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Housing for India's Low-Income Urban Households:

A Demand Perspective

DEBARPITA ROY

MEERA ML

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Abbreviations

ABY	Ayushman Bharat Yojana
AHP	Affordable Housing in Partnership
AHS	American Housing Survey
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
ARHC	Affordable Rental Housing Complex
BHK	Bedroom Hall Kitchen
BLC	Beneficiary-led Construction
BLC (E)	BLC (Enhancement)
BPL	Below Poverty Line
BSUP	Basic Services to Urban Poor
CLSS	Credit-linked Subsidy Scheme
CPI	Consumer Price Index
DU	Dwelling Unit
EU	European Union
EWS	Economically Weaker Section
FAR	Floor Area Ratio
FSU	First Stage Units
GOI	Government of India
HFAPoA	Housing for All Plan of Action
HFC	Housing Finance Company
HIG	High-income Group
HTI	Housing Price to Monthly Income
IEC	Information, Education and Communication
IHSDP	Integrated Housing and Slum Development Programme
ISSR	In Situ Slum Redevelopment
IW	Industrial Worker
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
LIG	Low-income Group
LPG	Liquefied Petroleum Gas
MCE	Monthly Consumer Expenditure
MIG	Middle-income Group

MoHUA	Ministry of Housing and Urban Affairs
MoHUPA	Ministry of Housing and Urban Poverty Alleviation
MPCE	Monthly Per Capita Consumer Expenditure
MTA	Model Tenancy Act
NBO	National Buildings Organisation
NCP	National Commission on Population
NSS	National Sample Survey
NSSO	National Sample Survey Office
NULM	National Urban Livelihoods Mission
OLS	Ordinary Least Squares
PMAY U	Pradhan Mantri Awas Yojana – Urban
RAY	Rajiv Awas Yojana
RBI	Reserve Bank of India
R&D	Research and Development
SC	Scheduled Castes
SFCPoA	Slum Free City Plan of Action
SRS	Slum Rehabilitation Scheme
ST	Scheduled Tribes
TG 11	Technical Group 11
TG 12	Technical Group 12
ULB	Urban Local Body
UN MDG	United Nations Millennium Development Goals
UNSD	United Nations Statistics Division
UT	Union Territory
2SLS	Two-Stage least squares

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Abstract

Housing, particularly for low income urban households, is a long-standing challenge in India. In 2012, 96 per cent of the all India urban housing shortage of 18.78 million was confined to low-income economic groups. This study empirically examines three facets of urban India's housing demand using the latest available nationally representative household data on housing conditions. First, we estimate the urban housing shortage. Employing a methodology similar to that used by the Technical Group for the Twelfth Five-Year Plan (TG12) based on households which are physically inadequately housed, we find the shortage to be 29 million in 2018. However, the much needed and sustained policy focus on slum housing, which is not restricted to physically inadequate slum houses, warrants a broader approach to estimating housing shortage. Employing a broader approach, we estimate the upper bound of urban housing shortage to be 50 million. We find more than 99 per cent of the shortage has been confined to low-income economic groups in 2018. Second, we analyse the housing consumption demand of low-income households, or these households' demand for housing for purposes of residing or 'living in', and find demand to be price and income inelastic. Inelasticity or the lack of sensitivity of housing consumption demand to changes in price and income, is more pronounced in the case of poorer households and in the case of price. Third, since congestion in households is a prime cause of housing inadequacy, we focus on understanding the demand behaviour of congested households. We find low-income households seem to have accepted congestion as a way of life and it does not impact their housing demand behaviour, making the task of addressing congestion even more challenging. Our findings indicate that policies for housing urban India's inadequately housed households would have to work in tandem with efforts to improve their health, education, and livelihoods, focus on rental housing for the most vulnerable economic group among low-income households, and further incentivise incremental housing to address congestion.

Key words: *Housing shortage, congestion, housing demand, household surveys, slum, income groups*

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Authors' email: *droy@icrier.res.in, debarpitaroy@gmail.com, mml@icrier.res.in*

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Housing for India's Low-Income Urban Households: A Demand Perspective

Debarpita Roy and Meera ML

1. Introduction

As India's urban population swells, its housing woes increase, particularly for its low-income residents. Economic growth, stringent planning and development regulations leading to inefficient land use, and speculative investment in land and real estate has led to a rise in land and housing prices in cities and a decline in housing affordability. Over the last 20 years, housing prices in the largest seven cities[1] of India more than doubled (The Economic Times 2020). Although the rate of increase in prices has tapered off over the last 10 years with prices declining in some cities over the last 5 years, housing affordability has worsened on the back of already high prices. Measured as the ratio of median housing price to monthly income (HTI), affordability worsened with the HTI increasing from 56.1 to 61.5 between 2015 and 2019 across 13 metropolitan cities (RBI 2019). In a study of 49 metropolitan and non-metropolitan cities, it was found that households with an annual income of less than Rs.6 lakh could afford to purchase a new house in only five of the cities, households with an annual income of less than Rs.12 lakhs in nine of the cities and households with an annual income of less than Rs.18 lakhs in 18 of the cities (Palayi and Priyarajan 2018). Besides, a study of 29 metropolitan cities found that households that earned less than the city's average income were unable to afford the rent for a 1 BHK apartment in any of these cities in 2017 (Mahadevia 2019).

Formal housing supply has been out of sync with housing affordability and demand from low-income households. The last two decades saw more and more houses built for middle- and high-income households, with supply outstripping demand (Cushman and Wakefield 2016). But, formal supply of housing for the low-income group did not increase in tandem with their need for housing. The formal housing stock built for these households under public housing programmes also found few takers as these failed to take into account the preferences of these households. Households were unable to afford suitable existing and new formal housing stock and found themselves being pushed to the city peripheries, to in-city slum housing and to living in congested conditions. Many scholars see this as the failure of the urban planning process to be inclusive (Bhan 2013) and as one of the factors contributing to the incompatibility between housing demand and supply. This incompatibility between housing demand and supply is manifested in the fact that one-tenth of urban housing stock remains vacant (Census 2011). In addition to this, increasing economic activity in cities has led to one-fifth of urban housing being used for non-residential purposes. However, alongside vacant houses and residential units not used for residential purposes, a large section of low-income urban households continues to live in slum housing that is inadequate – physically, socially and in the eyes of the law and the government. More than 22 per cent of urban households lived in slums in the 2543 cities in which there were slums (Census 2011). Low-

[1] Delhi, Mumbai, Bengaluru, Hyderabad, Ahmedabad, Chennai and Kolkata

income households, including the urban poor, also live in non-slum areas in inadequate physical housing conditions with inadequate tenure security. In addition to this, 0.94 million low-income individuals were homeless in the cities (ibid).

In 2012, the Technical Group (TG 12) set up by the Ministry of Housing and Urban Poverty Alleviation (MoHUPA) for assessing the urban housing shortage estimated the need for 18.78 million 'new houses' and 'houses needing enhancement', based on their estimate of inadequately housed urban households across India. This definition of an inadequately housed household was purely in the physical sense, based on physical characteristics of the house and the household. A household was considered to be living in inadequate housing if it was either homeless or living in an unserviceable *katcha* house or in an obsolescent house or in congested condition. Of the 18.78 million, 18 million were low-income households i.e. they belonged to the economically weaker section (EWS) and low-income group (LIG). Based on this shortage estimate, the *Pradhan Mantri Awas Yojana* – Urban (PMAY U) scheme under the 'Housing for All' mission was launched in June 2015 with the tentative target of enabling the construction and enhancement of 20 million houses across urban India.[2] It is important to keep in mind that usually unless a household itself eithers chooses to relocate or upgrade its home, its housing condition cannot be improved. Thus, at best, the urban housing shortage of 18.78 million units was an indicator of the number of existing houses to be augmented or new houses to be built. It was not an exact measure of the aggregate demand for houses. So, the mission revised its target based on the number of applications approved and identified an aggregate demand of 11.22 million houses across EWS, LIG and middle-income group (MIG) households, for its four verticals – *in situ* slum redevelopment (ISSR), credit-linked subsidy scheme (CLSS), affordable housing in partnership (AHP) and beneficiary-led construction (BLC). Following the large-scale exodus of migrant workers from cities after the imposition of a nation-wide lockdown, which highlighted the lack of secure rental housing in cities, a social rental housing scheme called the 'affordable rental housing complex' (ARHC) was launched in May 2020, under the PMAY U umbrella.

It is possible that the number of households who might be inadequately housed might be more than 11.22 million. So, it is important to be aware of the present scenario in terms of households who are living in inadequate housing and require policy attention and interventions. Hence, the first objective of the paper is to estimate the number of urban households living in inadequate housing, keeping in mind the policy focus on provision of physically adequate houses which are formal in nature.

Current and past housing policies and interventions in low-income housing since independence have been formulated in the context of the housing gap in terms of inadequately housed households. At the same time, it is widely recognised that success has been limited. Identified demand side limitations include the limited off take of houses built for low income households as part of schemes such as Basic Services to Urban Poor (BSUP)

[2] https://pib.gov.in/newsite/PrintRelease.aspx?relid=122576, accessed on July 31, 2020

due to location and type of house built (Bhan 2014), difficulty in mobilising community support for such initiatives (Barnhardt et al. 2017), challenges to accessing credit (Das et al. 2018) and exclusion of households from government schemes because they are unable to prove occupation of their houses or ownership of land (Das and Mukherjee 2018). We supplement the existing literature on urban India's housing demand issues with an understanding of the nature of low-income households' demand for housing, based on the latest available data.

Housing is a consumption good as well as an investment good. A household consumes housing services or resides in a house based on its consumption demand for housing (Henderson and Ioannides 1983, Ioannides and Rosenthal 1994). A house caters to both consumption demand as well as investment demand for housing in the case of an owner-occupier household (ibid). The proportion of owner-occupied households in urban India has consistently risen over the past few decades from 46.2 per cent in 1961 to 69.2 per cent in 2011. A renter household's home caters to its consumption demand for housing. Such a household might own a house elsewhere, in which case the house it owns but does not live in caters to its investment demand.

In the case of low-income households, investment in physical assets such as land and housing are the most common avenues for investment and asset creation. An exact estimate of asset value held as housing by households is not available at the household level. But 47 per cent and 45 per cent of the total value of the sum of all physical and financial assets of urban households in 2013 was on account of household ownership of land and buildings (NSS 2014[3]). Rental housing available to low-income households is rarely of a formal nature and usually lacks in tenure security (Kumar 2001). Available rental housing is usually of poor quality, compared to owner-occupied housing. Thus, there is a strong preference for home ownership among EWS and LIG households. Living in a house they own does not translate into living in adequate housing. In 2012, about 96 per cent of inadequately housed households belonged to EWS and LIG households (TG 12) and about 62 per cent of all inadequately housed households were owner-occupier households.[4] Moreover, a significant number (13.75 million) of all urban households lived in slums and about 70 per cent of all slum households were owner-occupiers (Census 2011).

Most housing policies targeting EWS and LIG households are designed based on the understanding that an urban household lives in inadequate housing since it cannot afford to invest in a house of choice. Thus, incentives and subsidies, which lower the cost of either purchasing a house or costs associated with self-construction of a new house or augmenting an existing one, have been a primary policy focus.

To address the issue of households living in an inadequate house, the focus has to be on ensuring that households live in a house which is adequate for them. One is better equipped

[3] Key Indicators of Debt and Investment, NSS 70th round survey, 2014

[4] Authors' calculation based on estimates presented in TG 12 report

to do so if one is able to understand the nature of households' consumption demand for housing, which manifests in the flow of housing services consumed over a period of time for both owner-occupier and renter households. This is the second objective and the third section of our paper and will help design more effective policies and strategies to spur the demand for housing or 'demand for housing to live in' for India's EWS and LIG urban households. In order to do so, it is important to use an appropriate measure of the flow of housing services consumed over a period of time. We capture this through rent for rented houses and imputed rent for owner-occupied houses. Imputed rent for an owner-occupied house is predicted based on the hedonic price function for rented houses, thus, ensuring that the imputed rent for an owner-occupied house is a pure measure of the flow of housing services to the exclusion of any value derived from it as an asset.

Lack of adequate space or congestion is one of the predominant causes of inadequate housing. Eighty per cent of the urban housing shortage was due to households living in congested conditions in 2012 (TG 12). TG 12 identified a household as living in congestion if a married couple did not have a separate room. Using another definition of congestion that considers households having a household size of two or more living in one room or having no exclusive room as congested, Kundu et al. (2016) finds 35.7 per cent of households in metropolitan cities, i.e., cities with a population of 1 million or more and 30.4 per cent of households living in cities with a population between 1 lakh and 1 million lived in congested conditions based on data from Census 2011.

One of the findings based on the first objective of this paper indicate congestion as a persistent condition, affecting urban EWS and LIG households. The first step to rectifying congestion and ensuring adequate housing for such households is to understand if living in congested conditions has any effect on the demand behaviour of these households. This forms the basis of our third objective – understanding the effect of living in congested conditions on demand for space captured through the number of rooms. The next three sections i.e. the second, third and fourth sections focus on the three specific objectives of the paper. The fifth and final section discusses three specific policy implications.

2. Households living in inadequate houses and housing shortage

The core goal of housing policies worldwide is to ensure access to adequate housing for inadequately housed households. What constitutes an adequate house is based on housing characteristics as well as characteristics of the household occupying the house, and varies across countries, communities and agencies defining them. The right to adequate housing is recognised as a part of the right to an adequate standard of living by the United Nations (UN 1948, 1966). Ideally, an adequate house is one which provides a household with security of tenure and protection from forced eviction, access to basic services while being affordable for the household, i.e., it does not make the household compromise on the enjoyment of other human rights, is spacious enough for the household, protects against adverse weather and pollution, is structurally safe, close enough to the place of employment, schools, hospitals, etc., and does not adversely impact the household's social and cultural identity (UN 1991,

1997). Norms defining adequate housing are stricter in developed countries than in developing countries.

The American Housing Survey (AHS) considers a housing unit to be severely inadequate if there are issues in water supply, plumbing, air conditioning, electricity or structural issues such as cracks in the wall, etc.[5] Similarly, housing inadequacy across countries in the European Union (EU) is primarily defined and measured in terms of availability of basic services and structural issues and overcrowding (Eurofound 2016). In Brazil, households living in housing built with non-permanent materials, more than one household living in one dwelling unit (DU), more than three individuals sharing a bedroom and any poor household spending more than 30 per cent of its monthly income on rent is considered to be inadequately housed (Acolin et al. 2015, Leite Jr. et al. 2016). Similarly, in Mexico, households living in houses built with non-permanent materials and in crowded conditions with more than two individuals per room are considered as living in inadequate houses (Federal Mortgage Society, Government of Mexico 2019). In India, a *pucca* house, i.e., an all-weather single unit or a unit in a multi-storeyed super structure having a carpet area of at least 30 sq. m with adequate basic civic and infrastructure services like toilet, water, electricity, etc., is considered to be an adequate house for a household comprising a couple and their unmarried children and having a monthly income of Rs.25000 or less, under the PMAY-U scheme (MoHUA 2015).[6] Such a house typically consists of two rooms, one toilet, one bath and one kitchen and is possibly designed keeping in mind an average urban household size of four. It is built in compliance with prevalent planning norms and development regulations and thus, is a part of the formal housing stock with clearly defined property titles. So, in the Indian urban housing policy context, an adequate house is one which is physically adequate, i.e., it is structurally adequate, not congested, and is formal in nature.

Largely based on the number of 'inadequately housed households', the urban 'housing shortage' was estimated every five years to help formulate India's five-year plans and is widely acknowledged to be rising over time (Graph 1). 'Inadequately housed households' were usually households living in structurally inadequate houses and in congested conditions, i.e., in houses that were physically inadequate to serve its needs; and the surplus of households over existing housing stock. Urban 'housing shortage' is an estimate of the number of houses that need to be augmented and the new houses required to ensure that all inadequately housed urban households, including the homeless, are adequately housed. It is difficult to ascertain the division of housing shortage between the number of houses that need to be augmented and the new houses required. As a result, past housing shortage estimates too have not been explicit in making a distinction between the two. However, urban housing shortage has often been interpreted as the number of new houses required in popular discourse.

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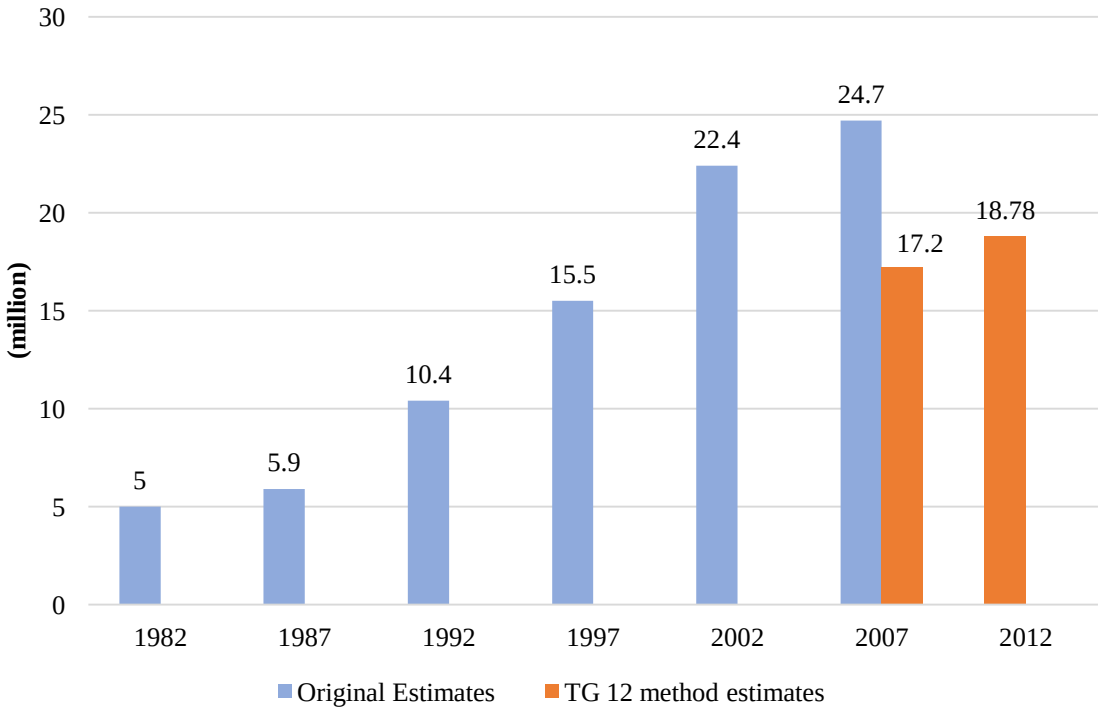
5 https://www.census.gov/content/dam/Census/programs-surveys/ahs/publications/HousingAdequacy.pdf, accessed on May 20, 2020

6 https://pmaymis.gov.in/PDF/HFA_Guidelines/hfa_Guidelines.pdf, accessed on May 20, 2020

The method of estimating shortage has varied across years and was revised significantly by the Technical Group for the Eleventh Five-Year Plan (TG 11). Using the same method as used by the Tenth Five-Year Plan to estimate housing shortage, it indicated a housing surplus rather than shortage during the Eleventh Five-Year Plan period. This led to a change in methodology for estimating the housing shortage by the TG 11, which was further refined by the Technical Group of the Twelfth Five-Year Plan (TG 12). Urban housing shortage estimated in the Eleventh Five-year Plan (2007-12) was 24.7 million, higher than the shortage estimated for the Twelfth Five-Year Plan (2012-17). But if estimated using the TG 12 methodology, which includes homeless households, households living in obsolete houses, in congested conditions and in unserviceable *katcha* houses, but excludes excess of households over housing stock from estimation of housing shortage,[7] it was 17.24 million and lower than Twelfth Five-Year Plan shortage (TG 12).

Graph 1: Urban housing shortage – 1982 to 2012



Note: Blue bars are original housing shortage estimates for the respective Five-Year Plans

Source: Planning Commission

These past estimates of housing shortage have focused on the physical inadequacy of housing. India's urban housing policy focus has been centred on enhancing access to formal housing for low-income households. Slum housing has been a housing solution for a sizeable

[7] The TG 12 report explains that excess of households over housing stock need not be a negative phenomenon; it could be due to single-member households such as students and young workers sharing a house.

number of such households. Slum settlements are usually viewed as irregularities that need to be corrected by the urban planning and regulatory processes. Hence, slums and housing in slums have received specific policy focus not limited to physically inadequate houses. In light of this, we expand on the previously employed approaches.

The housing shortage for 2018 has been estimated in two steps. First, the number of inadequately housed households, taking into account non-slum households which live in physically inadequate houses, slum households and homeless, has been estimated in sections 2.1, 2.2, 2.3 and 2.4. Based on this, the urban housing shortage has been estimated in section 2.5. The sum of inadequately housed households and the number of extra houses required on account of congested households whose current houses do not allow for augmentation to address congestion is the urban 'housing shortage'. Housing adequacy is strongly linked with affordability, with presence of housing inadequacy being higher in lower-income groups. Hence, the distribution of housing shortage across income groups has also been estimated in section 2.6.

2.1 Inclusion of slum housing in the estimate of inadequately housed households

Slum housing in the estimate of inadequately housed households is based on its treatment in India's urban housing policy. The rehabilitation of slum households, *in situ* redevelopment and *in situ* upgradation of slum houses, and conferment of property rights for slum houses form the cornerstone of India's urban housing policy framework. For instance, the latest national urban housing missions – *Rajiv Awas Yojana* (RAY) (2013 to 2015) – which envisions the creation of 'slum free cities' (Kundu 2013) and the PMAY U's *in situ* Slum Redevelopment (ISSR) (2015 to 2022), vertical are apt examples. Earlier, the national level BSUP scheme and the Integrated Housing and Slum Development Programme (IHSDP) under JNNURM, as well as the city level slum rehabilitation schemes (SRS) of Mumbai and Ahmedabad adopted similar strategies (Bhide 2012, Mahadevia 2018). Odisha's JAGA Mission (Odisha Liveable Habitat Mission) supported by the Odisha Land Rights to Slum Dwellers Act, 2017, focuses on granting land titles to slum dwellers and follows it up with housing upgradation.[8] Delhi's '*Jahan Jhuggi Wahan Makaan'* (2020) focuses on improving housing conditions and granting legal rights to slum dwellers (Bhan et al. 2020).

An assessment of the type of housing intervention required at the slum and at the household level was a part of RAY and PMAY U. The city-level slum free city plan of action (SFCPoA) in the case of RAY and the housing for all plan of action (HFAPoA) as a part of PMAY U were to define the housing strategy to be adopted for each slum. Both plans of action focused on slum housing as a separate head requiring attention. In the case of RAY, intervention strategies included relocation of slum households to new houses in the case of non-tenable slums, *in situ* redevelopment of housing and slum upgradation involving incremental housing improvements and constructing *pucca* houses in place of *kutcha* ones in case of tenable

[8] http://www.jagamission.org/pdf/Odisha%20Land%20Rights%20to%20Slum%20Dwellers%20Act%202017.pdf, accessed on November 1, 2020

slums. Tenable slums are those that can be redeveloped *in situ*. PMAY U's intervention strategies included the creation of new houses *in situ* as part of slum redevelopment (ISSR vertical) and *in situ* beneficiary-led construction (BLC) of new houses or augmentation of existing ones in the case of tenable slums; construction of new houses as a part of affordable housing in partnership (AHP), and credit subsidy to households for purchase or construction purposes (CLSS), in the case of non-tenable ones.

It is important to note that not all slum houses are physically inadequate. As per our calculations, about 56 per cent of slum households live in housing that can be considered physically adequate, i.e., *pucca* and neither obsolete nor congested (authors' calculations, NSS 2019a). Information on what proportion of households are in tenable slums and hence, do not need to be relocated to new houses is not available for all urban areas. Although these houses might be physically adequate, it is common knowledge that living conditions in slums are significantly inferior compared to housing in non-slum areas. As of 2018, about 50 per cent of all slum households lived in houses which were plagued by either all or some of these conditions: insufficient drinking water, lack of proper drainage, visible human faeces and stagnant water in or around the house (author's calculation, NSS 2019a). An improvement in living conditions through slum upgradation might be difficult to achieve in the case of high-density slums. In that case, redevelopment of the entire slum including the households that are physically adequately housed might have been considered. Similarly, if new houses are required for a majority of households residing in a tenable slum, the physically adequately housed households will also be included in the redevelopment scheme. Interventions pertaining to formal recognition and conferment of land and property rights to eligible beneficiaries also include the physically adequately housed. Thus, slum households considered for housing interventions might not be limited to those that live in physically inadequate houses.

Exercises such as SFCPoA and HFCPoA focused on identifying beneficiaries for the respective schemes. Thus, there is a chance that even if a household requires housing intervention, unless it is eligible as per the scheme guidelines, it is not included as a household in need of housing intervention. An all-India level estimate of the aggregate number of slum households considered for housing interventions is not available. Keeping in mind the housing policy focus on slums, the total number of households living in slums can be considered as the upper bound of the size of India's slum housing challenge.

Estimating the number of slum households in 2018: The urban slum population in 2011 was 65 million or 17.4 per cent of India's total urban population and 22.4 per cent of the population in cities where the presence of slums was found (Census, 2011). According to Census 2011, slums include notified slums or all areas in a town or city notified as 'slum' by the state, UT or urban local government under any 'Act' (36.1 per cent of slum households); recognised slums, i.e., areas not yet notified but recognised as slums by the state, UT or urban local government or housing and slum boards (27.6 per cent); and identified slums, i.e., 'any compact area of at least 300 population or about 60-70 households of poorly built congested

tenements in unhygienic environment usually with inadequate infrastructure and lacking in proper sanitary and drinking water facilities'[9] (36.3 per cent).

NSSO follows a wider definition for identifying an area as a slum. It classifies slums into two categories – notified slums, which broadly follows the Census definition, and non-notified slums – a contiguous area in which at least 20 households live in poorly built tenements that are crowded together in unhygienic condition with inadequate drinking water and sanitary facilities. Further, any settlement with less than 20 households is classified as a 'squatter settlement' by the NSSO. We include such settlements as slums in our analysis. Living conditions in these settlements are usually the worst and only 1 per cent urban households lived in them in 2018 (NSSO 2019a).

In 2009, a committee set up by MoHUPA, GOI, following the NSSO slum definition, projected the population living in slums for the period from 2011 to 2017 (NBO 2010). The Committee projected the slum population at 104.7 million in 2017,[10] which is 23.9 per cent of National Commission on Population (NCP)'s projected urban population for 2017. Estimates from the UN MDG database of United Nations Statistics Division (UNSD) also support this. As per UN MDG, the proportion of the slum population in urban population was 24 per cent in 2014.[11] The divergence between the Census 2011 estimates and MoHUPA and UN MDG estimates could be due to the difference in definitions followed to identify slum areas.

Since the aim of this study is to achieve as wide a coverage as possible of inadequately housed urban households across urban India, the MoHUPA estimates have been used as the base. It has been assumed that 23.9 per cent of the urban population lived in slums in 2018. This translates to 106.9 million people or 26.5 million households living in slums as of 2018 (Table 1). While the actual slum population as of 2018 may have been more or less, given the existing information available in the public domain, this is the best possible estimate.

[9] https://www.censusindia.gov.in/2011-Documents/Slum-26-09-13.pdf, accessed July 21, 2020

[10] The committee approached the task by dividing cities/ towns into two – one with reliable data on slum and the second with suspicious estimates. Following this, ward wise information on 119 original and derived parameters were collected from Census 2001. These parameters were related to population demographics pertaining to various social groups including gender, literacy, working categories and social groups. After suitable aggregation and matching of these parameters, important covariates for the slum population were identified to form a correlation matrix. Variables from the Census with a significant coefficient for slum population were identified and segregated. The identification of these variables was extended to state wise identification as well. As a result, 6 covariates were identified – SC population, ST population, illiterate population, non-workers' group, marginalised worker groups and casual labour groups. But these identified covariates were highly correlated with each other. Due to multicollinearity, a Principal Component Analysis approach was adopted. The Committee estimated the slum population in smaller cities/towns by utilising slum data for cities/towns with population ranging from 20000 to 25000 (applying correction factor).

[11] http://mdgs.un.org/unsd/mdg/Data.aspx, accessed on July 21, 2020

Table 1: Estimated number of slum households, 2018

S. No.		
A	Projected slum population 2017 in million (Committee set up by MoHUPA, GOI)	104.7
B	Projected urban population 2017 in million (NCP)	438.1
C	Estimated share of slum population 2017 (%) (A/B)	23.9
D	Projected urban population 2018 in million (NCP)	447.3
E	Estimated slum population 2018 in million (D*C)	106.9
F	Slum household size 2018 (NSS 76th round)	4.04
G	Estimated number of slum households 2018 in million (E/F)	26.5

Source: Authors' calculations based on UNSD (2015), NBO (2010), NCP (2019) and NSSO (2019a)

2.2 Inadequately housed households in non-slum areas

A household living in a physically inadequate house in non-slum areas has been considered inadequately housed. A physically inadequate house is one which is either obsolete or unserviceable *katcha* or congested for the household. The first step in estimating the number of inadequately housed urban households in non-slum areas is computing the obsolescence and congestion factors.

Obsolescence factor: The estimation of the number of 'inadequate houses' is based on relevant ratios calculated using household level data of the latest (76th round) NSSO sample survey of drinking water, sanitation and housing conditions for the year 2018. Data on the age and condition of the house is captured through categorical responses. The age of houses has been captured in 11 brackets,[12] with the highest age bracket being 60 years or more. The condition is captured as good, satisfactory or bad. Houses that are more than 60 years old, and houses that are between 40 and 60 years old and in bad condition, have been classified as obsolete houses. This criterion is similar in structure to the obsolescence criteria followed in the TG 11 and TG 12 reports,[13] and is well supported by other existing literature. The average life span of a *pucca* house in India is 50 years (Ramesh et al. 2012) to 75 years (Praseeda et al. 2016). In 2018, four per cent of non-slum households lived in obsolete houses.

Congestion factor: Households where married couples do not have a separate room are considered as households living in congested conditions, following TG 12 and TG 11. About 20 per cent of non-slum households were living in congested conditions in 2018. Of this, about 0.8 per cent of households also lived in obsolete houses. So, to avoid double counting, we consider 19.2 per cent of non-slum households to be living in congested conditions net of obsolescence, in non-slum areas. More than 90 per cent of congested non-slum households had only one couple without a separate room for themselves; in 6.7 per cent households, two couples had no separate room for themselves and in the rest, i.e., 2 per cent households, there were three or four couples who did not have separate rooms for themselves (Table A5).

[12] Less than 1 year, 1 to 2 years, 2 to 3 years, 3 to 4 years, 4 to 5 years, 5 to 10 years, 10 to 20 years, 20 to 40 years, 40 to 60 years, 60 years or more, not known

[13] TG 12 and TG 11 had classified houses more than 80 years old and more than 40 years old but in bad condition as obsolete houses

Unserviceable katcha houses: Unserviceable *kutcha* houses are houses that cannot be upgraded and should be replaced. Such houses were not restricted only to slum areas, although only 0.1 per cent of non-slum households lived in unserviceable *katcha* houses.

Table 2: Estimated number of non-slum households, 2018

A	Projected population in 2018 in million (NCP)	447.3
B	Household size 2018 (NSS 76th round)	3.9
C	Estimated number of households in 2018 in million (A/B)	114.7
D	Share of slum population in urban population (%) (MoHUA 2010)	23.9
E	Estimated slum population, 2018 in million (D*A)	106.9
F	Average size of households living in slum 2018 (NSS 76)	4.0
G	Total number of slum households 2018 in million (E/F)	26.5
H	Total number of non-slum households 2018 in million (C - G)	88.2

Source: Authors' calculations based on UNSD (2015), NBO (2010), NCP (2019) and NSSO (2019a)

By multiplying these relevant ratios with the projected number of non-slum households (Table 2), it was found that 3.5 million households lived in obsolete houses, 16.9 million non-slum households lived in congested conditions excluding those living in both obsolete and congested conditions, and 0.09 million non-slum households lived in unserviceable *katcha* houses (Table 3). So, in total, 20.5 million non-slum households or 23.2 per cent of all non-slum households are estimated to have been living in inadequate housing in 2018.

Table 3: Estimated number of inadequately housed non-slum households, 2018

A	Estimated number of non-slum households in million	88.2
B	Ratio of non-slum households living in obsolescence (%) (NSS 76)	4
C	Number of non-slum households living in obsolescence in million (B*A)	3.5
D	Ratio of non-slum households living in congested houses net of obsolescence (%) (NSS 76)	19.2
E	Number of non-slum households living in congestion net of obsolescence (D*A)	16.9
F	Ratio of non-slum households living in unserviceable katcha houses (%) (NSS 76)	0.1
G	Total number of non-slum households living in unserviceable katcha houses in million (F*A)	0.09
H	Total number of non-slum households living in inadequate houses in million (C+E+G)	20.5

Source: Authors' calculations based on UNSD (2015), NBO (2010), NCP (2019) and NSSO (2019a)

2.3 Homeless households in urban India

There were 0.26 million urban homeless households in 2011 (Census 2011).[14] The number of homeless households increased at an annual rate of 3.1 per cent between 2001 and 2011.[15]

[14] https://censusindia.gov.in/2011census/hh-series/hh02.html , accessed on November 6, 2020

[15] Number of urban homeless households was 0.19 million as per Census 2001. The exponential growth rate in number of homeless households between 2001 and 2011 was 3.1 per cent.

Applying the same growth rate, an estimated 0.3 million urban households were homeless in 2018.

2.4 Inadequately housed households in urban India

Adding the number of homeless households to the number of slum households and inadequately housed non-slum households, the estimated number of urban households inadequately housed in 2018 works out to a maximum of 47.3 million or 41 per cent of urban households.

Table 4: Estimated number of inadequately housed households in urban areas, 2018

A	Estimated number of slum households in million	26.5
B	Estimated number of inadequately housed non-slum households in million	20.5
C	Estimated number of homeless households in million	0.3
D	Estimated maximum number of inadequately housed urban households in million (A+B+C)	47.3

Source: Authors' calculations

2.5 Estimating urban housing shortage based on inadequately housed households

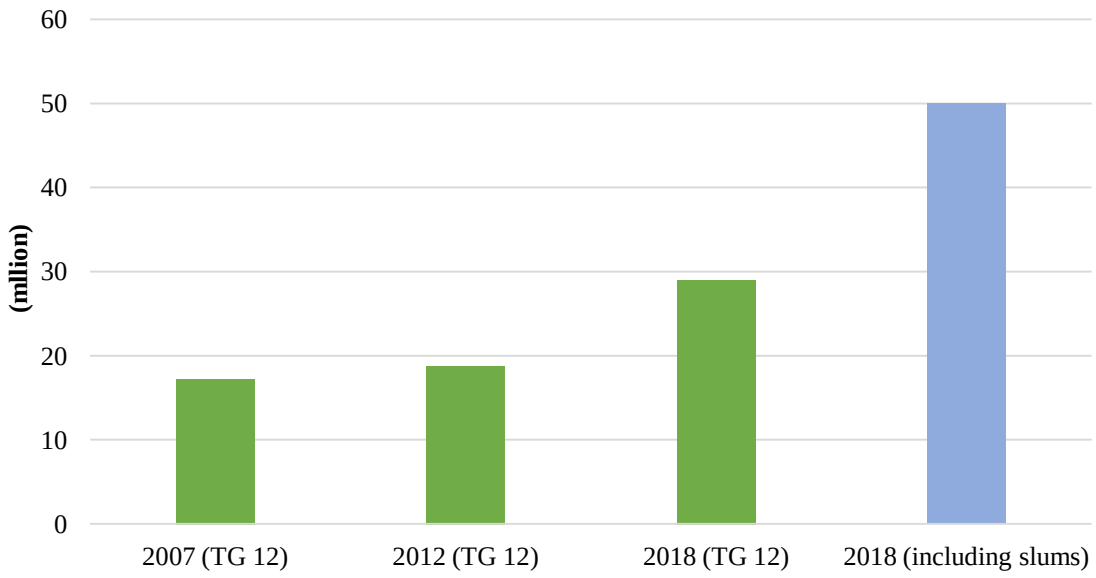
An estimate of the urban housing shortage can be arrived at by adding the estimated number of households with two or more married couples without separate rooms in slum and non-slum areas to the number of inadequately housed households[16]. In slum areas about 5 per cent of households had two or more couples without a separate room, which translates to an estimated 1.3 million additional houses. In non-slum areas about 1.6 per cent of households had two or more couples without a separate room, which translates to an estimated 1.4 million additional houses[17]. So, the estimated maximum housing shortage or the upper bound of the urban housing shortage as of 2018 is around 50 (47.3 + 1.3 + 1.4) million. This estimate includes the number of houses which would need to be either repaired, augmented or redeveloped and the number of additional houses required.

To have a more complete understanding of the increase in urban housing shortage between 2012 and 2018, the housing shortage following the exact methodology used by TG 12 is estimated. Following this method, the urban housing shortage is estimated to be 29 million as of 2018, this is one and a half times the urban housing shortage in 2012. To reiterate, this method is based on the physical inadequacy criterion irrespective of the settlement type a household lives in (slum, non-slum).

[16] In case of non-slum households, it is assumed that a household with one couple not having a separate room can be accommodated by housing augmentation. In case of slum households, it can be addressed either by moving to a new house which has one additional room for the couple or through housing augmentation of the existing house. Thus, no additional house is required in both cases.

[17] Additional rooms required for slum households: 5 per cent of 26.5 million = 1.3 million, additional rooms required for non-slum households: 1.6 per cent of 88.2 million = 1.4 million.

Graph 2: Urban housing shortage - 2007 to 2018



Source: Estimates from Planning Commission and authors' calculations

Note: Green bars depict housing shortage for the respective years, estimated using TG 12 method. Blue bar depicts the upper bound of the housing shortage in 2018.

2.6 Housing shortage across income groups

It is a general notion that a household usually lives in an inadequate house since it finds an adequate house unaffordable. A lower income household is more likely to be inadequately housed compared to a higher income household. Housing policies, like other welfare policies, are usually designed for specific income groups and target lower income and middle-income groups. In 2012, 95.6 per cent of urban housing shortage was accounted for by low-income households: EWS (56.18 per cent) and LIG (39.44 per cent) (TG 12). An EWS household was a household with monthly income less than or equal to Rs.5000, LIG household was a household with income greater than Rs.5000 but less than Rs.10,000, based on the norms laid down by MoHUPA, GOI. With the launch of the PMAY U mission in 2015, the income brackets were revised by the Ministry of Housing and Urban Affairs (MoHUA), Government of India – households whose annual income was up to Rs.300,000 or monthly income was up to Rs.25,000 were classified as EWS households, those with monthly income between Rs.25,000 and Rs.50,000 were classified as LIG households. MIG households were divided in two groups with monthly income between Rs.50,000 and Rs.100,000 (MIG I) and between Rs.100,000 and Rs.150,000 (MIG II). It is important to note that upper limit for both EWS and LIG category of households was revised upwards five times between 2012 and 2015.

Income levels are applicable for beneficiary households defined to comprise a married couple and their unmarried children.[18]

Since NSSO surveys do not have information on household income, we depend on reported monthly consumer expenditure (MCE) of households to ascertain which income bracket a household belongs to (TG 11, TG 12). To determine the distribution of households living in inadequate housing across income groups, we further divide the EWS category into two groups – EWS 1 or 'urban poor households' having household consumption expenditure below the poverty line,[19] and the rest of the EWS or EWS 2 households, who are above the poverty line but with a monthly income less than Rs.25000. LIG households are households whose income is more than Rs.25000 but less than Rs.50000. The middle income group (MIG) and other higher income households are households with a monthly income higher than Rs.50000. To arrive at the distribution of households across different categories based on the MCE of households, certain assumptions have to be made about the savings rate of households belonging to different income groups. In the TG 11 and TG 12 reports, EWS households were assumed to have a zero savings rate, and LIG households were assumed to have 17.5[20] per cent and 5[21] per cent savings rate for the years 2007 and 2012 respectively.

We assume a savings rate of zero for EWS 1 households. In case of EWS 2 households and other higher income households, we assume a savings rate of 19 per cent. This savings rate is based on a pan-India survey of Indian consumers conducted in 2014. This survey found that the average annual income of an urban household was Rs.264940 with a consumption expenditure of 81.2 per cent and saving of 18.8 per cent in 2013-14 (PRICE 2014).[22] Based on these assumptions, EWS 1 households are households having an MCE of at least Rs.10341,[23] EWS 2 households have an MCE greater than Rs.10341 but less than Rs.20300, LIG households have an MCE is between Rs.20300 and Rs.40600; households with MCE greater than Rs.40600 are MIG and other higher income group households.

For policy purposes such as identifying a beneficiary household for PMAY U, household income is a critical parameter. Since a household is defined as comprising husband, wife and

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18 As per PMAY U guidelines, a beneficiary is a family that comprises husband, wife and unmarried children https://pmaymis.gov.in/PDF/HFA_Guidelines/hfa_Guidelines.pdf, accessed on July 23, 2020

19 In 2011-12, the poverty line for urban areas defined by the Tendulkar Committee was Rs.1000 and by the Rangarajan Committee, Rs.1407. Following the Rangarajan Committee poverty line, any individual who incurs an MPCE less than Rs.1407 is considered poor. We adjust the poverty line using the CPI for industrial workers to reflect 2018 prices and multiply it by 5 (average household size of bottom two MPCE deciles) to arrive at the monthly consumption expenditure of a 5-member household, which is around Rs.10341. Poverty lines are sourced from https://www.rbi.org.in/scripts/PublicationsView.aspx?id=18621 and CPI for IW is sourced from https://dbie.rbi.org.in/DBIE/dbie.rbi?site=publications, accessed on July 22, 2020

20 MoHUPA, GoI 'Report of the 11th Five Year Plan (2007-12) Working Group on Urban Housing Shortage with Focus on Slums', page 24. Accessed from https://niti.gov.in/planningcommission.gov.in/docs/aboutus/committee/wrkgrp11/wg11_housing.pdf on September 7, 2020

21 TG 12 report, page 51

22 Source: http://www.ice360.in/uploads/files/thenationalsurveyofindianconsumers-web.pdf, accessed July 22, 2020

23 Refer to footnote 19

unmarried children, it is prudent to consider the monthly per capita consumer expenditure (MPCE) and the average household size for each MPCE decile as the basis for the distribution of households across income groups. Based on the 68th NSS round on Consumer Expenditure and 76th NSS round on Housing Conditions, we infer the distribution of households across the four categories for 2018 to be as follows: EWS 1 – 27 per cent, EWS 2 – 63.5 per cent, LIG – 9 per cent and MIG and above – 0.4 per cent of all households. In 2012, the distribution was as follows: EWS – 33.3 per cent, LIG – 46.7 per cent and MIG and above – 20 per cent (TG 12). At first glance, it appears as though this distribution has worsened in 2018 since 2012; however it is not so. The variation is due to changes in income thresholds defining the three categories. Instead of worsening, the distribution of households across different categories has improved between 2012 and 2018. Applying the 2012 income thresholds[24] on the 2018 household MCE data adjusted for inflation, we find that the EWS category accounted for 10 per cent, LIG for 48 per cent and MIG and above for 42 per cent of all households in 2018.

To determine the distribution of housing shortage across the four categories, we estimate the number of households living in obsolete houses, congested houses, unserviceable *katcha* houses in non-slum areas, and in slums across the MPCE deciles. Based on Tables A2, A3 and A4 and the prevailing distribution of households, we infer that 40.6 per cent of the housing shortage affected EWS 1 or below poverty line households, 56.8 per cent affected EWS 2 households, 2.6 per cent affected LIG households and a miniscule 0.04 per cent affected MIG and other high-income group households, in 2018. The concentration of housing shortage in the EWS category validates and underscores the importance of policies and schemes such as PMAY U, which target this group in particular.

Table 5: Housing shortage across household categories

Household category	**2018**		
	MCE	**Housing Shortage** *(million)*	**Share in housing shortage** (%)
EWS 1	<10341	20.3	40.6
EWS 2	10341 – 20300	28.4	56.8
EWS (EWS 1 +EWS 2)	<20300	48.7	97.4
LIG	20300- 40600	1.3	2.6
MIG & above	>40600	0.02	0.04
Total		50	100

Source: Authors' calculations

Note: 50 million is an estimate of the maximum or upper bound of the urban housing shortage. The distribution of housing shortage based on only physical inadequacy in 2018 across the four categories totalling 29 million follows a similar pattern: EWS 1 – 44.8 per cent, EWS 2 – 51.7 per cent, LIG – 3.5 per cent, and MIG and above – 0.05 per cent. (Authors' calculations)

[24] adjusted for inflation using CPI IW (RBI 2018b)

These estimates of the number of inadequately housed urban households, urban housing shortage and its distribution are meant to provide Indian policymakers and various other stakeholders an idea of the likely size of the existing urban housing challenge. We understand it is at best an approximation and needs to be supplemented with city-level housing shortage and requirement estimates conducted by local governments at regular intervals. The ongoing pandemic, loss of livelihoods, and the housing crisis faced by millions of informally housed migrant households following the nationwide lockdown only adds to the need to do so.

3. Effect of price and income changes on housing demand

It is important to note that unless housing inadequacy takes the form of consumption demand i.e., a household's demand for a house to reside or live in, the housing inadequacy faced by the household cannot be addressed and the household will continue to be inadequately housed. Hence, we focus on understanding household consumption demand for housing.

Households can live in a house as an owner-occupier or as a tenant. A house occupied by an owner-occupier household caters to two kinds of household demand – consumption demand for housing services, and investment demand for housing, i.e., a household's demand for a house as an asset (Lin 1999, Henderson and Ioannides 1983, Ioannides and Rosenthal 1994). A house occupied by a tenant household caters predominantly to the consumption demand for housing of the occupier household (ibid). A household will live in a house only when the house caters to its consumption demand for housing. Houses that cater to investment demand for a household are houses bought for the returns they could generate in terms of capital gains and rental returns. Unless such houses also cater to the consumption demand of the same household or another household, no one lives in them and they either remain vacant or are used for non-residential purposes. Of urban India's housing stock, about 10 per cent was vacant and 18 per cent was being used for non-residential purposes (Census 2011), primarily because these houses catered to the investment demand for housing.

We focus on understanding the nature of consumption demand for housing among low-income households (EWS 1, EWS 2 and LIG households) since these households make up more than 99 per cent of all inadequately housed urban households. This understanding should help formulate effective demand side policies. The two most important factors affecting consumption demand for housing are price and income. Other factors include household size, age of household head, gender of household head and ethnicity of household (Goodman 1988, Tiwari et al. 1998 and 1999, Ahmad et al. 2013).

3.1 Literature Review

There are eight existing studies on households' housing demand behaviour in the urban Indian context. Seven of these studies – Mehta and Mehta (1989), Malpezzi and Tewari (1991), Tiwari and Parikh (1998), Tiwari et al. (1999), Ahmad et al. (2013), Ahmad (2015) and Roy (2018) – pertain to the study of consumption demand for housing since they are based on rent or imputed rent of houses. Imputed rent for owner-occupied houses used in these studies was the imputed rent as reported by the household during the conduct of the

survey or was an estimate by the surveyor based on prevailing rents in the neighbourhood. In the first case, there is a possibility that the imputed rent might include in some measure the flow of services the household derived from the house as an asset. Most of these studies found urban Indian households' consumption demand for housing to be income and price inelastic (Box 1). Bandopadhyay et.al. (2008) uses the sale price of a house and thus is the only study which estimates price and income elasticity of housing by considering both consumption and investment demand for housing. But it does not consider consumption demand and investment demand separately.

Only Tiwari and Parikh (1998) and Tiwari et al. (1999) had attempted to understand price and income elasticities of housing demand across economic groups. Given the present situation where more than 99 percent of urban housing shortage is concentrated in the EWS 1, EWS 2 and LIG categories, and a significant proportion of households in each category are inadequately housed, it is important to estimate price and income elasticity of consumption demand for each of the three separately, using the latest available household level information for urban India. Ahmad et al. (2013), Ahmad (2015) and Roy (2018) estimated the price and income elasticity of demand separately for slum households and non-slum households. We include this stratification in our analysis as well.

Box 1: Existing housing demand studies pertaining to urban India

1. Mehta and Mehta (1989) analysed consumption demand for housing in Ahmedabad based on a household survey conducted in 1983 covering 933 renter and owner-occupied households. Income elasticity of demand was found to be between 0.17 and 0.43 for renters, and 0.20 for owners. Price elasticity of demand was 0.8 for renters and 0.4 for owners.
2. Malpezzi and Tewari (1991) studied the effects of rent control in Bangalore based on a survey conducted for 211 rental houses in 1984. Income elasticity for uncontrolled houses was 0.32, and non-significant for rent controlled houses. The study did not report any estimates of price elasticity.
3. Tiwari and Parikh (1998) analysed consumption housing demand across all the major states of India, based on the 1987-88 NSSO housing round survey. Consumption demand for housing was found to be income inelastic for owner-occupier and renter households, and price inelastic for owner-occupier households and price elastic for renter households.
4. Tiwari et al. (1999) estimated the housing consumption demand function for Mumbai, based on a survey of 6128 households in 1987. Housing demand in Mumbai was found to be income and price elastic.
5. Bandopadhyay et al. (2008) found housing demand to be price and income inelastic for 13,487 houses purchased through home loans. These home loans were disbursed from 1993 to 2007 by a housing finance company (HFC) across 20 cities. The study did not provide separate estimates of price and income elasticities for consumption and investment demand for housing.
6. Ahmad et al. (2013) analyses consumption housing demand for Delhi using household level information on housing and household characteristics from the 58^{th} round of the NSSO housing conditions survey. Price and income elasticity of demand for housing, which was proxied by demand for floor area or size of the house, were computed for the entire sample, slum households, non-slum households, renter households and owner households. Consumption demand for housing was found to be price and income inelastic for the entire sample and each subset.
7. Like the earlier study, Ahmad (2015) used the 65^{th} round NSSO housing round survey data to estimate income elasticity for owner, renter and slum households for India as a whole. Consumption demand for housing was proxied by demand for floor area and found to be income inelastic. No price variable was included in the demand function.
8. Roy (2018) analysed the 58th round (2002) and the 65th round (2009) NSSO housing conditions survey for non-slum and slum households for the six most populous cities of India. Consumption demand for housing was found to be price inelastic and income inelastic for both owner-occupier and renter households residing in non-slum areas and slum areas for both time periods with only one exception. In 2009, consumption demand for housing was income elastic for rented households residing in slum areas. Price elasticity was lower than income elasticity in all cases.

Source: Mehta and Mehta (1989), Malpezzi and Tewari (1991), Tiwari and Parikh (1998), Tiwari et al. (1999), Bandopadhyay et.al. (2008), Ahmad et al. (2013), Ahmad (2015) and Roy (2018)

3.2 Consumption demand for housing of low-income households

The 76th round NSS household level data for 2018 is the latest household level data on housing conditions and household characteristics available for urban India.[25] It helps in understanding recent changes in households' consumption demand behaviour with respect to changes in price and income. This analysis involves two steps. First, employing a hedonic price function[26], we predict the rent of rented houses and imputed rent of owner-occupied houses based on the information available for households living in rented houses. We use predicted rent instead of actual rent in the case of rented houses since predicted rent is a better indicator of the value of actual housing services consumed and can be expected to be free from any bias that affects rents reported by individual tenant households or estimates of rent by the surveyor based on his understanding of prevailing rents in the neighbourhood. Similarly, the predicted imputed rent of owner-occupied houses can also be expected to be free from any bias compared to imputed rent reported by households. There is also the possibility that owner-occupier households, when reporting imputed rent, might be influenced by the asset aspect of the house, they reside in. Imputed rent, if based on the asset value of house,[27] usually leads to higher income elasticities (Malpezzi and Mayo 1987). Second, we estimate the consumption demand for housing, where we use the predicted rent and imputed rent estimated in the first step as one of the inputs.

3.2.1 Estimating imputed rent of owner-occupied houses

Consumption demand for housing can be interpreted as the demand for a flow of housing services over a period of time, such as one month. The expenditure incurred or the willingness to pay for consumption of the flow of housing services is the monthly rent paid. Flow of housing services consumed in a month or the monthly rent r can be seen as a function of housing characteristics $z_1, z_2, z_3, \ldots\ldots z_n$ (Rosen 1974), also referred to as a hedonic price function.

$$r = f(z_1, z_2, z_3, \ldots\ldots z_n) \qquad (1)$$

For EWS and LIG households, housing can be expected to be defined by common housing characteristics such as floor area, type of the house (independent unit, flat or other), condition of the structure, presence of bathroom and latrine within house, presence of kitchen, availability of water, garbage collection, type of drainage, sanitation and hygiene around the house and its neighbourhood. Rent paid is reported for tenant occupied houses in the sample. Utilising the relationship embodied in (1), we predict rent for rented houses and imputed rent for owner-occupied houses. We model (1) for tenant occupied houses in urban India across

25 We consider households from 19 major states for household consumption demand analysis.

26 Hedonic price function describes the equilibrium relationship between characteristics of a heterogeneous product such as housing and its price

27 Captured through the EMI payable on a home loan or as a certain percentage of the capital value of a house such as annualised sale price calculated over the life time of the house

19 major states.[28] We employ a logarithmic transformation of rent as the dependent variable. Independent variables include logarithmic transformation of area of the house, number of rooms, percentage of the number of households in the neighbourhood or first stage units (FSU) whose heads have completed higher secondary education, and dummies which capture other housing characteristics (Table A6). We control for location using district dummies, and two other dummy variables which capture whether a household is located in a metropolitan city and whether a household is located in a slum or non-slum location.

$$\ln r = \alpha + \beta_1 lnz_1 + \ldots + \beta_n z_n + \varepsilon \quad \ldots\ldots (2)$$

where r is the rent or the value of the flow of housing services consumed by a tenant household. z_i is the amount of i^{th} housing characteristic consumed and ε is the independently distributed error term.[29] The results of this OLS regression are presented in Table A7. Based on the coefficients of equation (2), we predict the imputed rent of owner-occupied houses and rent for rented households in our sample.

In the next section, to understand the nature of consumption demand for housing for owner-occupier households and tenant households, we find out how a household's demand or willingness to pay for a house to live in varies with the price of housing services, household income and other household characteristics across income groups – EWS 1, EWS 2 and LIG – and by the settlement type – non-slum and slum – they live in.

3.2.2 Estimating household demand function

A demand function captures the relationship between quantity demanded and the factors affecting demand. To estimate the household consumption demand function for housing, we use predicted rent for tenant occupied houses and predicted imputed rent for owner-occupied houses instead of the quantity of housing services demanded and consumed (Q_h) as the dependent variable. This is so since we are unable to observe Q_h.

Q_h can be interpreted as the number of units of housing services consumed by a household in a given month. For the purposes of this paper, it is assumed a household living in a 500 sq. ft house vis-à-vis a household living in a 100 sq. ft house consumes approximately five times the amount of housing services in a month.

[28] Butler (1977) and Linneman (1980, 1981) provide empirical support for estimating hedonic price function at country level. The 19 major states include Maharashtra, Punjab, Haryana, Delhi, Rajasthan, Uttar Pradesh, Bihar, Assam, West Bengal, Jharkhand, Odisha, Chhattisgarh, Madhya Pradesh, Gujarat, Andhra Pradesh, Karnataka, Kerala, Tamil Nadu and Telangana.

[29] We use the logarithmic transformation for rent and floor area of the house for two reasons. First, rent does not increase in a linear manner with an increase in floor area implying a non-linear relationship between rent and floor area. Second, both variables have a right skewed distribution and employing a logarithmic transformation normalises the distribution.

Rent paid in a month is the product of the number of units of housing service consumed by a household and rent paid per unit of housing service. We calculate the price elasticity of demand (E_P) and income elasticity of demand (E_Y) as follows:

$$Ln(R_h) = \beta_0 + \beta_1\, ln(P_h) + \beta_2\, ln(MPCE_h) + \beta_3 HHsize_h + \beta_4 gen_h + \beta_5 \ln(age_h) + \xi \quad \text{.....(3)}$$

Or,

$$Ln(P_h Q_h) = \beta_0 + \beta_1\, ln(P_h) + \beta_2\, ln(MPCE_h) + \beta_3 HHsize_h + \beta_4 gen_h + \beta_5 \ln(age_h) + \xi \quad \text{..... (4)}$$

Or,

$$Ln(Q_h) = \beta_0 + (1 + E_P)\, ln(P_h) + \beta_2\, ln(MPCE_h) + \beta_3 HHsize_h + \beta_4 gen_h + \beta_5 ln(age_h) + \xi \quad (5)$$

where ξ is the error term, R_h is the predicted rent for rented houses or predicted imputed rent for owner-occupied houses, P_h is the predicted rent per square foot or predicted imputed rent per square foot in which household *'h'* resides, *MPCE* is the monthly per capita consumption expenditure, *HHsize* is household size, *gen* is the dummy for a female-headed household and *ln(age)* = log of age of household head.[30] Based on (3), (4) and (5), we find β_1-1 which is the price elasticity E_P, and $\beta_{2,}$ which is income elasticity E_Y. Since ln (P_h) occurs on both sides in (4), equation (3) is endogenous, i.e., ln(P_h) and ξ are correlated. We address this issue next.

Literature is divided on what should be the price variable in a housing demand function. Polinsky and Elwood (1979) and Murray et al. (2017) include price at the level of the dwelling unit, King (1973) included the neighbourhood price level; Ingram (1987) and Tiwari and Parikh (1998) and Tiwari et al. (1999) compute the price of a standardised housing unit for a sub-market and use it as the price variable in their analysis. Like Murray et al. (2017), we include a price variable 'P_h', which is the predicted rent per square foot for a tenant occupied house or the predicted imputed rent per square foot for an owner-occupied house. In both cases, P_h can be interpreted as the price of one unit of housing service consumed in a month by a household. However, P_h is endogenous with the dependent variable on two counts. First, it is derived from the rent/predicted rent of the house occupied by the household and hence can be expected to be related to the error term in the same way as the dependent variable. Second, it does not reflect the prevailing price in the sub-market or neighbourhood of which it is a part, leading to a possible case of omitted variable-induced endogeneity.

To address both issues and correct for endogeneity in the demand function, we use the instrumental variable approach and (4) is estimated using a two-stage least square regression. According to Cheshire and Sheppard (1998) and Murray (2017), house prices and rents in a neighbourhood are correlated with each other and can be considered as instrumental variables. The average of the predicted rent per square foot and predicted imputed rent per square foot for all other houses located in the same FSU is used as the instrumental variable

[30] We use logarithmic transformations of R_h, P_h and MPCE, as coefficient of ln (P_h) is price elasticity and coefficient of ln(MPCE) is income elasticity

for the price of housing services consumed for each household. We use the notation P_{h_neigh} for the instrumental variable. In NSSO surveys, each city/town is divided into contiguous and mutually exclusive FSU blocks. FSU blocks are demarcated by natural or manmade physical boundaries, and 80 to 200 households reside in each block. Thus, we consider an FSU block as a household's neighbourhood. The two-stage least squares regression includes the following.

First stage regression:

$$ln(P_h) = \alpha_0 + \alpha_1\, ln(P_{h\_neigh}) + \alpha_2\, ln(MPCE_h) + \alpha_3 HHsize_h + \beta_4 gen_h + \beta_5 \ln(age_h) + \varepsilon \;..\; (6)$$

Second stage regression:

$$ln(R_h) = \gamma_0 + \gamma_1 ln(P_h) + \gamma_2\, ln(MPCE_h) + \gamma_3 HHsize_h + \beta_4 gen_h + \beta_5 \ln(age_h) + \epsilon \ldots\ldots\ldots (7)$$

The consumption of the flow of housing services by a household is affected by a household's permanent income (Malpezzi and Mayo 1987). Permanent income is the present value of a household's lifetime earnings. We use monthly per capita consumer expenditure (MPCE) as a measure of permanent income. According to Friedman (1957), consumption expenditure is a better measure of permanent income than current income. Studies on housing demand in urban India have used monthly consumption expenditure of a household as a measure of permanent income (Tiwari and Parikh 1998, Das et al. 2018, Ahmad 2013). We use monthly per capita consumption expenditure since the consumption expenditure of a household is normalised with respect to household size and thus, provides a better measure of the level of wellbeing of a household. Considering the per capita measure instead of nominal monthly consumption expenditure also eliminates the possibility of any collinearity with household size. We also include gender and age of the household head as household characteristics.

In light of the extant housing shortage across EWS and LIG income groups, we estimate the household demand function (4) as 14 separate two-stage least square regressions[31] for EWS 1, EWS 2, and LIG income categories, further categorised by the two tenure types – owner occupier and renter – and two settlement types – non slum areas and slum areas.[32]

[31] Results from the Hausman test for endogeneity based on OLS regressions and two-stage regressions indicate that the estimates from the OLS regressions are consistent in 13 out of the 14 cases. This confirms the presence of endogeneity and the need to use instrumental variables and two-stage least square regression in 13 cases. The only exception is in the case of LIG renter households living in non-slum areas. Results from OLS and 2SLS estimation were similar in significance and signs of coefficients in the case of this specific group of households. We report the 2SLS results in Table A8.

[32] 14 regressions include EWS 1 non-slum owner occupiers, EWS 2 non-slum owner occupiers, LIG non-slum owner-occupiers, pooled non-slum owner occupiers, EWS 1 slum owner-occupiers, EWS 2 slum owner-occupiers, pooled slum owner-occupiers, EWS 1 non-slum renters, EWS 2 non-slum renters, LIG non-slum renters, pooled non-slum renters, EWS 1 slum renters, EWS 2 slum renters, and pooled slum renters.

3.3 Results

We calculate price elasticity by subtracting 1 from the coefficient of $ln(P_h)$. Income elasticity is the coefficient of *ln(MPCE)*. The signs of coefficients are as per expectations.

Table 6: Price Elasticity and Income Elasticity

Households	Price Elasticity	Income Elasticity
Owner Occupier		
Non-Slum EWS 1	-0.21	0.35
Non-Slum EWS 2	-0.37	0.54
Non-Slum LIG	-0.36	0.44
Non-Slum Pooled	-0.33	0.49
Slum EWS 1	-0.35	0.38
Slum EWS 2	-0.40	0.46
Slum Pooled	-0.38	0.38
Renter		
Non-Slum EWS1	-0.34	0.50
Non-Slum EWS 2	-0.53	0.65
Non-Slum LIG	-0.64	0.38
Non-Slum Pooled	-0.52	0.58
Slum EWS 1	0.1	-
Slum EWS 2	-0.34	0.43
Slum Pooled	-0.24	0.37

Source: Authors' calculation

Note: '-' denotes insignificant values

Six important findings emerge from Table 6.

1. We find consumption demand for housing is price inelastic, and income inelastic, i.e., inelastic with respect to permanent income for households across economic categories residing in both non-slum and slum areas. A likely explanation is that low-income households such as EWS 1, EWS 2 and LIG households usually consume a bare minimum flow of housing services. Hence, in case of an increase in unit price of housing services, they are unable to reduce their consumption of housing services, although this might mean lower consumption of non-housing goods and services; and in case of a decrease, they are likely to spend the amount saved on non-housing goods and services rather than increasing their consumption of housing services.
2. Income elasticity and price elasticity of EWS 1 and EWS 2 owner-occupier households located in non-slum areas are less than their renter counterparts. One reason could be that the transaction costs associated with moving are higher in the case of the former. High transaction costs might offset the gains from lower unit price of housing services and households are reluctant to move. Owner-occupier households might also be reluctant to move beyond their immediate neighbourhood and the community of which they have been a part of for long. Ninety-one per cent of EWS 1 and EWS 2 non-slum owner-occupier households have been staying in the same neighbourhood for the last five years

or more compared to 33 per cent of renter households. For similar reasons, owner-occupier households show reluctance to increase their housing consumption in case of an increase in income, and reluctance to reduce their housing consumption in case of decline in income. EWS 1 and EWS 2 owner-occupier households in non-slum areas are thus more likely to continue living in inadequate housing following a decline in unit price or increase in permanent income compared to renter households.

3. We find price elasticity to be less than income elasticity across economic groups, tenure and settlement type, with only one exception – LIG renter households living in non-slum areas. Put simply, demand for housing for the purpose of 'living in' is more sensitive to changes in permanent income than price or rent in all other cases. Thus, traditional housing policies, which normally focus on reducing the price or rent of housing to enhance affordability and increase demand, are likely to be more effective if administered along with measures that ensure higher household permanent income.

4. We find consumption demand for housing to be most price inelastic for EWS 1 households. It increases for higher income groups. So, price/rent based subsidies and incentives are likely to be less effective for households belonging to lower income groups vis-à-vis households belonging to higher income groups. Tiwari and Parikh (1998) and Tiwari et al. (1999) also reported declining price elasticity of consumption demand from higher to lower income groups. Thus, the more vulnerable a household, the higher is the requirement for improving its permanent income to stimulate consumption housing demand.

5. Price elasticity is lowest in magnitude and positive, while income elasticity is insignificant for the most vulnerable amongst all households – EWS 1 tenant households residing in slums. This indicates the high risk they are at in terms of their non-housing consumption in case of increases in rent and decline in income. The mass reverse migration from cities following the nation-wide lockdown in March 2020 was a manifestation of their vulnerability. Special attention needs to be paid to these households as a separate group.

6. Consumption demand for housing increases with increase in household size (Table A8, A9). The percentage of increase is more in the case of renter households than in the case of owner-occupier households. This is so since it is easier for renter households to adjust their consumption demand for housing compared to owner-occupier households. Consumption demand for housing is lower in the case of female-headed households, indicating their need for special attention. As expected, consumption demand for housing increases with the age of the household head.

4. Congestion and demand for number of rooms

Congestion is the most prevalent form of housing inadequacy contributing to urban housing shortage and it is worsening. Twenty per cent of households in non-slum areas and 41 per cent of households in slum areas live in congested condition (authors' calculations, NSS 2019a). The estimated number of households living in congested houses has gone up by 57 per cent between 2012 and 2018. The per capita consumption of floor area of congested

households declined from 111 sq. ft in 2012 to 83 sq. ft in 2018. So, addressing congestion is important. We consider a household to be living in congested conditions when a couple does not have a separate room. Congestion can be addressed better if we understand the demand behaviour of such households. We do so with regards to the number of rooms they live in. We estimate a demand function for number of rooms using the OLS method,[33] and examine the effect of congestion using the following equation:

$$Ln(rm) = \beta_0 + \beta_1\, ln(P_{rm}) + \beta_2\, ln(P_{rm}) * congstn + \beta_3\, ln(MPCE) + \beta_4\, ln(MPCE) * congstn + \beta_5 HHsize + \beta_6 gen + \beta_7 ln\,(age) + \mu \ldots\ldots \quad (8)$$

where *rm* = number of rooms, P_{rm} is the implicit price of rooms derived from the results of the hedonic price function (2). Based on Taylor (1988), we compute the implicit price for each household as $\beta_{rm}(\frac{rent}{rm})$; β_{rm} is the coefficient of the number of rooms from Table A7. Next, we compute the average implicit price of a room for a sub-market. A sub-market is defined at the district level by the type of urban area (metropolitan or non-metropolitan) and settlement type (non-slum or slum). Variables *MPCE, HHsize*, *gen* and *age* are defined as in Section 3. Whether a household lives in congested condition or not is captured through the *congstn* dummy. If any household has at least one couple not having a separate room, we consider such a household to be living in congested conditions and assign *congstn* = 1, otherwise *congstn* = 0. Signs of coefficients of *congstn*, *HHsize*, *gen* and *age* are as per expectation (Table A10, A11).

Price elasticity and income elasticity are coefficients of the log of the implicit price of room and log of the MPCE in the case of non-congested households. In the case of congested households, the coefficient of respective interaction effects between $ln(P_{rm})$ and *congstn*, and *ln(MPCE)* and *congstn*, if significant, are added to the coefficients of the log of the implicit price of a room and the log of the MPCE for price elasticity and income elasticity. The same value of price elasticity and income elasticity across non-congested and congested households signifies an insignificant interaction effect. As in the case of demand for housing services, the demand for the number of rooms is inelastic with respect to price and income. Price elasticity of rooms is also higher for rented households compared to owner-occupier households across settlement types and household categories (Table 7, 8).[34]

[33] We use log transformations in case of *rm*, P_{rm}, *MPCE* and *age* for reasons similar to those cited in footnote 29

[34] Since LIG slum households are small in number, these households have not been considered

Table 7: Price elasticity of demand for number of rooms of non-congested and congested households

Households	Non-congested Households	Congested Households
Owner Occupier		
Non-Slum EWS 1	-0.11	-0.06*
Non-Slum EWS 2	-0.15	-0.15
Non-Slum LIG	-0.18	-0.18
Non-Slum Pooled	-0.14	-0.14
Slum EWS 1	-0.15	-0.15
Slum EWS 2	-0.20	-0.20
Slum Pooled	-0.19	-0.19
Renter		
Non-Slum EWS1	-0.43	-0.33*
Non-Slum EWS 2	-0.35	-0.42*
Non-Slum LIG	-0.18	-0.18
Non-Slum Pooled	-0.34	-0.39*
Slum EWS 1	-	-
Slum EWS 2	-0.29	-0.29
Slum Pooled	-0.27	-0.1*

Source: Authors' calculation

Note: * significant interaction effect between ln (P_{rm}) and congestion dummy, '-' depicts coefficients not being significant

Table 8: Income elasticity of demand for number of rooms of non-congested and congested households

Households	Non-congested Households	Congested Households
Owner Occupier		
Non-Slum EWS 1	0.26	0.39**
Non-Slum EWS 2	0.36	0.40**
Non-Slum LIG	0.26	0.26
Non-Slum Pooled	0.35	0.65
Slum EWS 1	-	0.46@
Slum EWS 2	0.26	0.26
Slum Pooled	0.28	0.28
Renter		
Non-Slum EWS1	0.32	0.32
Non-Slum EWS 2	0.55	0.55
Non-Slum LIG	-	-
Non-Slum Pooled	0.44	0.55
Slum EWS 1	0.76	0.76
Slum EWS 2	0.44	0.44
Slum Pooled	0.43	0.23

Source: Authors' calculation

Note: ** - significant interaction effect between ln (MPCE) and congestion dummy, @ - significant interaction effect between ln (MPCE) and congestion dummy but coefficient of ln (MPCE) is not significant as depicted by '-'

Our results indicate that living in congested conditions does not have a significant effect on demand behaviour of owner-occupier households. Interaction effects between the log of the implicit price and congestion dummy and between the log of the MPCE and congestion dummy for EWS 2, LIG and pooled sample of households are either insignificant or muted (Table A10, A11). This is disconcerting. It implies an acceptance of congestion as a way of life among these households and makes the task of resolving the issue of congestion challenging both from the demand as well as supply perspective. It is more challenging in the case of EWS 1 households:

- For owner-occupier and renter EWS 1 households residing in non-slum areas, the interaction effect between the log of the implicit price and congestion dummy is positive and significant. As a result, congested EWS 1 households have lower price elasticity of demand for rooms as compared to non-congested households, implying higher chances of worsening living conditions in case of a rise in cost of housing. It also implies that price-based measures to increase demand for rooms will be less effective in the case of congested households compared to non-congested households.
- In the case of congested EWS 1 owner-occupier households residing in both non-slum and slum areas, income elasticity of demand is higher as compared to their non-congested counterparts. This is so since the interaction effect between the log of the implicit price and congestion dummy is positive and significant. Thus, measures to improve the permanent income of these households might help alleviate congestion. Thirty-three per cent and 53 per cent of owner-occupier EWS 1 households residing in non-slum areas and slum areas live in congested conditions.[35]
- There is no significant difference in income elasticity between EWS 1 renter households residing in congested conditions and their counterparts living in non-congested conditions. Thus, any demand side policy intervention will be largely ineffective in addressing congestion in the case of EWS 1 renter households.

Thus, it emerges that there exists a general lack of willingness across all types of low-income households to pay for additional rooms to address the problem of congestion. Acceptance of congestion as a way of life and the lack of willingness to spend on additional rooms could be one of the reasons behind increasing congestion. Outcomes of policy interventions targeted at enhancement of housing through construction of additional rooms or renting or purchase of another house might be sub-optimal due to this lack of willingness and may not have much of an impact in terms of beneficiary coverage.

[35] Authors calculations based on NSS 2019a

5. Conclusion and implications for policy

Housing woes continue to plague a significant portion of urban households. The maximum number of urban households estimated to be living in inadequate houses in 2018 is 47.3 million (41 per cent of urban households). It is estimated that 26.5 million (24 per cent) of urban households live in slums, 20.5 million (23.2 per cent) of non-slum households live in physically inadequate houses and 0.3 million households are homeless. Unaffordable housing prices and rents, coupled with unresponsive supply in the formal housing market, are most often cited as the key factors behind the unabated increase in the number of urban households living in physically inadequate housing and in slums. Policies since independence have taken note of this phenomenon plaguing EWS and LIG urban households. Over the years, with economic growth, flexibility in regulations for the private sector and increased access to capital, the role of the government has evolved from that of a provider to that of a facilitator of housing (including self-construction by households), built by the private sector. The outlook for EWS and LIG housing also underwent a change from being viewed as a social sector activity to being viewed as a private sector activity requiring regulatory and institutional support from the government. Policy thrusts have ranged from carrying out land reforms, undertaking R&D for lowering construction cost, providing subsidies to households for house purchase and construction, providing subsidies to private suppliers of formal housing, cross subsidisation, controlling rent, enabling greater access to credit for formal housing, formalising informal housing through granting property rights and undertaking *in situ* development of slums and slum rehabilitation (Mathur 2009, Tiwari and Rao 2016). Alongside the union government, many state governments such as Andhra Pradesh, Gujarat, Haryana, Maharashtra, Rajasthan, Tamil Nadu and West Bengal have implemented state level policies and undertaken projects for housing EWS and LIG households (Kundu and Sharma 2017). Most measures and approaches taken by both the union and state governments suffered from common shortcomings that include a lack of understanding of the needs of beneficiaries through greater community participation, the cornering of benefits from schemes meant for lower income households by higher income households, fragmented design and implementation of programmes, the lack of viable rehabilitation options for evicted slum households, and lack of convergence between housing schemes and schemes relating to employment and health of lower income households (Mathur 2009, Tiwari and Rao 2016). At the same time, all these policies have been guided by a common objective – to make housing more affordable for ownership by EWS, LIG and, of late, MIG households. Past experience and our analysis suggest that housing policy measures targeting EWS and LIG households should probably consider a broader approach, with a sharper focus on ensuring that inadequately housed urban households are adequately housed.

1. *Standalone housing policies are not the best housing solutions for low-income households*: The findings of this study reinforce the importance of a household's permanent income or the present value of its lifetime earnings in determining quality and quantity of housing services demanded and consumed by a household. Age, health, education, employment and wealth are important determinants of permanent income of urban households (Miles 1997). Like Ahmad et al. (2013) and Tiwari and Parikh (1998),

we find higher sensitiveness of consumption demand for housing to permanent income vis-à-vis price, for owner-occupier and renter low-income households. Tiwari and Parikh (1998) recommends income subsidies for increasing consumption demand of housing. Ahmad et al. (2013) states economic growth will lead to increase in consumption demand for housing and suggests implementation of income improvement measures for households.

Housing policies in India and elsewhere have largely focused on lowering the price or cost of housing, easing access to credit and providing free housing to increase housing demand and hence, consumption, with hardly any exceptions. The effect of income and permanent income is assumed to be positive and straight forward for policy purposes. Higher income or permanent income is interpreted as higher demand for and consumption of housing services. However, the effect of housing policy interventions on a household's permanent income and thereafter its consumption demand for housing, is often ignored.

For instance, any housing initiative that involves relocation or even *in situ* rehabilitation of a low-income household will usually have an impact on the household's permanent income. Since permanent income is not observable, the effect of relocation on a household's access to employment opportunities, health outcomes, educational outcomes and social networks needs to be considered in its place. In case these are adversely affected, the household's consumption demand for housing services gets adversely affected and the household opts out of housing provided by the initiative. In cases of relocation, households often move back to earlier inadequate housing or one which is closer to it. Even in cases where the slum household is given free formal housing on the same location, it re-locates to slum housing since it is unable to manage higher dwelling maintenance costs and loss of earnings caused due to lack of access to its earlier informal economic space.

Certain slum rehabilitation schemes with households rehabilitated elsewhere or *in situ* bear testimony to this. Slum rehabilitation schemes have been a popular choice to address the problem of inadequate housing in metropolitan cities. Rehabilitation schemes are designed to monetise high land values in these cities and have been conceived as a win-win proposition for all stakeholders – notably the government, private developer and slum dweller. In most cases, these policies have been implemented without taking into consideration the effect of re-location or re-settlement on health, earning potential and the household's social network – factors that determine the permanent income of slum dwellers. Evidence from an experimental stand-alone rent-to-own housing programme in Ahmedabad, which relocated slum dwellers from within a city slum to subsidised rental housing in the city's periphery, indicated that the programme was a failure – 34 per cent of slum dweller households selected through lottery did not re-locate; 32 per cent of the relocated beneficiary households returned to in-city slums (Barnhardt et al. 2017). None of the re-located households stayed on and paid the subsidised rent for 20 years to eventually gain possession of the house. The study found that there was no increase in the households' income or human capital under the programme. Similarly, in the case of Mumbai's Slum Rehabilitation Scheme (SRS) projects, a significant number of *in situ* rehabilitated slum households have relocated back to slum housing due to

the economic distress associated with relocation to formal housing (Debnath et al. 2019, Restrepo 2010). Along-with economic distress, these households also reported substantial built environment stress, which caused them to move out of the formal housing they were rehabilitated to (Debnath et al. 2019). The poor architectural design of these projects resulted in substantial health-related issues such as an increased incidence of tuberculosis among re-located slum dwellers in SRS projects (Pardeshi et al 2020). Loss of informal economic space leading to lower earnings was another factor. Thus, stand-alone housing policies focussed only on improving the housing outcomes of low-income urban households should be implemented along with measures focusing on overall development and the welfare of the household.

Such a holistic approach was taken by New Zealand's 'Healthy Housing' programme. This programme was initiated to better health outcomes of poor families living in Auckland's poor neighbourhoods in public rental housing. It identified and corrected housing deficiencies to achieve the final objective of improving health outcomes. The concerns of households regarding overcrowding, inadequate ventilation and inadequate heating were addressed. As a result, significant improvements were recorded in Auckland's public rental housing stock with housing being better integrated with health and social services. A survey-based assessment of the programme conducted found tenants were better aware of housing services required by them as a result of this intervention and initiated improvements in their housing outcomes (Bullen et al. 2008).

In India, as part of the ongoing PMAY U mission, the *'Angikaar'* initiative was designed as a social awareness campaign for those PMAY U beneficiaries whose houses have been completed to improve the housing services they consume. It intends to help beneficiaries acclimatise better to their new surroundings through social behaviour change. Door-to-door awareness campaigns were to be carried out about other central government schemes, the most important ones canvassed being the *Pradhan Mantri Ujjawala Yojana* to enable access to LPG by BPL households, and *Ayushman Bharat Yojana* (ABY) to provide health insurance to all poor and vulnerable households.[36] At present, PMAY U has 11.2 million, *Ujjwala* has 8 crore and *Ayushman Bharat Yojana* has 11 million beneficiary households. Our findings indicate that households for whom convergence can be achieved are likely to exhibit sustained increase in their consumption of housing services.

Going ahead, given that around 47.3 million urban low-income households are still inadequately housed, increased focus on improving permanent income or health, education and employability skills of low-income households will aid in generating higher and sustained consumption demand for housing services. It is important to think beyond

[36] The *Angikaar* initiative has been designed to make PMAY U beneficiaries whose houses have been completed to be made aware of initiatives of six other central government ministries – Ministry of Petroleum and Natural Gas, Ministry of Health and Family Welfare, Ministry of New and Renewable Energy, Ministry of Power, Ministry of Environment, Forest and Climate Change and Ministry of Jal Shakti and 3 other MoHUA initiatives – *Swachh Bharat Mission*, *AMRUT* and DAY NULM , to ensure participation of the PMAY U beneficiary households in these initiatives and schemes.

traditional standalone price-based 'housing policies' and focus on a more holistic approach that includes access to housing services, health, education, employment and established social networks.

2. *Social rental housing for BPL slum tenants:* Price elasticity of EWS 1 households or below poverty line households living as tenants in slums is close to zero and income elasticity is not significant (Table 6). Any rent related incentives and subsidies is unlikely to have any effect on their consumption demand for housing. Any marginal change in permanent income will also have no effect on their consumption demand for housing services. These households are also the worst housed amongst all. Besides, their per capita MCE is the lowest amongst all households. Usually these households are also overlooked in slum rehabilitation programmes, since they do not possess *pattas*[37].

First and foremost, correct identification of EWS 1/BPL slum renter households is crucial. Periodic surveys identifying such households should be conducted by ULBs.

Second, since demand side impetus for such households is unlikely to increase demand for housing services, targeted supply side interventions are required. Social rental housing schemes such as the recently announced Affordable Rental Housing Complexes (ARHCs) targeting migrant workers, EWS and LIG households (Box 2) should reserve a specific number of units in each ARHC for EWS 1 households at a rent lower than that payable by EWS 2 and LIG households. Rents for an EWS 1 household in these complexes should be fixed at no more than 5-20 per cent of total household consumption expenditure, following Wadhwa (2009) and Parekh (2007),[38] which works out to between Rs.500 and Rs.2000 per month.[39] Thus, the financial viability of the ARHCs have to be ensured at rents affordable to EWS 1/BPL households. Checks should be carried out at the time of initial allotment and subsequent contract renewal to ascertain eligibility of households as tenants of these complexes. In case a household is found ineligible to continue as a tenant, the household should be required to vacate the rental unit after having been given the requisite notice. Otherwise, over time, these rental units might be usurped by beneficiaries who have moved up the income ladder and fail to cater to the needs of those who need it the most.

Third, any supply side effort such as ARHCs needs to be supplemented with measures that improve the livelihood, education and health outcomes of EWS 1 households to improve their permanent income. Provisioning of school and skilling centres as a part of the ARHC will go a long way in improving the long-term welfare of these households and increase their demand for housing services over the long term. Most importantly, all ARHCs should be located close to existing employment centres of EWS 1 households.

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37 *Patta* is a document reflecting ownership of a property and land

38 http://www.naredco.in/pdfs/report-high-level-task.pdf, accessed 20 August 2020

39 Assuming a household monthly income of Rs.10000, which approximates the urban poverty line in 2020 (refer to footnote 19)

Box 2: Affordable Rental Housing Complex Scheme

The nationwide lockdown to contain the spread of Covid 19 brought economic activity to a standstill across cities. Lakhs of migrant workers were seen leaving the cities of their employment due to loss of their livelihoods and homes. In the wake of this mass reverse migration from major cities, rental housing for EWS and LIG groups including migrants, regained focus and the Affordable Rental Housing Complexes (ARHC) scheme was launched under the ongoing PMAY U mission. The salient features of interest of the scheme for the purposes of this study are the following.

- Provision of 1BHK, 2BHK apartments and dormitory beds of 30 sq. m, 60 sq. m and 10 sq. m in ARHCs having a minimum of 40 DUs. Dormitories are to have 4/6 beds per dormitory and 3 dormitory beds is to be considered as one 1 DU. One BHK and 2 BHK DUs are to include one or two bedrooms, one living room, kitchen, bathroom and toilet. All DUs have to have access to basic services such as water, sewage, sanitation and electricity. Each project will have health centres, crèches and a shop catering to daily necessities, etc. Any project can have a maximum of one-third of all DUs as 2BHK DUs.
- The scheme is to be administered through two models: Model 1 involves renting of unused and vacant housing constructed under any government scheme through concessionaires; Model 2 involves the construction, operation and maintenance of ARHC on their own land by public and private entities.
- In the case of Model 1, concerned states/UTs/parastatals/ULBs are required to identify and list all vacant and unused government houses. Of the total 13.83 lakh houses sanctioned under JnNURM and RAY missions, 1.08 lakh houses remain vacant across 159 cities. In addition, vacant houses constructed by various state governments can also be covered.
- In the case of Model 2, states/UTs/parastatals/ULBs are to identity public and private entities with vacant land. In the case of non-residential vacant land, required changes in Master Plan are to be made to allow for residential use of such land. Fifty per cent additional *floor area rat*io (FAR) may be allowed without any additional cost.
- Initial rent for the DUs and dormitories are to be set by ULBs after conducting a local survey at the proposal stage. Rents can be increased by a maximum of 8 per cent every two years, provided it does not increase by more than 20 per cent in five years. Illustrative models showcasing the financial viability of the scheme assume rent per DU to be between Rs.2500 and Rs.3500 for Model 1. For Model 2, rent of Rs.3000 per dormitory bed and Rs.6000 per 1BHK DU has been assumed for the financial viability analysis, which might be unaffordable for EWS 1 or BPL households.
- ARHC projects will be out of the purview of existing state rental laws and will be governed by the Model Tenancy Act (MTA) or state laws modified on the lines of MTA.
- Convergence with other government missions such as smart cities, *AMRUT, Swach Bharat Mission*, NULM, *Ujjwala, Ujala*, Make in India and Atal Innovation Mission and Skill India Mission is to be achieved.

Source: ARHC Operational Guidelines available at http://arhc.mohua.gov.in/filesUpload/Operational-Guidelines-of-ARHCs.pdf, accessed on August 5, 2020 and authors' analysis

3. *Addressing housing inadequacy through enhancement of existing house:* Housing inadequacy in the case of households living in congested conditions in non-slum settlements, can be addressed by constructing one more room in houses occupied by 17-18 million households, by constructing two or more rooms in houses occupied by 2 million households, where permitted (Table A5) [40,41]. Improvements and repairs might also address issues of obsolescence plaguing an estimated 3.5 million non-slum households. Housing enhancements or augmenting one's owned house through incremental improvements is the most common approach to address housing inadequacies and changes in consumption demand for housing and is usually preferred to moving to a new house. Households undertake incremental construction, alterations and repairs over time depending on the availability of funds, availability of land and whether such an enhancement is structurally safe, and in accordance with existing building bye-laws in the case of formal housing. Housing enhancements undertaken by landlord households for renting purposes is also a common practice, catering to the investment demand for housing for landlords and consumption demand for housing for tenants. With more than 60 per cent of households living in independent houses (NSS 2019a), the potential for creating more rental housing through this method is substantial and merits greater policy attention.

Of late, housing enhancement has received policy attention with subsidies being provided to households under the BLC vertical of PMAY U, also referred to as BLC (Enhancement) or BLC (E). As a part of this vertical, EWS households living in houses of less than 30 sq. m (322 sq. ft) in size are eligible for central and state government subsidies to construct an additional room, which can be accompanied by the construction of a toilet and/or bathroom and/or kitchen. The proposed enhancement must be at least 9 sq. m (96.6 sq. ft) in area, and the total area of the enhanced house should not exceed 30 sq. m. According to our estimates, about 7 million non-slum households living in a less than 30 sq. m house had either one or two couples with no separate room to themselves in 2018. An additional room can be constructed for such households under the BLC (E) vertical. Based on the information available from the PMAY – U website so far, 226,522 houses have been sanctioned under the BLC (E) across 12 states.[42] But this might be an underestimate since for many major states, information in the public domain on BLC (E) is not available as a separate item, and is clubbed with new constructions under the BLC vertical. Thus, based on our estimates and the available information on the number of BLC (E) beneficiaries, there is still scope for a considerable number of households who could be covered under BLC (E) or similar schemes that focus only on housing enhancement with additional incentives or revised eligibility conditions. In future, similar schemes can be launched at the central and state government level for construction of bigger houses as well. EWS, LIG and MIG households can also avail

[40] In non-slum areas

[41] The respective ratios for households requiring one room and two rooms or more rooms out of the total number of households, have been calculated based on Table A5. These ratios are then multiplied with the total number of projected non-slum households as of 2018 (row A, Table 3) to arrive at the number requiring augmentation for the respective number of rooms.

[42] https://pmay-urban.gov.in/minutes, accessed on July 28, 2020.

of subsidised home loans under the CLSS vertical to carry out housing enhancements in addition to construction or purchase of a house. So far, 12.33 million (EWS and LIG – 8.04 lakh, MIG - 4.29 lakh) beneficiaries have availed of home loan subsidies[43] under the vertical. However, a break up between the purchase and construction of new houses and housing enhancements under CLSS is not available. Possibly an increased focus on home extension or home improvement loans as a part of the CLSS can be considered. In light of the findings indicating an acceptance of congestion as a way of life among congested EWS and LIG households, it is important to ensure participation of these households in ongoing schemes through better information, education and communication (IEC) strategies and counselling.

Over and above this, better land records, faster resolution of land disputes, liberal building norms, faster approvals and better access to credit incentivising housing enhancements are measures needed to spur housing enhancements. Housing enhancements by owner-occupiers and prospective landlords of low-income housing can emerge as an effective solution to congestion and inadequate housing.

[43] https://pmay-urban.gov.in/covid19/progress/1.pdf, accessed December 15, 2020

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Appendix

(All tables present authors' calculations based on the 76th NSS round on 'Drinking Water, Sanitation, Hygiene and Housing Condition in India', unless otherwise specified)

Table A1: Urban housing shortage following TG 12 methodology

A	Estimated number of households (in millions)	114.7
B	Ratio of households living in obsolescence (%) (NSS 76)	4.1
C	Estimated number of households living in obsolescence (in millions)	4.7
D	Ratio of households living in congested houses net of obsolescence (%) (NSS 76)	20.5
E	Estimated number of households living in congestion including those requiring new houses (in millions)	23.5
F	Ratio of households living in unserviceable *katcha* houses (%) (NSS 76)	0.17
G	Estimated number of households living in non-serviceable *katcha* houses in million	0.2
H	Estimated number of homeless household	0.32
I	Estimated number of inadequately housed urban households (in millions) (C+E+G+H)	29

Source: Authors' calculations based on UNSD (2015), NBO (2010), NCP (2019) and NSSO (2019a)

Table A2: Households living in obsolete houses across MPCE deciles in non-slum areas

Decile	Number of households living in obsolescence 2018 (in millions)
1	0.4
2	0.5
3	0.4
4	0.3
5	0.3
6	0.3
7	0.3
8	0.2
9	0.2
10	0.3
Total	3.5

Note: Decile 1 – MPCE less than Rs.1742, decile 2 – MPCE between Rs. 1742 and Rs.2186, decile 3 – MPCE between Rs.2186 and Rs.2600, decile 4 – MPCE between Rs.2600 and Rs.3000, decile 5 – MPCE between Rs. 3000 and Rs.3500, decile 6 – MPCE between Rs.3500 and Rs.4000, decile 7 – MPCE between Rs. 4000 and Rs.4688, decile 8 – MPCE between Rs.4688 and Rs.5492, decile 9 – MPCE between Rs.5492 and Rs.7292, decile 10 – MPCE between Rs.7292 and Rs.114583

Table A3: Households living in congested conditions across MPCE deciles in non-slum areas

Decile	Number of households living in congestion, 2018 (in millions)
1	2.2
2	2.3
3	2.1
4	1.7
5	1.8
6	1.7
7	1.4
8	1.2
9	0.9
10	0.6
Total	17

Note: Decile 1 – MPCE less than Rs.1742, decile 2 – MPCE between Rs. 1742 and Rs.2186, decile 3 – MPCE between Rs.2186 and Rs.2600, decile 4 – MPCE between Rs.2600 and Rs.3000, decile 5 – MPCE between Rs. 3000 and Rs.3500, decile 6 – MPCE between Rs.3500 and Rs.4000, decile 7 – MPCE between Rs. 4000 and Rs.4688, decile 8 – MPCE between Rs.4688 and Rs.5492, decile 9 – MPCE between Rs.5492 and Rs.7292, decile 10 – MPCE between Rs.7292 and Rs.114583

Table A4: Households living in slum areas across MPCE deciles

Decile	Number of living in slums, 2018 (in millions)
1	5
2	3.4
3	3.6
4	4.1
5	3.4
6	2.3
7	1.4
8	1.7
9	1.4
10	0.3
Total	26.4

Note: Decile 1 – MPCE less than Rs.1742, decile 2 – MPCE between Rs. 1742 and Rs.2186, decile 3 – MPCE between Rs.2186 and Rs.2600, decile 4 – MPCE between Rs.2600 and Rs.3000, decile 5 – MPCE between Rs. 3000 and Rs.3500, decile 6 – MPCE between Rs.3500 and Rs.4000, decile 7 – MPCE between Rs. 4000 and Rs.4688, decile 8 – MPCE between Rs.4688 and Rs.5492, decile 9 – MPCE between Rs.5492 and Rs.7292, decile 10 – MPCE between Rs.7292 and Rs.114583

Table A5 Married couples without separate rooms in non-slum areas

No of married couples	Couples without separate room				Total households
	1	2	3	4	
1	1,35,52,375	0	0	0	1,35,52,375
2	19,76,350	10,08,014	0	0	29,84,364
3	3,91,466	1,31,088	1,48,041	0	6,70,595
4	57,162	13,835	8,665	8,099	87,761
5	2,265	3,638	1,912	0	7,815
6	0	1,874	0	1,674	3,548
Total	1,59,79,618	11,58,449	1,58,618	9,773	1,73,06,458

Table A6: Descriptive Statistics of Housing Characteristics Used in Hedonic Regression

	Mean	Standard Deviation
Floor area (square feet)	346.25	229.42
Number of rooms	3.37	1.6
Household heads who have passed high school or more in neighbourhood/FSU (%)	43	27
Households (%)		
Settlement type – slum	6.52	
Type of house – flat (Base category - independent house)	48.4	
Type of house – 'others' (Base category - independent house)	20.13	
Condition of structure – bad (Base category is good or satisfactory)	7.06	
Bathroom and latrine both located outside the house	12.9	
Drainage system is covered *pucca* (Base category is underground)	18.08	
Drainage system is open *pucca* (Base category is underground)	17.67	
Drainage system is open *katcha* (Base category is underground)	3.26	
No drainage system (Base category is underground)	5.26	
Ventilation is satisfactory (Base category is good)	43.78	
Ventilation is bad (Base category is good)	10.03	
Availability of water is sufficient	36.08	
Absence of separate kitchen with water tap (0-Yes, 1-No)	34.15	
Garbage is not collected daily (Base category – it is collected daily)	58.33	
Experienced flood in the last 5 years	4.15	
Metropolitan city[44]	39.73	

[44] Cities with a population of 1 million or more

Table A7: Hedonic Price Regression for Rented Households

Dependent variable is natural log of rent	Coefficients
Log of floor area	0.41***
Number of rooms	0.06***
Percentage of household heads who have passed high school or more in neighbourhood	0.09***
Settlement type (non-slum=0, slum=1)	-0.06**
If type of house is flat (Base category - independent house)	0.08***
If type of house is 'others' (Base category - independent house)	-0.03
Condition of structure is bad (Base category is good or satisfactory)	-0.20***
Bathroom and latrine both are outside the house	-0.14***
Drainage system is covered *pucca* (Base category is underground)	0.02
Drainage system is open *pucca* (Base category is underground)	-0.03
Drainage system is open *katcha* (Base category is underground)	-0.10***
No drainage system (Base category is underground)	0.02
Ventilation is satisfactory (Base category is good)	-0.09***
Ventilation is bad (Base category is good)	-0.15***
Availability of water is sufficient	0.06***
Separate kitchen with water tap (0-Yes, 1-No)	-0.16***
Garbage is not collected daily (Base category – it is collected daily)	-0.04***
Experienced flood in the last 5 years	-0.02
Metropolitan city	0.21***
Constant	5.17***
District Dummies	Yes
Observations	10,078
R-squared	0.577

Note: *** p<0.01, ** p<0.05, * p<0.1

Table A8: Estimation Results of Consumption Demand of Owner-Occupied Houses

VARIABLES	Owned Non-Slum EWS1	Owned Non-Slum EWS2	Owned Non-Slum LIG	Owned Non-Slum Pooled	Owned Slum EWS1	Owned Slum EWS2	Owned Slum Pooled
Log of rent per square feet	0.78***	0.63***	0.64***	0.67***	0.65***	0.60***	0.61***
Log of MPCE	0.35***	0.54***	0.43***	0.49***	0.38***	0.46***	0.38***
Household Size	0.08***	0.09***	0.10***	0.09***	0.09***	0.09***	0.09***
Female headed household	-0.05***	-0.03***	-0.03	-0.04***	-0.07	-0.05	-0.07*
Log of age of household head	0.36***	0.29***	0.23***	0.30***	0.22**	0.33***	0.30***
Constant	2.00***	0.98***	2.09**	1.34***	2.22***	1.18**	1.95***
Observations	6,165	16,205	819	23,292	508	988	1,510
Adjusted R-squared	0.36	0.38	0.35	0.45	0.29	0.35	0.37

Note: *** p<0.01, ** p<0.05, * p<0.1

Table A9: Estimation Results of Consumption Demand for Rented Houses

VARIABLES	Rented Non-Slum EWS1	Rented Non-Slum EWS2	Rented Non-Slum LIG	Rented Non-Slum Pooled	Rented Slum EWS1	Rented Slum EWS2	Rented Slum Pooled
Log of rent per square feet	0.66***	0.47***	0.36***	0.48***	1.1***	0.65***	0.75***
Log of MPCE	0.50***	0.64***	0.38***	0.58***	0.04	0.43***	0.36***
Household Size	0.10***	0.17***	0.29***	0.15***	0.02	0.11***	0.09***
Female headed household	-0.12***	-0.01	7.01e-05	-0.04**	-0.18	0.10	0.07
Log of age of household head	0.20***	0.29***	0.64***	0.35***	0.14	0.09	0.10
Constant	1.28**	-0.17	0.96	0.23**	4.28**	1.69**	2.08***
Observations	1,067	6,867	516	8,525	119	520	650
Adjusted R-squared	0.42	0.40	0.41	0.43	0.56	0.32	0.40

Note: *** p<0.01, ** p<0.05, * p<0.1

Table A10: Estimation Results of Number of Rooms of Owner-Occupier Households

	Owned Non-Slum EWS1	Owned Non-Slum EWS2	Owned Non-Slum LIG	Owned Non-Slum Pooled	Owned Slum EWS1	Owned Slum EWS2	Owned Slum Pooled
Log of implicit price of room (1)	-0.11***	-0.14***	-0.17***	-0.14***	-0.15**	-0.20***	-0.19***
Dummy for congested household (2)	-1.6***	-0.69***	0.69	-0.72***	-3.72*	-0.70	-0.31
Interaction effect between (1) and (2)	0.05**	-0.01	-0.09	0.02	-0.02	-0.004	-0.01
Log of MPCE (3)	0.26***	0.36***	0.26***	0.35***	-0.07	0.26***	0.28***
Interaction effect between (3) and (2)	0.13***	0.05*	-0.05	0.03***	0.46*	0.04	-0.005
Log of household size	0.47***	0.37***	0.18***	0.38***	0.46***	0.45***	0.44***
Dummy female headed household	-0.09***	-0.001	-0.007	-0.03***	-0.18**	-0.10**	-0.11***
Log of age of household head	0.45***	0.31***	0.20***	0.35***	0.29***	0.29***	0.3***
Constant	-2.40***	-2.42***	-0.86	-2.55***	0.71	-1.63***	-1.84***
Observations	5,624	15,686	810	22,223	324	868	1,206
Adjusted R-squared	0.328	0.291	0.172	0.341	0.230	0.331	0.305

Note: Dependent variable is log of number of rooms, and p<0.01, ** p<0.05, * p<0.1

Table A11: Estimation Results of Number of Rooms of Renter Households

Dependent variable – log of number of rooms	Rented Non-Slum EWS1	Rented Non-Slum EWS2	Rented Non-Slum LIG	Rented Non-Slum Pooled	Rented Slum EWS1	Rented Slum EWS2	Rented Slum Pooled
Log of implicit price of room (1)	-0.43***	-0.35***	-0.17***	-0.34***	-0.007	-0.29***	-0.27***
Dummy for congested household (2)	-1.09	-0.40	-8.17	-0.99***	3.14	-0.47	0.55
Interaction effect between (1) and (2)	0.10*	-0.07**	-0.31	-0.05**	0.28	0.09	0.17***
Log of MPCE (3)	0.32***	0.55***	0.11	0.44***	0.76**	0.44***	0.43***
Interaction effect between (3) and (2)	0.047	0.048	1.02	0.11***	-0.62	-0.04	-0.20**
Log of household size	0.41***	0.50***	0.58***	0.49***	0.29*	0.37***	0.36***
Dummy female headed household	-0.04	0.01	0.01	0.002	-0.10	0.03	-0.003
Log of age of household head	0.024	0.17***	0.58***	0.19***	0.50**	0.11	0.15**
Constant	-0.20	-2.99***	-1.42	-2.20***	-6.96**	-2.33***	-2.39***
Observations	1,067	6,868	516	8,526	119	520	650
Adjusted R-squared	0.25	0.39	0.54	0.37	0.15	0.26	0.21

Note: Dependent variable is log of number of rooms and p<0.01, ** p<0.05, * p<0.1

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