2006, 2010) surveys thousands of slum residents across five Indian cities, asking about current and past employment. Though he conducts original surveys, he admits that the sample of slums he studies is drawn from official lists for these cities, which are "neither comprehensive nor exhaustive. Various illegal/squatter settlements and marginal settlements located in different parts of the cities are necessarily not covered by this list" (Mitra, 2006). In this set of neighborhoods, he finds limited evidence of upward mobility measured by job type (Mitra, 2006) and no improvements in job type over time (Mitra, 2010). Similarly, Krishna (2013) surveys over a thousand households from 14 slums in one Indian city, asking about occupations of respondents as well as the respondent's parents. This sample was also derived from an official list of slums and therefore likely represents relatively well-off slums providing a "*most-likely* scenario" for upward mobility. Yet, he concludes, "The majority of households have lived in slums for multiple generations... There is some economic improvement across generations, but the extent of improvement is small on average, and many families have experienced reversals of fortune." In a follow up study, Krishna et al. (2014) leverage satellite data to identify disadvantaged slum areas not listed in government data. They are able to locate these slums from satellite data based on their roof material. After identifying these undocumented areas, they conduct household surveys on occupation, parental occupation, and current and past purchasing power, finding "social mobility is virtually non-existent..."

The limited preliminary evidence points more toward a conclusion of slum residents remaining trapped in poverty than climbing to the middle class. However, more rigorous evidence is needed to inform appropriate policy responses in a rapidly urbanizing world. Given government lists tend to undercount urban slums and to focus on the most well-off areas, scholars need to consider developing alternate sample frames to locate unlisted areas. Furthermore, in the absence of panel data like those used to measure

[3] See Turok and Borel-Saladin (2018) for a detailed review.

[4] The National Sample Survey Organization counted 44 million slum dwellers in 2008. UN-Habitat estimated 104 million in 2014.

social mobility outside the developing world, scholars will need to consider alternate methods that reliably document changes in status levels over time.

We address both of these issues in this paper. First, we develop an original sample of slums that spans a wide range of conditions across three Indian cities. Second, we consult alternative sources of data, allowing us to triangulate the results of multiple analyses. Broadly, we examine neighborhood-level and household-level improvements as well as movement in and out of neighborhoods. In each case, we use multiple methods, not resting our conclusions on a single analysis. The data and analyses are discussed in the next section.

3. Materials and methods

This study draws on a large primary data collection effort undertaken across three Indian cities – Bengaluru, Jaipur, and Patna – each a state capital, located respectively in the south, west and east. These cities vary substantially from one another along geographic, economic, cultural, and political dimensions.

Bengaluru (formerly Bangalore), in the southern state of Karnataka, is the largest of the three cities. The estimated population in 2015 was 10.1 million, a 49% increase over ten years.[5] Bengaluru is also the wealthiest and most rapidly growing of the three cities, having received global attention for its internationally competitive and booming information technology (IT) sector (Jayatilaka & Chatterji, 2007).

Patna, the capital of the Eastern state of Bihar, is the smallest city in our sample with an estimated population of 2.2 million (an increase of 21% over a decade). Patna is also the poorest and slowest-growing city of the three (McKinsey Global Institute, 2010). Bihar remains one of the poorest states in India and much of its development focus has been on rural areas (Mathew & Moore, 2011; Witsoe, 2013). The government estimates that over 90 per cent of Patna remains unplanned (Rodgers & Satija, 2012).

Jaipur represents an intermediate case. Capital of the western state, Rajasthan, Jaipur has an estimated population of 3.4 million (an increase of 31% over a decade). This city has recently been growing due to investments in real estate as well as IT, though not to the same extent as Bengaluru (Parmar, 2009). Though the city was historically well planned – in contrast to Patna – little information exists on how well the city has planned in recent years (Kavilkar & Deshmukh, 2014).

We employ a series of methods to identify, demarcate and classify slum neighborhoods. We begin by examining publicly available satellite images of the Bengaluru metropolitan area. We first identify urban neighborhoods that are visually distinct from formal, middle class neighborhoods. We next iterate between satellite analysis, and ground verifications undertaken by a team of experienced investigators in order to inductively develop an initial short list of criteria to identify slums from satellite images: lack of space between shelter units, roofs that appear to be low quality based on color, haphazard arrangement of shelter units, lack of proper roads, and lack of shadows, signifying single-story units.

We continue to iterate between manual identification of potential slum areas in Google Earth and ground verification to compile a list of groundtruthed slums spanning a wide range of physical characteristics. Using these groundtruthed slums, we also train algorithms to successfully identify slums throughout Bengaluru.[6]

To expand our inquiry to Jaipur and Patna, we build on information from local partners who conducted intensive slum mapping exercises. In Jaipur, we begin with a list of geolocations of nearly 300 slums compiled by a colleague over years of fieldwork.[7] In Patna, we begin with a list of over 100 slums provided by a local partner.[8] In each city, we also meet with local partners to identify more recently formed neighborhoods.

After compiling these lists of groundtruthed slums, we draw on satellite data to strategically select a subset of slums spanning a wide range of characteristics. To do so, we plot slum locations in Google Earth and classify each image according to the number of slum-like physical characteristics observable from satellite images. Within each city, we randomly select neighborhoods, stratified according to their location and discernible satellite characteristics. For example, if 10% of all slums are located in the northeast quadrant of a city and display all of the identified slum-like characteristics discernible from satellite images, then four out of 40 slums of this type from the northeast quadrant are randomly selected for the study sample.

In total, we select 223 neighborhoods to conduct detailed surveys in between 2015 and 2017. In each slum, we randomly select up to 60 households for detailed surveys on a range of topics, including migration histories, current and past household expenditures, occupations, and educational attainment. Overall, we collect data from 9439 households across these three cities – 4566 from Bengaluru, 2718 from Jaipur, and 2155 from Patna. In each neighborhood, we also undertake focus group discussions on neighborhood-level infrastructure and settlement history.[9]

We expect the prospects for social mobility in slums to be highest in Bengaluru, where both population and economic growth outpaces those of the other two cities. As such, we collect additional data from Bengaluru to further examine social mobility. First, we compile publicly available satellite images from Google Earth to create a panel dataset of physical characteristics of 135 slums at three separate points in time. Second, we conduct 75 in-depth qualitative interviews with residents of five neighborhoods selected as exemplary cases in Bengaluru. These five neighborhoods were selected based on our household survey data to ensure they vary in housing tenure security, infrastructure quality, and location within the city. Respondents included equal numbers of men and women geographically distributed throughout each neighborhood.[10]

3.1. Measuring neighborhood-level improvements

We first examine changes at the neighborhood-level before turning to changes at the household-level and to households' movement out of slums. To enable empirical comparisons across neighborhoods, we develop two different measures of neighborhood well-being. First, we draw on household and neighborhood survey data to calculate a "slum score." We calculate an index from indicators of the physical characteristics specified by the UN-

[5] All population estimates are pulled from World Urbanization Prospects 2018. See https://population.un.org/wup/Download/.

[6] We are working on developing deep neural network approaches to detecting slum areas. For an early expression of this work, see Gadiraju, Vatsavai, Kaza, Wibbels, & Krishna (2019).

[7] This list was provided by Adam Auerbach, who received a map of slums from a government of Rajasthan joint venture, which he built on.

[8] This list was provided by Support Programme for Urban Reforms (SPUR), a partnership between the Government of Bihar and the UK Department for International Development (DFID).

[9] Focus groups composed of men and women with a particular preference for longer-term residents were conducted in each slum by a team of trained investigators. Oral histories of slum settlement and upgradation with critical turning points and related events are of special relevance to this part of the investigation. Between seven and 15 residents constituted the focus group in different settlements.

[10] Each interview lasted about one hour. Audio recordings were transcribed and translated from Kannada to English for analysis. Further details on recruitment methods are provided in the Appendix.

Table 1
Summary of indicators used to calculate slum score.

Condition	Indicators	Data source	Calculation
Durability of housing	Roof type	Household surveys	Average score (tarp = 0, brick = 1, tin = 2, cement sheet = 3, concrete = 4)
Sufficient living space	Square footage per person	Household surveys	Median household area per capita. The median is taken across the neighborhood rather than the mean to account for potential measurement error in area.
	Building height	Household surveys	Average height (single story = 1, double story = 2, triple story = 3)
Access to safe water	Water source	Neighborhood surveys	Average score of all water sources present in neighborhood (tanker = 0, borewell = 1, handpump = 2, private connections = 3). Data are not available on proportion using each type of water.
Access to adequate sanitation	Toilet source	Household surveys	Average score (none = 0, shared public = 1, shared private = 2, private toilet = 3)
	Drainage type	Neighborhood surveys	Weighted average of the proportion of the neighborhood covered by each drain type (none = 0, open rough = 1, open sturdy = 2, closed = 3)
Availability of economic resources	Asset score	Household surveys	Average first component score from principal component analysis of 20 binary variables indicating whether or not the household owns that asset

Habitat definition, as detailed in Table 1. Higher scores indicate better conditions.

We also draw on satellite data to compare neighborhoods over time. For each of the 135 slums we survey in Bengaluru, we compile a panel dataset of satellite images from 2000 (or the date of the first available image), the year surveyed (2015, 2016, or 2017), and the most recently available images from 2019 i.e., considering a period of approximately 20 years. We next develop a "satellite score" based on the criteria we previously identified through groundtruthing as visible characteristics of slum settlements. We code the following characteristics: lack of space (0 = dense; 1 = not dense), haphazard arrangement (0 = haphazard; 1 = arranged along a grid), distinct roof color (0 = blue; 1 = brown ish/orange; 2 = white; 3 = gray), quality of roads (0 = none; 1 = dirt only; 2 = dirt and cement; 3 = cement only), and building height (0 = all single storey; 1 = few multistorey; 2 = many multistorey; 3 = all multistorey). After scaling each indicator from 0 to 1, we take an unweighted average to generate the overall satellite score for each image. These scores are highly correlated with the "slum score" calculated from the survey data ($\rho = 0.7$), and each of the individual indicators are positively correlated with the slum score, providing support for the measure's validity. Scores range from 0 to 1 where higher scores correspond to better physical infrastructure and lower scores correspond to worse infrastructure.[11]

We examine the extent of changes over time to assess levels of neighborhood-level development over a span of nearly two decades. We also test the relationship between neighborhood development and location within the city, as scholars have argued settlements in the urban periphery may have greater tenure security, and thus, ability to develop, than more transient areas in the center (Portes, 1971; Turner, 1969). Finally, we merge the satellite panel data with our household and focus group data in order to test the relationship between neighborhood development and settlement age.

3.2. Measuring household-level mobility

We next turn to an examination of household mobility. Measuring social mobility is particularly challenging in developing countries where longitudinal data is lacking and household income is more likely to fluctuate (Iversen et al., 2018). We draw on two measures to address the challenge of missing longitudinal data.

The first measure uses the Stages-of-Progress approach, which has proved useful for investigating poverty dynamics in diverse rural and urban contexts (Krishna, 2010) and has been adapted by researchers for similar use in other parts of the world (e.g., Narayan et al., 2009). The respondent specifies how many assets or capabilities ranked from one to ten they are able to possess, as well as how many they were able to possess ten years ago. The list, which corresponds to increasing levels of wellbeing – or increasing stages of progress – was developed over time with extensive inputs from the communities studied. A clear sequence of stages was related by respondents. After households gained the capacity to feed and house themselves, send their children to school, and repay what they owe to others, the next stages-of-progress involve acquiring material assets. In prior community meetings held in different slums the same sequence of stages was narrated by the assembled community groups. Not only does the position on the Stages-of-Progress economic ladder serve as a promising indicator for level of wellbeing, but – importantly – it is easier to recall the position from ten years ago than it is to recall other indicators often used to measure wellbeing. Studies undertaken in places where previous period data on asset holdings were available found a close correlation between households' asset scores and their Stages-of-Progress scores (Krishna, 2010).

The second method we utilize for tracking household-level social mobility is our comparison of intergenerational occupation status. In literature on social mobility developed for Western contexts, researchers code formal occupations into different classes and compare parent occupations to child occupations. This same occupational classification does not adapt well to the developing country context, where many people work in the informal sector. Instead, we apply a slightly adapted occupational classification scheme developed specifically for the Indian context (Iversen, Krishna, & Sen, 2017) to compare father and son occupational classes.[12] The classes range from 1 to 5, with 5 corresponding to higher prestige jobs (Table 2).

We assess levels of mobility using both measures by subtracting past levels from current levels. After examining summary statistics, we turn to regression analysis to examine the correlates of upward and downward household mobility. We run two sets of models. In the first set, models [1A] to [2B], we analyze the correlates of upward mobility. In the second set, models [3A] to [4B], we examine the correlates of downward mobility.

[11] For the first 80 codes (40 neighborhoods at 2 time periods), two coders worked separately and reconciled differences. Given low discrepancy between the first 80 codes, a single coder created the remaining codes. A random set of 20% of neighborhoods were then double-checked.

[12] Other work suggests prospects for intergenerational mobility in urban slums may be higher for women than for men (Krishna, 2013). However, we do not consider mother and daughter occupational differences in this paper because we expect the occupation schema to differ by gender. Developing an appropriate schema to measure female occupational mobility is an important avenue for future research.

Table 2
Occupational class categorization.

Class	Type	Examples
1	Manual labor	Daily wage labor; construction; garbage collection; factory work
2	Lower status vocational occupations	Butcher; carpenter; driver
3	Higher status vocational occupations	Cook; electrical work; grocer; security guard
4	Clerical	Corporation or government worker
5	Professional	Teacher; engineer; doctor

For upward mobility, we estimate the following equation:

$$logit(y_{ij}) = \beta_0 + \beta_1 time_{ij} + \beta_2 migrant_{ij} + \beta_3 remittances_{ij} + \beta_4 age_j + X + \boldsymbol{\theta} + \varepsilon_{ij} \quad [1A, 1B]$$

The dependent variable, y_{ij}, equals 1 if household *i* in neighborhood *j* experienced upward mobility according to stages-of-progress [1A] or occupational change [1B] and equals 0 otherwise, distinguishing in the first instance only between the upwardly mobile and all other slum residents. To understand prospects for mobility over time, we are interested in several household-level characteristics and several neighborhood-level characteristics. First, the coefficient, β_1, corresponds to the number of years the respondent has lived in their neighborhood; while, β_2, corresponds to whether the respondent was born in the city or not. As a proxy for circular migration, we include the proportion of expenses spent on remittances to the native rural area, captured by coefficient β_3. The slum-level characteristic of interest is slum age, corresponding to coefficient β_4.[13]

We include a standard set of socioeconomic control variables, X, including household size, respondent occupation type (model [1A]) or current stages-of-progress score (model [1B]), education, gender, religion, and caste.[14] We also include the stages-of-progress score from ten years prior, replacing this with father occupation for the models using occupational gains. We include city fixed effects, $\boldsymbol{\theta}$, and cluster standard errors at the neighborhood-level, *j*.

We also estimate the following:

$$y_{ij} = \beta_0 + \beta_1 time_{ij} + \beta_2 migrant_{ij} + \beta_3 remittances_{ij} + \beta_4 age_j + X + \boldsymbol{\theta} + \varepsilon_{ij} \quad [2A, 2B]$$

where the dependent variable, y_{ij}, equals the *magnitude* of stages-of-progress increase [2A] or the magnitude of intergenerational occupational increase [2B] for the subset of households that experienced upward changes over time.

In the second set of models, [3A] to [4B], we estimate the same equations for downward mobility. In models [3A] and [3B] we reproduce the 0–1 analysis, in this case, distinguishing between the downwardly mobile and others. In models [4A] and [4B] we consider the magnitude of downward mobility.

3.3. Assessing extent of households moving out of slums

It is crucial that we consider the possibility that some slum residents experience substantial levels of upward mobility and then move out of slum areas. Existing research has not adequately explored this possibility, but if this were the case, conclusions drawn solely from evidence on current slum residents would be downwardly biased. As we do not have a way of locating former slum residents, we turn to our next best option: triangulating evidence from three datasets on both self- and neighbor-reported movement patterns.

We first examine self-reported movement trends from the household survey data. This allows us to assess whether respondents who have moved from another area to their current area moved from less well-off or more well-off areas to their current location. We first present descriptive statistics on the number of movers, where they moved from, and why. We next run a logistic regression to assess whether those who have moved within the city are more likely to have experienced upward mobility than others. Finally, we assess whether those who moved to less well-off areas transitioned from renting to owning a home – which could constitute one indicator of an increase in wellbeing. To do so, we run a multinomial logit model with home ownership status as the dependent variable and whether movers moved from better, worse, or similar neighborhoods.

These data can tell us about those who have moved among slums within the city, but we still face the problem of missing those who have moved out of slums entirely. As such, we turn to neighbor reports from both focus group and qualitative interview data. During the focus groups, we ask about whether other families have moved in or out of the neighborhood within the past two years, as well as whether those who moved went to nicer areas. Finally, we turn to in-depth qualitative interviews, where we ask people to discuss whether anyone in their neighborhood has ever become particularly successful and, if so, whether they moved out or not.

4. Results

4.1. Wide range of neighborhood conditions

In the least well-off neighborhoods in our sample, houses are constructed from low quality materials like tarp and mud; these houses lack water, drainage, and other basic infrastructure. In the most well-off neighborhoods, which are nearly indistinguishable visually from lower middle-income neighborhoods, people live in sturdily constructed houses with piped water, metered electricity, closed drainage systems and private toilets, though they lack the secure tenure needed to be considered formal settlements. The conditions in the other neighborhoods increase along a continuum spanning these two poles.

We examine characteristics based on the "slum score" calculated from household and neighborhood survey data as described in Table 1. Table 3 provides descriptive statistics by slum score quartile. Not only do the indicators that comprise the slum score increase substantially from the bottom to the top quartiles, but other socioeconomic characteristics do as well. For example, average educational attainment increases from only 2.6 years in bottom quartile neighborhoods to 6.3 years in the top quartile and the proportion of people working in manual labor decreases from 58% to 30%.

Slum scores are not equally distributed throughout the three cities. Most of the slums sampled in Patna, the poorest of the three cities, cluster in the bottom quartile. Though Bengaluru is the wealthiest of the three cities, a larger proportion of the slums sampled from Jaipur cluster in the top quartile than those sampled from Bengaluru.

4.2. Neighborhood mobility

We next turn to an analysis of changes in the "satellite score," which ranges from 0 to 1. The least developed slum areas have

[13] We do not include an indicator for slum notification status because we find notification status to be highly variable across official lists and inconsistent between government lists and resident self-reports (Krishna, Rains, & Wibbels, 2020).

[14] We do not include respondent age because it is highly correlated with other covariates.

Table 3
Descriptive characteristics by slum score quartile.

Indicator	Quartile 1	Quartile 2	Quartile 3	Quartile 4
% with cement roofs	13%	38%	49%	63%
% with private toilets	21%	68%	82%	82%
% with piped water	13%	32%	65%	75%
% working manual labor	58%	39%	31%	30%
% migrant	41%	24%	18%	26%
Avg years in current home	16.7	21.0	19.3	23.0
Avg years education	2.6	5.0	5.8	6.3
% of Patna neighborhoods	65%	28%	7%	0%
% of Jaipur neighborhoods	18%	18%	20%	44%
% of Bengaluru neighborhoods	15%	27%	33%	26%

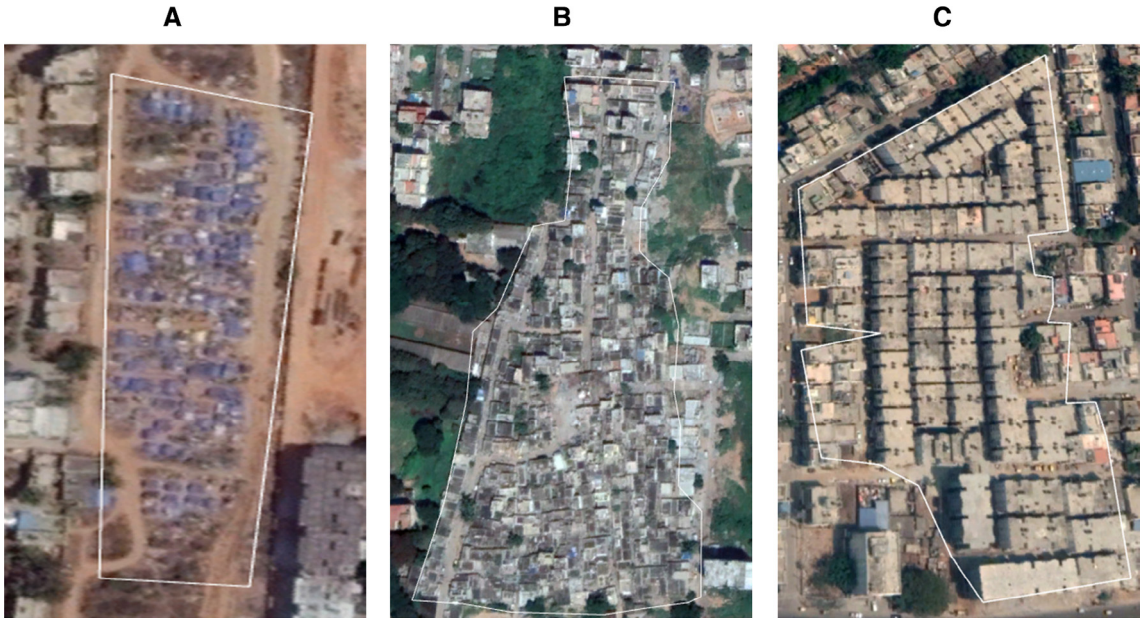

Fig. 1. Variation in visible infrastructure. *Note:* Images are pulled from Google Earth. The neighborhood in Fig. 1A has a satellite score of 0.07; the neighborhood in Fig. 1B has a higher satellite score of 0.43; the neighborhood in Fig. 1C has the highest satellite score of 1.

satellite scores close to 0, while non-slum areas have scores close to 1, as shown in Fig. 1.

At the time of the surveys, in 2015, 2016, or 2017, based on the neighborhood, the average satellite-based score is 0.39, which is approximately double the average score of 0.19 from 15 to 17 years prior, as assessed from the images for 2000. The most commonly observed change over this period is in roof type, which improves in 86 percent of the areas. This is consistent with empirical evidence from Pune, India. Nakamura (2014) finds a large proportion of slum residents invest in incrementally improving housing construction, regardless of whether they have secure property rights or not, and "the proportions of pucca [sturdy] housing in notified and non-notified slums converge in the long run." We also see improved road quality for 67 percent of areas and upward expansion in 46 percent of neighborhoods. Changes in haphazard housing arrangement and reductions in density are much rarer. In fact, in many cases, neighborhoods become denser as the number of households increases.

At the time of the surveys, two (out of 135) slum neighborhoods had satellite scores of 1, and, thus, were visibly indistinguishable from non-slum areas. In both cases, the neighborhoods had recently experienced substantial physical improvements as a result of government-led in situ development. To examine whether any other neighborhoods experienced similarly large levels of development, and now appear physically indistinguishable from non-slum areas, we examine satellite images from 2019, i.e. 2–4 years after completion of our surveys. None of the neighborhoods' satellite scores increased to 1 by 2019. Furthermore, four of the neighborhoods with the lowest slum scores are no longer visible, appearing either to have been evicted or otherwise relocated.

We run a regression to examine correlations between changes in physical characteristics, slum age, slum size, and location. The output is provided in Appendix A2.[15] These results suggest slums do not necessarily develop along similar trajectories over time or across space. Though the signs on the coefficients suggest slums may develop more quickly at first and then experience decreasing marginal improvements, the magnitude of these coefficients is near zero. We find no substantive relationship between slum age and satellite score, or in change in satellite score over nearly two decades. We also do not find meaningful differences across space: the relevant coefficients for distance from the city center are also approximately zero.[16]

The analyses suggest entire neighborhoods do not inexorably develop into non-slum-like areas. While some do, many don't,

[15] We use the change in score between 2000 and the year surveyed (rather than 2020) because the covariates were measured at the time of the survey.

[16] To check robustness, we calculate 5 alternate satellite scores. In each case, we drop one indicator and calculate the satellite score as the average of the other 4 indicators. The results are robust to alternate calculations of the satellite score.

and the observed trends suggest slums develop at different rates. Explaining which slums convert to non-slum areas is outside the scope of this paper. Scholars who have taken up this subject for close consideration emphasize the importance of local politics. Even in notified slums, where the government is mandated to improve infrastructure, there is no assurance of infrastructure provision (Anand, 2017; Krishna et al., 2020). Slum-level propensities for collective action and leadership are more often responsible for variation in slums' levels and rates of infrastructural development (Auerbach, 2016; Auyero, 2000), as is also indicated by our focus groups.

4.3. Household mobility

At the time of the survey, the average household reported being at stage 4.65 of the 10-point stages-of-progress scale. This reflects a 69 percent increase from the average of 2.75 ten years prior. Most households (78 percent) have experienced some upward mobility. However, 12 percent remain at the same level as ten years before and 9 percent are worse off than they were ten years before the survey. This rate of downward mobility of 9 percent over ten years is comparable to the rates reported for remote rural India (Krishna, 2010).

Table 4 lists the percentage of households who experience upward mobility, downward mobility, remain poor, and remain nonpoor over a ten-year period by city.[17] As expected, the percentage of households who experienced upward mobility is highest in Bengaluru and lowest in Patna. Notably, a sizeable share of households (16%) experience downward mobility in Jaipur and Patna.

Evidence from the stages-of-progress measure shows that, though most people have experienced some upward mobility, stages-of-progress scores remain low, and the vast majority remain poor.

We also consider intergenerational occupational mobility. Most employed men work in manual labor (41.2 percent) or lower status vocational occupations (32.8 per cent). Very few (3.5 percent) work in professional, category 5 occupations. Table 5 lists the percentage of male respondents working, respectively, in higher-prestige, lower-prestige and equal-prestige jobs compared to their father by city. Consistent with the findings from the stages-of-progress measure, we find more instances of upward mobility (41 percent) than downward mobility (12 percent).[18] However, it is most common that individuals work in the same occupational class as their father (47 percent). The most commonly observed trend (34 percent) is that both fathers and sons work in class 1 positions. The most common upward trend (21 percent) is a movement from class 1 to class 2 positions.[19] Similarly, the most common downward trend (3 percent) is a movement from class 2 to class 1. Movements up happen most frequently in Bengaluru. Movements down, which occur least often in Bengaluru, occur with similar frequency in Jaipur and Patna.

Table 4
Changes in stages-of-progress by city.

	Patna	Jaipur	Bengaluru
% moved up	60%	65%	95%
% moved down	16%	16%	02%
% no change	24%	19%	03%
% stayed poor	92%	70%	83%
% stayed nonpoor	02%	07%	00%

Table 5
Changes in occupational category by city.

	Patna	Jaipur	Bengaluru
% moved up	29%	35%	44%
% moved down	17%	17%	8%
% stayed in same type of job	54%	47%	48%

We observe fewer instances of mobility using this measure than we do with the stages-of-progress measure. However, with both metrics, we find substantial instances of upward mobility and more examples of upward than downward mobility. As with the stages-of-progress metric, we note that, despite improvements, absolute levels remain low in slums. Most people work in manual labor, while only 4 percent work in the most formal, class 5, occupations.

The evidence presented so far suggests households and neighborhoods experience more upward mobility than we would expect if slum residents were stuck in poverty traps, but less mobility than we would expect if residents were on a steady upward trajectory. To more explicitly analyze these trends, we run models [1A] to [2B] to estimate the correlates of upward mobility and we run models [3A] to [4B] to estimate the correlates of downward mobility. All results discussed are robust to an alternate specification including slum-level random effects.

The output for the first set of models on the correlates of upward mobility are displayed in Table 6. We include collinearity diagnostics in Appendix A3.

The household-level coefficients of interest are the years lived in current neighborhood, migration status, and the proxy for circular migration. We find no relationship between these variables and the likelihood of experiencing increases. However, the magnitude of gains in stages-of-progress are higher for longer-term residents and lower for migrants. The neighborhood-level coefficient of interest is slum age. Though the coefficient is significant on slum age for model [2B], the size of the relationship is substantively negligible.

These results, that length of time in and connection to the city may magnify gains, provide weak evidence that slum residents experience upward mobility rather than stasis over time. However, the model results also suggest that upward gains ultimately plateau. Those with higher initial stages-of-progress are less likely to experience gains. Similarly, men whose fathers worked in more prestigious jobs are less likely to experience occupational mobility. This likely suggests that gains taper off rather than reflects estimation ceiling effects, given the low baseline stages-of-progress levels and that nearly no fathers worked in class 5 occupations.[20]

The results also reveal that gains are not equally likely across groups. Notably, lower caste men are much less likely to make occupational gains than other men, while female headed house-

[17] We classify scores less than 7 as poor and scores greater than or equal to 7 as nonpoor (Krishna, 2010).

[18] Elsewhere, stated rates of upward occupational mobility for India are lower than what we report here (Iversen, Krishna, & Sen, 2017). However, these statistics are not directly comparable. Nearly all slum residents work informally. A class 3 job without formal benefits is distinctly riskier than a class 3 job with benefits. We expect informal employment to be much higher in slum than non-slum areas, but we can only compare occupational categories (rather than formal status) with this paper.

[19] Though we note above that we cannot directly compare occupational mobility between our sample and the sample from Iversen et al. (2017), it is worth noting that the largest share of occupational gains in their sample is from class 3 to 4 occupations. Our sample suggests that many slum residents, even upon experiencing upward mobility, continue to work in lower status jobs than non-slum residents.

[20] It is difficult to ascertain whether non-slum neighborhoods also exhibit plateau effects without having data of the same granularity. Future research is required to clarify these similarities and dissimilarities.

Table 6
Model output for correlates of upward mobility.

Variables	[1A] Positive (sop)	[1B] Size (sop)	[2A] Positive (occupation)	[2B] Size (occupation)
Occupation class 2[a]	0.510***	0.267***	−1.623***	−0.317***
	(0.122)	(0.0489)	(0.127)	(0.0466)
Occupation class 3	0.541***	0.356***	−2.097***	−0.145
	(0.154)	(0.0673)	(0.221)	(0.0886)
Occupation class 4	0.291*	0.501***	−4.368***	0.000804
	(0.162)	(0.0893)	(0.579)	(0.125)
Occupation class 5	0.753***	0.510***	–	0.902***
	(0.292)	(0.119)		(0.131)
Stages of progress[b]	−0.811***	−0.248***	0.154***	0.0376***
	(0.0480)	(0.0186)	(0.0245)	(0.0131)
Female household head	−0.334***	−0.175***	−0.106	0.0987
	(0.129)	(0.0562)	(0.332)	(0.146)
Household size	0.0407**	0.0141	−0.00959	−0.00745
	(0.0201)	(0.0108)	(0.0207)	(0.00884)
Religion (Muslim)	−0.144	−0.198**	0.220	0.0157
	(0.142)	(0.0802)	(0.146)	(0.0502)
Caste (SC/ST)	−0.0503	−0.108**	−0.408***	−0.0983**
	(0.111)	(0.0516)	(0.0976)	(0.0424)
Migrant	−0.0558	−0.141**	0.0868	0.0648
	(0.112)	(0.0545)	(0.104)	(0.0488)
Remittances to rural area	−0.373	−0.688***	0.184	−0.164
	(0.480)	(0.202)	(0.394)	(0.157)
Years in home	−0.00178	0.00486***	−0.00313	−2.59e−05
	(0.00330)	(0.00169)	(0.00309)	(0.00122)
Years of education	0.0638***	0.0274***	0.0947***	0.0366***
	(0.0110)	(0.00517)	(0.0108)	(0.00559)
Knows informal leader	0.168	0.0909	−0.0707	−0.0651
	(0.111)	(0.0551)	(0.114)	(0.0478)
Slum score	0.281***	0.169***	0.321***	0.0676***
	(0.0548)	(0.0293)	(0.0523)	(0.0149)
Slum age	−0.00121	−0.000416	−0.000133	0.000867*
	(0.00158)	(0.000844)	(0.00157)	(0.000501)
Slum size (households)	0.000171*	4.76e−05	8.52e−05	7.22e−05*
	(9.75e−05)	(4.14e−05)	(8.25e−05)	(3.68e−05)
Jaipur	−1.574***	−1.029***	−0.00645	0.0436
	(0.165)	(0.0825)	(0.142)	(0.0575)
Patna	−1.834***	−1.327***	0.364*	0.0609
	(0.180)	(0.0836)	(0.189)	(0.0674)
Constant	4.416***	3.031***	−1.009***	0.445***
	(0.302)	(0.136)	(0.214)	(0.0921)
Observations	4,819	4,341	3,177	3,133
(Pseudo) R-squared	0.336	0.334	0.177	0.163
Robust standard errors in parentheses				

***p < 0.01, **p < 0.05, *p < 0.1.
[a] Occupation is respondent occupation for [1A] and [1B] and father occupation for [2A] and [2B].
[b] Stages-of-progress score is from ten years before survey for [1A] and [1B] and the score at the time of survey for [2A] and [2B].

holds are much less likely to experience increases in stages-of-progress. Furthermore, gains vary substantially across neighborhoods. Residents of nicer slums, as measured by the slum score, are more likely to experience upward mobility, and gains tend to be larger than those made in less well-off slums. Houses in Bengaluru are more likely to improve according to stages-of-progress and to experience larger increases, but occupational advances are, interestingly, more likely in Patna.

The full output for the second set of models on the correlates of downward mobility are displayed in Appendix A4. The results again provide weak support for upward mobility in slums rather than stasis. Longer term residents are less likely to experience a decrease in stages-of-progress. Migrants are not more likely to experience occupational descents but, when they do, they tend to be larger in magnitude than the occupational descents experienced by non-migrants. We find a negative relationship between slum age and the probability of experiencing descents in stages-of-progress, but the results are substantively small. When all other covariates are held at their mean value, the expected probability of experiencing downward mobility decreases from 0.033 (±0.01) for slums aged in the 25th percentile to 0.028 (±0.01) for slums aged in the 75th percentile.

However, the results also suggest that – while slum residents may be more upwardly mobile than stuck – conditions are volatile, and gains are precarious. Households with higher initial stages-of-progress scores are more likely to experience downward mobility than other households, and these descents are steeper. Occupational descents are also larger in magnitude when they occur in higher-end slums.

These results should be interpreted carefully because of the potential for floor effects. But, together with the results on upward mobility, the evidence presents a compelling narrative. Most slum residents experience some upward mobility, though the level of upward mobility plateaus over time. Some neighborhoods and some households are more likely than others to experience upward mobility, but all slum dwellers are susceptible to shocks and we observe larger downward movement in the neighborhoods where we also observe the largest increases in mobility.

This is further illustrated by the point that we find no relationship between average changes in stages-of-progress and slum score, but we find the standard deviation increases significantly with slum score.[21] Fig. 2 shows the average neighborhood-level standard deviation of changes in stages-of-progress by slum score. This evidence suggests that in slums that experience greater overall infrastructural development households experience wider fluctuations in material wellbeing.

The largest gains and the largest losses are observed in the best-off slums. It is quite possible, though we cannot test it directly, that people who experience the largest gains in a prior ten-year period suffered the greatest losses in the ten-year period under review; that would be consistent with how rarely people move out of slums.

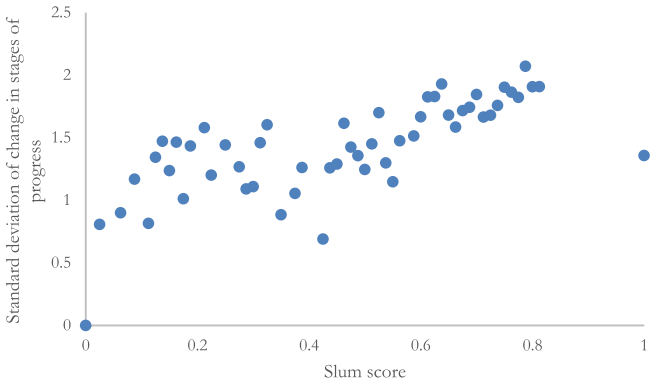

Fig. 2. Standard deviation of changes in stages-of-progress by slum score.

4.4. Moving up and then out?

We next examine the extent of movement out of slums. We first draw on self-reported information from our household survey data. Crucially, though slums are often perceived as home to transient, migrant groups, we find 73 percent of households are native to their city of residence, and 66 percent of families have lived in the same city for multiple generations. People have lived in their current home for an average of 20 years.

Among those who have moved, we do not find evidence of movement from worse to better neighborhoods. In one survey wave (from Bengaluru in 2017), we ask those who had moved from a different neighborhood whether their previous neighborhood was "better", "worse", or "the same" as their current neighborhood. Most households that have moved within Bengaluru (85%) report moving from a better or similar neighborhood, while only 15% report moving to a nicer settlement. The most commonly reported reasons for moving from nicer and similar areas are that the former was too expensive or too far from work. The most common reason for moving to a nicer area was also to be closer to work, while the second most common reason was safety, consistent with case studies from slums in Durban, South Africa (Posel & Marx, 2013).

We also run a logistic regression to determine whether higher levels of upward mobility correspond to a greater probability of moving.[22] We find a larger increase in stages-of-progress corresponds to a *lower* probability of moving within Bangalore. It is possible there is some circularity in this relationship. It could be the case that those who have stayed in a slum home for longer may have incrementally developed the capacity to deal with equanimity with the risks associated with other forms of informality, but further research is required to examine the strength and direction of this association.

Finally, we consider whether people choose to move to a neighborhood with a lower slum score in order to transition from renting in a more expensive area to purchasing in a less expensive area. Our findings do not support this pattern. We run a multinomial logit model with home ownership status (whether one rents, purchased their home, inherited their home, or "squats") as the dependent variable and whether movers moved from better, worse, or similar neighborhoods. Relative to renters, home purchasers are no more or less likely to have moved from a better neighborhood.

We next draw on neighbor reports. According to our focus group data, most neighborhoods experience limited movement. In 29 percent of the neighborhoods, focus groups report at least five families had moved out within the past two years. However, in only three percent of these cases did the focus group respondents believe neighbors had moved to nicer neighborhoods. Even if there is some within-city relocation to nicer slums, it is certainly a fringe phenomenon.

Finally, we draw on in-depth interviews. Most people cannot think of someone in their neighborhood that they would describe as having become particularly successful, as expressed by one lab attendant: "I am the only government employee here. Out of 150 households, I am the only one. If I haven't reached better places myself, then where will the others go?"[23]

Only 5% of those interviewed describe examples of people from their neighborhood moving out after joining influential jobs (for example, police officer) or selling property. Notably, all of these examples are from the most well-off, most secure neighborhood.

In several neighborhoods, respondents describe some examples of high educational attainment among their young residents, but express frustration at the prospects of translating educational attainments into more formal employment. As one young woman told us, "I have studied 'til 2nd year PU. I wanted to enroll in a degree course after a month. In the meanwhile, I joined a computer course. They said if I go to the computer class, I will get a job. I finished the computer course, but haven't found a job. I am [still] at home."[24]

In another neighborhood, a mother of a college-educated son who works delivering packages says, "We also have aspirations. Nobody comes forward to support. We have aspirations that our children should work in a bank or should get a [good] job. Nobody comes forward to offer those kind of jobs here."[25]

The in-depth interviews also elucidate insights into potential barriers to outward movement. Several people emphasize that a comparable home in a non-slum area would be markedly more expensive. According to these interviewees, households would need to experience exceptionally high and sustained levels of economic progress to be able to move out to a non-slum neighborhood:

> "If I want to go outside... to the city, I can't. We have to control and manage with the budget we have. If I have to buy in the city, I will have to pay lakhs of rupees... See, now if we go to the same house ...same dimension house... if you go outside

[21] This finding is robust to including controls. Results available upon request. We observe a similar pattern with intergenerational occupational mobility. Both fathers and sons work in higher occupational classes in more well-off neighborhoods. However, the standard deviation in occupational classes is higher for sons than for fathers, suggesting recent gains in employment status are volatile.

[22] We include standard socioeconomic controls and cluster standard errors by neighborhood.

[23] Author interview, November 11, 2018.

[24] Author interview, November 7, 2018.

[25] Author interview, November 11, 2018.

we have to pay Rs. 20,000 rent. Here, not even 1.5 kms from here. If we just go for a same house, same infrastructure and all we have to pay [high] rent."[26]

"It is definitely not possible. It won't happen. It won't be sufficient. No matter how much happens, it won't be enough. Here, we have made everything the way we want it. [For] the same thing, if we go elsewhere, maybe this [rent] will be tripled or quadrupled."[27]

"If we have to go anywhere else, it would cost lakhs of rupees. If you were to valuate this site, it would cost around Rs 15 lakhs to buy a place like this outside... In earlier times, we purchased this place for just Rs 5000 from another person."[28]

5. Discussion

The evidence presented suggests slum neighborhoods develop along very different trajectories, though they rarely convert to non-slum areas. Within neighborhoods, many households experience upward mobility, the level of upward movement plateaus, and residents remain particularly susceptible to downward turns. Furthermore, we find people rarely move out to non-slum – or even to nicer slum – neighborhoods. We distill the evidence discussed here to what we believe are the five most important findings on social mobility in slums.

First, most slums develop over time, but few cease to exhibit the deprivations characterizing slum areas. We find no relationship between slum age and infrastructure quality. Rather, neighborhoods develop at different rates. Preliminary evidence suggests variation is driven by differences in political support, though this remains an important avenue for future inquiry.

Second, movement in and out of slums is relatively limited, and people rarely move to non-slum areas. The vast majority of slum residents are urban natives and have only ever lived in one neighborhood in their home city. Those who do move out tend to move to other urban slums, usually to be closer to work opportunities. The rare cases of movement to non-slum areas that were reported are limited to a small number from the most well-off slums.

Third, many slum households experience upward mobility, but opportunities are greater for some groups than others. Historically marginalized caste groups experience smaller gains than other groups and are more likely to work in the same occupational categories as their parents. Opportunities are also stratified by location. Those in more well-off neighborhoods are more likely to experience upward mobility, and to make larger gains, than those in less well-off neighborhoods, though, as discussed, their chance of downward mobility is also greater. Furthermore, residents of Bengaluru experience upward mobility (and downward mobility) more frequently than those residing in slower growing cities.

Fourth, though some upward mobility is common, the level of upward mobility reaches a plateau. Most people have experienced some positive gains but not enough to transcend to middle class status. Basic capabilities remain low and moving to non-slum areas remains prohibitively expensive. Most slum residents continue to work in manual labor and other unskilled informal occupations, despite rising educational attainment. This is consistent with longitudinal evidence from Brazil, where the labor market has become more dualized and a rising educational premium has made it harder for the urban poor to move from informal to formal positions (Perlman, 2006).

Finally, we find high volatility across slums. In the areas where we see the largest upward mobility, we also observe the largest downward mobility, suggesting gains remain precarious as long as one resides in a slum.

The informal nature of slum life has a great deal to do with the precarity that limits sustained gains. Many slum residents are "triply informal" with informal *jobs* (not protected by a contract or labor laws and not assured of social protections, like health care and old-age pensions); informal *properties* (with no titles or partial titles); and informal *identity papers* (Rains & Krishna, 2019). As a result, slum residents are susceptible to financial shocks (Harriss-White, Olsen, Vera-Sanso, & Suresh, 2013), vulnerable to displacement from evictions and increasingly unaffordable property values (Gulyani & Talukdar, 2008; Payne, 2001), and face outsized health risks from hazardous environmental conditions (Ezeh et al., 2017; Marx et al., 2013; Seeliger & Turok, 2014). Multiple dimensions of informality cumulatively contribute to the precariousness of life in slums.

Informality results in disconnection from various institutions that serve as a source of economic vitality for other city residents. Only 1.8 percent of slum households had health insurance compared to 5.1 percent of non-slum urban households, as indicated by a nationwide sample survey.[29] Less than five percent of slum dwellers had availed themselves of institutional sources of home financing compared to more than three times this proportion, 18 percent, of non-slum households. Less than three percent of residents in the best-off slums of Bengaluru transact with banks. Less than two percent were provided with career advice or assisted in their job search by any NGO, social or religious body or government institution The vast majority of working adults – 95 percent of men and 94 percent of women – have learned their trades and acquired their skills in informal ways. Interventions should both help connect slum dwellers to institutions that allow them to move beyond plateaus and mitigate against the risks present in slums that threaten upward gains.

6. Conclusion

The increasing number of people living in slums globally poses important challenges for development. Practitioners and researchers need better information to be properly equipped to address these challenges. In light of severe data deficiencies, we build our own original sample of Indian slums, including both documented and undocumented neighborhoods across three diverse cities. Similar data collection efforts should be undertaken in other cities around the world to ensure policy lessons are not drawn from misleading statistics but rather cover the entire continuum of slums.

Our findings suggest it is important to recognize that slums are not temporary phenomena and should not be treated as such. Instead, policy interventions should focus both on supporting upward mobility and mitigating against risks to downward mobility.

Many households experience upward growth, but a move to a more stable middle class is unlikely without additional support. Without affordable housing options or connections to more highly skilled employment opportunities, people will not be able to surpass the plateaus.

For containing downward mobility, slum residents require stronger social safety nets. Progressively formalizing the informal conditions of life in slums is necessary to reduce risks and volatility. Not only is insurance against job loss and basic health prob-

[26] Author interview, November 11, 2018.
[27] Author interview, November 1, 2018.
[28] Author interview, November 5, 2018.

[29] This survey, the Human Development Profile of India – II, covering more than 50,000 households, was administered by the Indian National Council for Applied Economic Research (NCAER) in 2004–05.

lems necessary, but insurance against the elements is also crucial. Specific policy interventions are likely to vary across locations, though measures are required to both raise upward mobility and reduce downward mobility. Future work should evaluate both types of interventions.

CRediT authorship contribution statement

Emily Rains: conceptualization, investigation and methodology, analysis, writing - original draft, and writing - review & editing. **Anirudh Krishna:** conceptualization, funding acquisition, investigation and methodology, project administration, writing - original draft, and writing - review and editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix

A1. Recruitment for qualitative interviews

Household recruitment:

The field managers had prior familiarity with the neighborhoods and neighborhood leaders, and went first to each neighborhood to recruit potential interviewees. After interviewing area leaders (not drawn on in this article), households were recruited. The field managers followed the right-hand rule approach based on a "sampling" interval to recruit households. The interval was calculated based on the number of households in the neighborhood as estimated in their focus group data. The goal was to cover the entire spatial distribution of the neighborhood and to recruit up to 30 possible candidates per neighborhood.

The field manager discussed the study and asked if they were willing to sign up. They were told they would not be offered compensation; though we gave all participants – leaders and non-leaders – a gift (a tiffin) upon completing the interviews. We interviewed 15 people in each neighborhood; half (7 or 8) women and half (8 or 7) men. We started by conducting interviews with the previously recruited individuals, schedule permitting. To recruit the additional remaining people, we recruited on days we also conducted interviews. We alternated visiting on weekends and weekdays and on field visit days, we spent the entire day in the neighborhood, such that we could check on the same house at various times in the day.

A2. Model output for correlates of satellite score

VARIABLES	Satellite score	Change in satellite score
Previous score		−0.145
		(0.140)
Number of households	3.11e−05*	2.31e−05
	(1.64e−05)	(1.46e−05)
Slum age	0.00658***	0.00435***
	(0.00107)	(0.00102)
Slum age squared	−3.73e−05***	−2.50e−05***
	(7.05e−06)	(6.55e−06)
Distance from city center	1.83e−05*	1.98e−05**
	(1.00e−05)	(8.88e−06)
Distance squared	−1.08e−09**	−1.14e−09**
	(5.16e−10)	(4.57e−10)
Constant	0.102*	0.00604
	(0.0617)	(0.0568)
Observations	135	135
R-squared	0.293	0.190

Standard errors in parentheses.
***p < 0.01, **p < 0.05, *p < 0.1

A3. Variance inflation factor for model variables

Variables	[1A]	[1B]	[2A]	[2B]
Occupation class 2[a]	1.97	1.39	1.34	1.12
Occupation class 3	1.47	1.30	1.10	1.04
Occupation class 4	1.44	1.28	1.10	1.05
Occupation class 5	1.22	1.20		1.15
Stages of progress[b]	5.26	1.44	7.23	1.30
Female household head	1.21	1.07	1.05	1.03
Household size	4.06	1.15	4.08	1.15
Religion (Muslim)	1.53	1.35	1.59	1.37
Caste (SC/ST)	2.15	1.31	2.12	1.29
Migrant	1.63	1.24	1.76	1.31
Remittances to rural area	1.17	1.14	1.20	1.16
Years in home	3.48	1.30	3.63	1.37
Years of education	2.60	1.38	2.77	1.28
Knows informal leader	3.45	1.15	3.97	1.14
Slum score	1.62	1.75	1.58	1.74
Slum age	3.49	1.28	3.67	1.28
Slum size (households)	1.75	1.12	1.88	1.13
Jaipur	2.65	1.74	1.84	1.38
Patna	2.59	1.87	2.20	1.75
Mean VIF	2.35	1.34	2.45	1.27

[a]Occupation is respondent occupation for [1A] and [1B] and father occupation for [2A] and [2B].

[b]Stages-of-progress score is from ten years before survey for [1A] and [1B] and the score at the time of survey for [2A] and [2B].

A4. Model output for correlates of downward mobility

Variables	[3A] Negative (sop)	[3B] Size (sop)	[4A] Negative (occupation)	[4B] Size (occupation)
Occupation class 2[a]	−0.587***	−0.0451	−3.243***	−0.255**
	(0.156)	(0.0728)	(0.314)	(0.104)
Occupation class 3	−0.623***	−0.0260	−1.541***	−0.0169
	(0.220)	(0.0875)	(0.290)	(0.182)
Occupation class 4	−0.222	−0.0413	−1.938***	−0.0807
	(0.217)	(0.0845)	(0.287)	(0.191)
Occupation class 5	−2.584***	−0.792***	–	1.134***
	(0.475)	(0.125)		(0.221)
Stages of progress[b]	1.069***	0.337***	−0.140***	0.00402
	(0.0685)	(0.0188)	(0.0457)	(0.0355)
Female household head	0.448***	0.0864	0.781**	0.219
	(0.166)	(0.0666)	(0.384)	(0.195)
Household size	−0.118***	−0.0387***	−0.0460	−0.00447
	(0.0339)	(0.0102)	(0.0333)	(0.0214)
Religion (Muslim)	0.308*	0.0882	−0.411**	−0.0634
	(0.178)	(0.0856)	(0.195)	(0.115)
Caste (SC/ST)	0.157	0.128**	−0.244	−0.179**
	(0.143)	(0.0608)	(0.174)	(0.0786)
Migrant	−0.136	−0.0549	0.0620	0.313***
	(0.170)	(0.0553)	(0.207)	(0.105)
Remittances to rural area	0.506	0.0621	−1.093	0.618
	(0.649)	(0.407)	(0.915)	(0.588)
Years in home	−0.00869*	−0.000513	0.00639	0.00154
	(0.00463)	(0.00188)	(0.00572)	(0.00322)
Years of education	−0.0693***	−0.00746	−0.0858***	0.0214*
	(0.0156)	(0.00727)	(0.0226)	(0.0114)
Knows informal leader	−0.0163	0.110*	−0.237	−0.00637
	(0.176)	(0.0576)	(0.183)	(0.0807)
Slum score	0.0266	0.00748	−0.123	0.0704**
	(0.0599)	(0.0175)	(0.0844)	(0.0300)
Slum age	−0.00405**	−0.00109**	0.000190	0.000921
	(0.00173)	(0.000533)	(0.00139)	(0.001000)
Slum size (households)	−0.000294	−4.97e-05	0.000124	0.000104
	(0.000201)	(3.70e-05)	(9.74e-05)	(7.21e-05)
Jaipur	0.576***	−0.522***	−0.427**	0.419***
	(0.195)	(0.126)	(0.188)	(0.120)
Patna	1.638***	−0.379***	−0.785***	0.460***
	(0.202)	(0.123)	(0.262)	(0.131)
Constant	−5.411***	−0.0491	3.562***	0.128
	(0.332)	(0.167)	(0.471)	(0.201)
Observations	4,819	1,126	1,104	720
(Pseudo) R-squared	0.413	0.397	0.220	0.209

Robust standard errors in parentheses.

***p < 0.01, **p < 0.05, *p < 0.1.

[a]Occupation is respondent occupation for [3A] and [3B] and father occupation for [4A] and [4B].

[b]Stages-of-progress score is from ten years before survey for [3A] and [3A] and the score at the time of survey for [4B] and [4B].

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