The Welfare Effects of Urban Land Use Policies on Slum Dwellers: The Case of Mumbai

Akie Takeuchi
(University of Maryland)

Maureen Cropper
(University of Maryland, World Bank)

Antonio Bento
(University of Maryland)

April 2005

We thank Judy Baker, Rakhi Basu, and Somik Lall (World Bank) for their contribution in data collection and the World Bank TUDUR for funding the study.

The Welfare Effects of Urban Land Use Policies on Slum Dwellers: The Case of Mumbai

Akie Takeuchi, Maureen Cropper and Antonio Bento
University of Maryland

I. Introduction

Slums, which are characterized by substandard housing and inadequate water and sanitation facilities, are among the most pressing urban environmental problems in developing countries. Policies to improve the welfare of slum dwellers include upgrading slum housing—for example, by providing piped water and sewage connections—and relocating slum dwellers to better quality, low cost housing.

The goal of this paper is to evaluate the welfare effects of such programs using data for Mumbai (Bombay), India. A key issue in slum upgrading is whether current residents are made better off by improving housing in situ, or by being relocated. The answer to this question depends on the tradeoffs people are willing to make between commuting costs, housing costs and the attributes of the housing that they consume. If, for example, a relocation program distances a worker from his job and, if finding a new job is difficult, in situ improvements in housing may dominate relocation programs. The utility of relocation programs also depends on neighborhood composition: if households depend on neighbors of the same caste or ethnic group for information about employment or for social services, relocation to neighborhoods of different ethnicity may be welfare-reducing.

Evaluating the welfare effects of slum upgrading and resettlement programs requires estimating models of residential location choice, in which households trade off commuting costs against the cost and attributes of the housing they consume, including neighborhood attributes. We accomplish this using data for 5,000 households in Mumbai, a city in which 40% of the population lives in slums. A key feature of Mumbai that distinguishes it from other Third World cities is that many slums are centrally located, i.e., located near employment centers, rather than being relegated to the periphery of the city. Most slum relocation projects will therefore involve moving people to more remote locations. We ask what corresponding improvements in housing and/or commuting costs would be necessary to offset the location change.

To answer these questions we estimate a nested logit model of commute mode choice and residential location choice for households in Mumbai. In estimating the model we treat the workplace location of the two principal household earners as fixed and model commute mode choice conditional on household vehicle ownership. The choice of residential location is modeled as a discrete choice problem in which each household's choice set consists of the chosen house plus a random sample of 99 houses from the subset of the 5,000 houses in our sample that the household can afford. Houses are described by a vector of housing characteristics and by the characteristics of the neighborhood within a 1 km radius of the house. In estimating the residential location model we capture unobserved heterogeneity in housing by estimating a house-specific constant for all dwellings in our sample (Bayer, McMillan and Rueben, 2004a, 2004b).

We use the model of residential location and commute mode choice to examine the welfare effects of specific programs—improvements in housing attributes and the provision of basic public services, and a slum relocation program. Most slum relocation projects in Mumbai are small-scale policies that do not fully eliminate the slum at its initial location. Instead the policy relocates a small fraction of slum dwellers. Slum dwellers have recently been relocated from locations near railroad tracks to the city suburbs as part of a program of infrastructure improvements in Mumbai. To address the potential welfare loss associated with an increase in commuting costs, we also couple a slum relocation program with an income subsidy.

The paper is organized as follows. Section 2 describes the data used in our empirical work and presents the stylized facts about where people live and work in Mumbai. Section 3 describes the models of commute mode choice and residential location choice. Section 4 presents estimation results and section 5 the welfare effects of slum upgrading policies. Section 6 concludes.

II. Job and Housing Locations in Mumbai

The target population of our study are households in the Greater Mumbai Region (GMR), which constitutes the core of the Mumbai metropolitan area. The GMR, with a population of 11.9 million people in 2001, is one of the most densely populated cities in the world. Located on the Arabian Sea, the GMR extends 42 km north to south and has a maximum width of 17 km. The Municipal Corporation of Greater Mumbai has divided the city into 6 zones (see Figure 1), each with distinctive characteristics. The southern tip of the city (zone 1) is the traditional city center. Zone 3 is a newly developed commercial and employment center, and zones 4, 5 and 6, each served by a different railway line, constitute the suburban area. In the remainder of this section we describe the distribution of population and jobs in the GMR, as well as the characteristics of the housing stock, based on a random sample of 5,000 households in Mumbai who were surveyed in the winter of 2003-2004 (Baker et al. 2005).

Table 1 presents our sample households, broken down by income category. Housholds earning 5,000 Rs. per month or less constitute the bottom quartile (26.5%) of our sample, households earning 5,000-7,500 Rs. per month the next quartile (27.7%), households earning 7,500-10,000 Rs. per month 22% of our sample, and households in the next two income categories 18% and 6% of our sample, respectively.[1]

Almost 40% of our sample households live in slums, with the percent living in slums increasing as income falls. This number is consistent with the extent of slums in other cities (United Nations Global Report on Human Settlements, 2003). According to the United Nations, 924 million people, or 31.6% of the world's urban population, lived in slums in 2001. Slums in Mumbai were formed by residents squatting on open land as the city developed.[2] Slum residents do not possess a transferable title to their property; however, "notified" squatter settlements have been registered by the city, and slum dwellers in these settlements are unlikely to be evicted.[3] Chawls, which house approximately 35% of sample households, are usually low-rise apartments with community toilets that, on average, have better amenities than slums. The remaining 25% of households live either in cooperative housing, which includes modern, high-rise apartments, in bungalows, or in employer-provided housing.

A. Distribution of Population and Housing

The spatial distribution of sample households by housing type is shown in Figures 2 and 3, where each dot represents 5 households, and is summarized in Table 2. Slums are not evenly spread throughout the city: they constitute a higher-than-average fraction of the housing stock in zones 5 and 6 (79% and 47%, respectively), but less than 20% of

---

[1] In PPP terms, 5,000 Rs. corresponds to $562 USD.
[2] For example, Dharavi, the world's largest slum, was originally a fishing village located on swamp land. Slums began forming there in the late 19th century when land was reclaimed for tanneries. Once on the periphery of Mumbai, Dharavi is now centrally located (in zone 2).
[3] 1.8 % of our sample households live in "non-notified" slums and 1.6 % in resettlement areas. The average tenure of households in notified squatter settlements suggests that squatters are unlikely to be evicted: 81% of households have been living in current location for more than 10 years while corresponding figure for the formal housing sector is 74%.

the housing stock in zones 1 and 4. Nonetheless, slum dwellers in Mumbai are considerably more integrated among non-slum dwellers than in other cities: 40% of slum-dwellers live in central Mumbai (zones 1-3).[4] In contrast, there are virtually no slums in central locations in Delhi or most cities in Latin America (United Nations Global Report on Human Settlements, 2003). In these cities, slums are typically located at the periphery: as a consequence, slum dwellers spend several hours commuting to work.

Table 3 shows characteristics of the housing stock by housing type and zone. It attests to the fact that slum dwellings are, on average, smaller than either chawls or cooperative housing, and less likely to have piped water connections or a kitchen inside the dwelling. It is, however, clear that the quality of slum housing varies considerably by zone: whereas 61% of slum households have piped water in zone 2, only 19% of slum households have piped water in zone 4.

B. Distribution of Jobs and Commuting Patterns

Table 4, based on data for 6,371 workers in our sample households, shows where people living in each zone work.[5] Fifty-seven percent of workers in our sample households work in zones 1-3, 31% in the suburbs (zones 4-6), and 6% at home. The rest either do not work in a fixed location or work outside of the GMR. A striking feature of Table 4 is the high percent of workers who live in the same zone in which they work. This is highest in zones 1-3, but is substantial even in the suburbs. Replicating Table 4 for different income and occupational groups reveals that the diagonal elements in the table (the percent of people working and living in the same zone) are higher for workers

[4] This is also true of the poor v. the non-poor. See Baker et al. (2005) Figure 2 and Tables 2 and 3.
[5] Table 4 is based on the usual commutes of the two most important earners in each household. Forty percent of sample households have more than one earner.

in low-income than in high-income households, and are higher for unskilled and skilled laborers than for professionals (Baker et al. 2005, Tables 38 and D-1).

Figure 4, which shows the distribution of one-way commute distances for workers in our sample is consistent with Table 4: the median journey to work is less than 3 kilometers, although the distribution of commute distances has a long tail. Table 5, which shows mean commute distance by zone and income, suggests that persons with longer commutes are more likely to live in the suburbs, especially in zones 4 and 6. With few exceptions, mean commute to work increases with income, regardless of zone of residence.

The information presented here suggests that, on average, people in Mumbai live close to where they work: This is especially true for the poor, and also for laborers. This suggests that households may place a high premium on short commutes. If, in the short run, workers' job locations are fixed, involuntary resettlement programs may reduce welfare if they move workers farther from their jobs. The impact of such programs on welfare will, however, also depend on the value attached to housing and neighborhood amenities.

III. Analytical Framework

The models of travel demand and residential location choice we have estimated are descendants of a nested logit model of mode choice, conditional on residential location, and choice of residential location (e.g., Lerman 1975), but incorporate the recent literature on the treatment of unobserved heterogeneity in discrete location choice models (Bayer et al. 2004a, 2004b). This section describes in detail the structure of these models and how they will be used to evaluate slum improvement programs.

A. Commute Mode Choice

Holding residential and employment locations fixed, a household must decide what mode to use for the main earner's commute. Formally, let V_{hm} denote the observable portion of the utility that is received from taking mode *m* from house *h* and e_{hm} the portion of utility known to the household but unobserved by the researcher. V_{hm} depends on the time cost of traveling (t_{hm}) and on money costs of traveling expressed in minutes of labor needed to earn this amount (c_{hm}/w), where *w* is the main earner's wage rate, on a mode-specific constant that captures the utility of the mode (d_m), and on interactions between characteristics of the traveler (W), and the time and money costs of travel,

$$V_{hm} = \beta_d d_m + \beta_t t_{hm} + \beta_c (c_{hm}/w) \qquad (1)$$

$$\beta_r = \alpha_0 + \alpha_w W, \qquad r = d, t, c.$$

Assuming that the $\{e_{hm}\}$ are independently and identically Gumbel distributed, the probability that mode *m* is chosen, conditional on living in house *h*, is given by the multinomial logit formula

$$P_m = P(V_{hm} + e_{hm} > V_{hn} + e_{hn},\ \forall n \neq m) = exp(V_{hm}) / exp(I_h) \qquad (2)$$

where

$$\mathrm{I}_h = \ln\{\sum_m \exp(V_{hm})\}$$

The denominator of (2), I_h, termed the logsum, is the expected maximum utility the household obtains from the main worker's commute, conditional on living in house *h*. It is increasing in the number of modes in the household's choice set, and decreasing in the travel time and travel cost of each mode. Once the parameters of the mode choice model have been estimated, the indexes $\{I_h\}$ measure accessibility to the workplace from different residential locations in the city.

B. Modeling Location Choice

For simplicity of exposition, suppose that there is only one worker in the household. Let the utility received from living in house *h* and commuting to work by mode *m* be given by

$$U_{hm} = V_h + V_{hm} + e_h + e_{hm} \tag{3}$$

where V_h is the systematic component of the utility of house h, V_{hm} the systematic component of the utility of commuting via mode m from house h, and e_h and e_{hm} represent unobserved characteristics of house h and of commuting by mode m from house h.[6] If we assume that e_h and e_{hm} are independently distributed for all m and h, that e_h is i.i.d. Gumbel with scale parameter μ_h, and e_{hm} is i.i.d. Gumbel with scale parameter μ_m, then the probability of choosing house h is given by

$$P_h = \exp(V_h + I_h / \sigma) / \sum_h \exp(V_h + I_h / \sigma) \tag{4}$$

where $\sigma = \mu_h / \mu_m$ and

$$I_h = \ln\{\sum_m \exp(\sigma V_{hm})\}$$

I_h is similar to the accessibility index defined above. The probability of commuting by mode m conditional on choosing house h is given by

$$P_{m|h} = \exp(\sigma V_{hm}) / \sum_n \exp(\sigma V_{hn}) \tag{5}$$

[6] To simplify notation, we have dropped the household subscript, i, from our equations. e_{hi} and e_{hmi} represent the unobserved, idiosyncratic preferences of households for housing and commuting characteristics.

The systematic component of utility V_h may be modeled as linear combination of observed house characteristics and neighborhood characteristics,

$$V_h = \beta_X X_h + \beta_Z \overline{Z}_h + \beta_p \ln(y - p_h) + \xi_h \tag{6}$$
$$\beta_{rj} = \alpha_{0j} + \alpha_{rj} Z, \quad r = X, Z, p \tag{7}$$

where X_h is a vector of house characteristics, $\overline{Z}_h$ is a vector of aggregate household characteristics of the neighborhood the house belongs to (i.e. average income, ethnic composition, etc), p_h is the user cost of housing, and ξ_h is a house specific constant that captures unobserved house characteristics. Equation (7) allows each element j of the β coefficient vectors to depend on the inner product of a vector of household characteristics, Z, and a vector of coefficients α_{rj}.

Estimation of the parameters of (4) (6) and (7) will allow us to infer the rate of substitution between accessibility to work and housing cost, and accessibility to work and neighborhood and housing characteristics. To evaluate the welfare effect of moving household i from its chosen location to a new one, we compute the amount, CV, that must be added to the Hicksian bundle to keep the systematic part of the household's utility constant when it is moved.[7]

C. Estimation of the Model

We estimate the model using the two-stage maximum likelihood procedure described above. In estimating the model of residential location choice each household's choice set consists of the chosen house plus a random sample of 99 houses from the

[7] CV is negative for a net improvement in housing and neighborhood characteristics.

subset of the 4,132 houses in our sample that the household can afford.[8] Because the housing attributes in our dataset are highly correlated, we use principal components of the attributes in estimating the parameters of equation (7). The use of principal components has the additional advantage that they are continuous, rather than dummy, variables. Because all arguments of the utility function are continuous variables, we are able to estimate the house-specific constants ξ_h jointly with the other parameters of the equation, rather than regressing the house-specific constants on instruments for house price and neighborhood characteristics, as in Bayer et al. (2004b).

We determine in two steps the parameter vector on housing/neighborhood characteristics, $\boldsymbol{\beta} = (\beta_X\ \beta_Z\ \beta_p)$ and set of house specific dummies $\{\xi_h\}$ that maximize the probability that households in our sample choose their current location. First, we find the vector $\boldsymbol{\beta}$ that maximizes the likelihood function for a given value of $\{\xi_h\}$ and calculate the estimated demand for each house h as

$$D_h = \sum_i P_{hi} .$$

In the second step, we search for the set of house specific constants $\{\xi_h\}$ that satisfy the maximization condition in equation (8), given our first-stage estimate of $\boldsymbol{\beta}$,

$$\partial \ln L / \partial \xi_h = (1 - P_{hh}) + \sum_{i \neq h} P_{hi} = 1 - \sum_i P_{hi} = 0 \text{, } \forall h . \tag{8}$$

Berry(1994) and Berry, Levinsohn, and Pakes (1995) show that for any $\boldsymbol{\beta}$ the unique $\{\xi_h\}$ that satisfy above conditions can be obtained by solving the contraction mapping

$$\xi_h^{t+1} = \xi_h^t - \ln(\sum_i P_{hi}) \tag{9}$$

[8] The original set of approximately 5,000 households is reduced because information about housing characteristics is missing for some houses, and because we eliminate employed-provided housing from the choice set.

The $\{\xi_h\}$ obtained in the second stage are used to re-estimate $\boldsymbol{\beta}$ in step one. The procedure iterated until our estimators converge.

IV. Estimation Results

A. Commute Mode Choice

Before presenting estimation results, we examine the commute mode choices of workers in our sample. Table 6 shows the main commute mode[9] to work for the two most important income earners in each household who work at a fixed location within the GMR.[10] The most important earner in each household is usually the household head (95% of which are male). Forty percent of sample households have more than one earner, and the second most important earner is also likely to be male.[11]

The most striking feature of Table 6 is the percent of work trips that are made on foot. Overall, 49% of workers walk to work, although this share decreases with income (Baker at al. 2005, Table 7).[12] After walking, train and public bus are the major modes used in commuting: 16% of workers rely on rail, 17% on bus and 6% on bus-plus-rail. The shares of two-wheelers and cars are small (9% and 3% respectively). However, if one looks at higher income groups, the share of private vehicles is considerably larger

---

[9] For multiple mode trips, the main mode is defined as the motorized mode in which the traveler spends the longest time. Walking and bicycling can be a main mode only if the trip is a single mode trip.

[10] Table 6 includes 4,958 of the workers in Table 4 who commute to a fixed location in the GMR. Persons who work at home, who work outside of the GMR, or who do not work at a fixed location are excluded from Table 6 and from estimation of the commute mode choice model. Workers whose main commute mode is bicycle, taxi or auto-rickshaw have also been excluded from the model due to the low shares for these commute modes.

[11] Only 10% of wives in our sample are employed outside the home, a figure that agrees with the 1999 National Sample Survey.

[12] If workers who bicycle to work or take taxis, auto rickshaws or shared ride (total of 5.3% of sample) were included in Table 6, the percent of workers who walk to work would decrease to 44%.

(21% for two-wheelers and 24% for cars for household earning more than 20,000 rupees per month).

In addition to estimating a multinomial logit model of commute mode choice, we also estimate mixed logit models that allow β_{dm}, β_t, and β_c to vary across travelers according to the distribution $F(\boldsymbol{\beta}|\boldsymbol{\theta})$, $\boldsymbol{\beta}=\{\beta_{dm}, \beta_t, \beta_c)$ where θ is a parameter that defines the density function. In the mixed logit model the choice probability of mode m becomes

$$P_m = \int [\exp(\mathrm{V}_\mathrm{m}(\beta)) / \sum_m \exp(V_m(\beta)] dF(\beta). \qquad (10)$$

We estimate the mixed logit model by simulated maximum likelihood when $\boldsymbol{\beta}$ is assumed to follow a triangular distribution and by hierarchical Bayesian methods when β_{dm} is assumed to be normally distributed and β_t and β_c are assumed to be lognormally distributed (Train 2003).

In estimating the commute mode choice models the worker is assumed to choose a commute mode from the following five options: (1)walking; (2) rail; (3) bus; (4) bus-plus-rail; (5) motorized two-wheeler (MTW); (6) car. Bicycle, auto rickshaw, taxi and shared ride are eliminated due to the very low frequency with which they are observed in the data. The bus-plus-rail option assumes bus access to nearest rail station, followed by travel by rail for the rest of the trip, since most multi-mode trips are of this form.

The choice set for each traveler is determined by the following rules: (1) the choice set for a given worker excludes two-wheeler and/or car if the household does not own one; (2) rail and bus-plus-rail are not an option if the nearest rail station to home and the nearest station to work are the same; (3) the walking and bus modes enter all commuters' choice sets. Details on the construction of the time and cost variables used in commute model choice models appear in the Appendix.

Table 7 presents results for six specifications of the multinomial logit model. In model 1 β_{dm}, β_t, and β_c do not depend on worker characteristics. In models 2 through 6, β_{dm}, β_t, and β_c are allowed to depend on worker characteristics. (Interactions of additional worker characteristics with time and cost variables, as well as with mode-specific constants, are summarized in Table A2.) Perhaps the most striking result in Table 7 is the high value of out-of-vehicle time. Time spent walking (calculated for a man with no small children) is valued at 1.38 to1.64 times the wage, depending on the specification. The value of in-vehicle time varies with mode: it is highest for bus and two-wheeler, lowest for rail and car, but in all cases lower than the value for out-of-vehicle time.[13]

Table 8, which presents results for the mixed logit models, suggests that there is considerable variation in the value of both in-vehicle and out-of-vehicle travel times across commuters. When the coefficients on cost and time are assumed to have triangular distributions, the spread in the coefficient of cost exceeds the mean value of the coefficient (in absolute value). There is also considerable spread in the value attached to walking time and rail time. Unfortunately, attempts to explain variation in value of time as a function of commuter characteristics are largely unsuccessful, as Table 7 and Table A2 demonstrate.

The mean values of time reported in Tables 7 and 8 are high compared to industrialized countries but not compared to studies for developing countries. It is not uncommon to find values of walking time that exceed the wage (Deaton et al. 1987,

[13] The value of in-vehicle travel time, averaged across all modes, is approximately equal to the wage.

DFID 2002). There are two possible explanations for this. One is that people are working more hours than they would like. The value of time can certainly exceed the wage for people who are over-employed. The second is that, given observed mode shares, the value of walking time will be higher the higher is the cost of motorized transport. As noted above, the one form of motorized transport available to all Mumbaikers is bus. Bus fares are, however, high relative to incomes: the cost of commuting 30 km round trip by bus is 20 Rs. per day, approximately the median hourly wage for workers in our sample.[14]

Personal and location characteristics have a significant impact on mode-specific constants. Table 7 suggests persons who work in zones 1 and 2 are more likely to take public transportation or drive a two-wheeler to work (compared to walking) than persons who work elsewhere. Workers who live in zones 1 and 2 are, however, less likely to take public transportation or drive a two-wheeler (compared to walking) than workers who live elsewhere. Women are less likely to drive a two-wheeler than men, and persons with small children are more likely to ride rail. The likelihood of driving a two-wheeler to work rises with age (up to age 35), while the probability of driving to work peaks at age 40.

For the purposes of modeling residential location choice, we use model 1 of Table 7 to compute the logsum for the first and second most important earners in each household. The "plain vanilla" model fits about as well as the models with covariates, and yields price and income elasticities of demand for different modes close to the mean elasticities from the mixed logit models.

[14] There are no bus passes available in Mumbai. Rail fares, by contrast are quite cheap: the cost of a monthly pass for the worker commuting 15 km each way to work would be 75 Rs., about 3 Rs. per day.

B. Residential Location Choice

Specification of the Utility Function

We assume that a household's utility from its residential location [eq. (7)] depends on the log of monthly income minus the monthly cost of housing (i.e., the log of the Hicksian bundle), on the10 housing characteristics listed in Table 9, on the logsums for the first and second principal earners in the household, computed from model 1 of table 7, and on the neighborhood characteristics listed in Table 9. Neighborhood characteristics include whether the house is within 0.3 km of a railroad track, the mean income of the neighborhood in which the house is located, and the percent of households in the neighborhood that (a) are of the same religion as the household in question and (b) who speak the same mother tongue. Neighborhood characteristics are computed using sample households within 1 km of each house.[15] We also add zone dummies.[16]

The Hicksian bundle is calculated as follows. All sample households were asked what "a dwelling like theirs" would rent for and what it would sell for.[17] We use the stated monthly market rent as the cost of the dwelling. In calculating the income of households who currently own their home, we add to household income from earnings

[15] A neighborhood contains, on average, 67 households in our sample, although the number varies depending on the population density of the area.
[16] The results in Tables 11 and 12 change little if zone dummies are replaced by section dummies. (There are 88 sections in Mumbai.) We report results using zone dummies for ease of interpretation.
[17] We have used the answers to these questions to compute for each household the interest rate that would equate the purchase price of the house to the discounted present value of rental payments. The mean interest rate is 5.6% and the median 4.8%. Additional evidence that stated market rents are reliable is provided by using them to estimate an hedonic price function for housing in Mumbai. The housing and neighborhood characteristics in Table 9, together with distance to the CBD, explain 65% of the variation in monthly rents in our sample. (See Table A1.)

and other sources the monthly rent associated with the dwelling they own. For renters, household income is stated income from earnings and other sources.[18]

As noted above, we use principal components of the 11 housing characteristics in Table 9 rather than the characteristics themselves. This deals with collinearity among the attributes, and prevents exact collinearity between the attributes and the house specific dummy, whose coefficient, ξ_h, captures unobserved housing and neighborhood characteristics. This permits us to estimate these parameters without using the two-step procedure of Bayer et al. (2004b). In Table 10, we present our preferred results, using the first two principal components of housing attributes, which have eigenvalues greater than one.[19]

Results

Table 10 presents the parameter estimates from 4 models, together with the marginal value of each amenity, i.e., the marginal rate of substitution between the amenity and the Hicksian bundle, evaluated at the median household income for our sample (6,250 Rs. per month). The four models include our preferred specification (with and without house-specific constants) and a model in which the distance to each earner's workplace replaces the logsum from the commute mode choice model (with and without house-specific constants). The value of the latter is that it is easier to interpret a 1 km increase in the distance to work than a one unit change in the logsum. Comparing estimation results with and without house-specific constants shows that ignoring these

[18] Seventy-four percent of sample households claim to own their own home, whereas 26% indicate that they rent. Surprisingly, 83% of households living in notified squatter settlements claim to own their own homes, although it is unlikely that they possess a transferable title.
[19] The first two principal components explain approximately 60% of the variance in housing attributes.

parameters is likely to overstate the value of neighborhood and location-specific amenities.

In our preferred specification (column 4) all housing attributes are statistically significant at the 5% level, with the exception of "good floor." Other things equal, being in a chawl (the omitted housing category), is worth 366 Rs. per month more than being in a slum, whereas being in a coop is worth 648 Rs. more than being in a chawl. Being in a high-rise building (flat) is worth 670 Rs. per month. Having a piped water connection is worth 244 Rs. per month, and having a private toilet 549 Rs. per month. Overall, the value attached to housing attributes seems reasonable, with the exception of "good floor" which is not statistically significant, and "good wall."

Workers in Mumbai place a premium on living close to where they work. The model in the second column, which replaces the logsum with distance to work, suggests that a household with income of 6,250 Rs. per month would give up almost 600 Rs. to decrease the main earner's one-way commute by 1 km and would give up slightly less than that (550 Rs.) to reduce the second most important earner's commute. Interestingly, when the logsum is used in place of commute distance, the disparity between the value placed on the primary and secondary earners' commutes is even greater, a finding that agrees with the U.S. literature. To put the value of a one unit change in the logsum in perspective, a reduction in commuting distance of about 2 km would, on average, correspond to a one unit increase in the logsum.

Neighborhood attributes matter. For a family with a monthly income of 6,250 Rs. a 1,000 Rs. increase in neighborhood income is worth 68 Rs. per month. The value of being with households who speak the same mother tongue and have the same religion is an increasing, concave function these variables. In a neighborhood where only 5% of one's neighbors speak the same mother tongue, the value of a one percentage point increase in mother tongue is large (186 Rs.). In a neighborhood where 50% of one's neighbors speak the same mother tongue, the value of a one percentage point increase is only 60 Rs. Similar results hold for living with members of the same religion: a one percentage point increase in the percent of households of the same religion is worth 142 Rs. evaluated at a baseline of 5% but is worth only 64 Rs. in a neighborhood where half of households are already of the same religion.

These values are large, and may reflect various forms of network externalities. Munshi and Rosenzweig (2004) emphasize the importance of networks, formed along caste lines, in determining the jobs available to workers in Mumbai. These networks are especially important for laborers and unskilled workers. Similarly, in the United States, Bayer, Ross and Topa (2004) find significant evidence of informal hiring networks, based on the fact that individuals residing in the same block group are more likely to work together than those in nearby but not identical blocks.

In addition to providing employment networks, neighborhoods also serve as social capital to mitigate the effects of poverty. For example, social networks make possible the creation of spontaneous mechanisms of informal insurance and can improve the efficiency of public service delivery and/or of public social protection systems (Collier 1998).

We should, however, be cautious in interpreting these effects. In reality it is virtually impossible to disentangle the different reasons why similar individuals live in the same neighborhood. Part of this sorting is indeed due to preferences. However, neighborhood composition could also be a result of imperfections in housing markets that segregate individuals to specific neighborhoods.

Other amenities that affect residential location are proximity to a railroad track as well as the zone dummies. Living next to a railroad track can be dangerous, in addition to providing visual disamenities: Approximately 6 people are killed each day crossing railroad tracks in Mumbai. The zone dummies indicate that, other things equal, living in zones 4 and 6 of the suburbs is considered more desirable than living in zone 1.

V. Evaluating Slum Improvement Programs

The set of policies that have been employed to improve the welfare of slum dwellers is diverse (Field and Kremer 2005, Mukhija 2001). Some projects have focused on providing secure tenure, on the grounds that this will provide an incentive for slum dwellers to invest in housing (Jimenez 1983, 1984; Malpezzi and Mayo 1987). Other projects, such as those implemented under the World Bank's Sites-and-Services program (Kaufmann and Quigley 1987; Buckley and Kalarickel 2004) have combined secure tenure with provision of basic infrastructure services (piped water and electricity) and loans to allow slum dwellers to themselves build/upgrade their housing.[20] More recently, greater emphasis has been placed on providing incentives for community management and maintenance, including constructing or rehabilitating community centers, and on improving access to health care and education.

[20] In the World Bank sites-and-services project in El Salvador evaluated by Kaufman and Quigley (1987), slum dwellers were given financing to purchase lots on which infrastructure services were provided, as well as materials to construct new homes. Imperfections in credit markets and in the provision of infrastructure services are major reasons for initiating slum improvement projects.

In this paper we focus on improving the physical aspect of slums by providing infrastructure services and improving housing quality. In Mumbai, virtually all slum dwellers have access to electricity; however, only half have piped water. Slum housing consists of small, dilapidated shacks with poor roofs. Programs to improve the physical quality of housing could involve in situ improvements or could involve housing reconstruction, either at the site of the original slum or in a location where bare land is available. Both types of projects have been implemented, albeit on a small scale, in Mumbai. In 1985 the World Bank launched the Bombay Urban Development Project. The goal of the project was to provide tenure security to encourage in situ upgrading by slum dwellers.[21] In the same year the Prime Minister's Grant Project (PMGP), introduced by the state of Maharashtra, proposed to construct 3,800 housing units on the sites of existing slums in Dharavi.[22] In fact, the program planned to construct 2,000 units on site of existing slums and to relocate 1,800 households (whose land was expropriated for road development) to new units in an alternate location (Mukhija 2002).[23]

A larger-scale relocation program is currently underway as part of the second Mumbai Urban Transportation Project (MUTP II). In order to make way for improvements in railway infrastructure, 20,000 slum households are being relocated to new, high-rise housing in zones 2, 5 and 6 of Mumbai. In this case, the possibility of building new housing at the location of existing slums is clearly infeasible. Although the goal of this relocation program is not slum improvement per se, we note that many slum improvement programs are likely to involve some relocation of households.

[21] By the end of the project in 1994, only 22,204 households had opted for legal tenure.
[22] Dharavi, with a population of 1 million, is the world's largest slum. It is located in zone 2.
[23] Mukhija (2001, 2002) describes the history of slum upgrading in Mumbai and details the pace of progress on this and other projects.

We now evaluate stylized versions of both types of programs—in situ upgrading and relocation of slum households to better housing. We focus on slum households located in zone 5, specifically households in sections 79 and 80 who are located within one mile of the Harbor Railway. The characteristics of our sample households living in these slums appear in Table 11. These households are, on average, much poorer than our sample as whole, although 85% claim to own their own home. Average house size is small—141 sq. ft. in section 79 and 161 sq. ft. in section 80. Almost no houses have good roofs and only one quarter have piped water connections. The primary earner in households in both sections commutes, on average, 5 km to work (one-way), although the variance in commute distance is large. In terms of language and religion, the majority of households in section 79 are Marathi-speaking Hindus. In section 80, the majority of households speak Hindi; sixty percent are Hindus and one-third are Muslims.

Table 12 calculates the Hicksian compensating variation (CV) associated with both in situ improvements and two relocation programs.[24] The table shows the mean and standard deviation of CV for each program as well as the 25th, 50th and 75th percentiles of CV. The in situ programs provide good roofs and piped water connections for households that do not have them. Both relocation programs move households from their current locations to new housing in Mankurd, where some households displaced by MUTP II have been relocated to modern, high-rise apartments. (The original locations of households and the relocation site are shown in Figure 5.) We present two relocation scenarios: Case 1 in which households are moved into very high-quality buildings, with private toilets and 213 sq. ft. of living space, and Case 2 in which households are moved

[24] In Table 12 marginal WTP values have been computed for each household in order to examine the welfare effects of various components of the relocation program, rather than using the approach described in section III.

into more modest, low-rise buildings with piped water but with community toilets. In both cases, welfare effects are computed assuming that households receive their new housing for free. We also assume that workers in resettled households continue to work in their old job locations. The religious makeup of the new neighborhood is approximately half Hindu and half Muslim. Sixty percent of households speak Hindi and one-third speak Marathi.

The welfare effects of the relocation programs are quite different for slum households who originally lived in section 79 and those who lived in section 80. Although both programs yield approximately equal housing benefits to both groups, and (on average) move households away from railroad tracks, workers from section 79 are being moved much farther from their jobs than workers who originally lived in section 80. Indeed, the latter, on average, actually benefit by being moved closer to their jobs. The other major difference in welfare between the two groups comes from neighborhood effects. Households who originally lived in section 79, who are primarily Marathi-speaking Hindus, are being moved into a neighborhood with a greater proportion of Muslim and Hindi-speaking households. Whether the impact of these neighborhood effects should be counted as part of the welfare impacts of the slum relocation program depends on how one interprets them. If they reflect true network effects, they should be counted; if they reflect imperfect information in housing markets, they should not.

Even if neighborhood effects are ignored, the impact of moving on the commutes of households from section 79 is enough to (on average) wipe out the benefits of the modest housing improvements afforded by scheme 2 and to significantly reduce the benefits of relocation program 1. Indeed, a quick glance at Table 12 suggests that, at least for households in section 79, in situ improvements dominate relocation programs, a result reported by Kapoor et al. (2004). A more positive way to interpret Table 12 is to say that exactly where households are moved matters. Keeping households with 1-2 km of their original location, which is the case for households in section 80, yields higher net benefits than the longer moves of households in section 79.

It must, of course, be kept in mind that the calculations in Table 12 assume that workers do not change job locations. What the long-term benefits of moving households to Manhkurd would be depends on whether workers will change their job locations, and on the earnings in their new jobs.

VI. Conclusions

In the early Twentieth Century, slum improvement programs in many countries were equivalent to slum clearance—hardly a solution to the problem of lack of adequate housing in developing country cities. Beginning in the 1970's the strategy shifted to one of improving and consolidating existing housing—often by providing slum dwellers tenure security, combined with the materials needed to upgrade their housing or—in areas where land was plentiful—to build new housing. Emphasis on in situ improvements has continued to the present. These improvements may take the form of providing infrastructure services and other forms of physical capital, but also include efforts to foster community management, and access to health care and education. At the same time, some have called for replacing slums with multiple story housing either at the site of the original slum or in an alternate location.

The quantitative literature on the benefits of slum improvements has, for the most part, consisted of hedonic studies that estimate the market value of various improvements, including tenure security and infrastructure services (Crane et al. 1997; Jimenez 1984). Kaufman and Quigley (1987) advance this literature considerably by attempting to estimate the parameters of household utility functions rather than limiting the analysis to the hedonic price function. We have attempted to extend the literature in two ways: first, we introduce the role of commuting to work as a factor influencing the choice of residential location; secondly, we attempt to account for unobserved heterogeneity in housing and neighborhood attributes, in the spirit of Bayer et al. (2004b).[25]

We have also attempted to quantify the role of endogenous neighborhood amenities—in particular, the language and religion of one's neighbors—in residential location choice in Mumbai. Here, more work remains to be done. As Bayer et al. (2004a) note, there are several explanations for households with the same language and/or religion living in the same neighborhood. We plan to explore these in future research. We also plan to expand the current model to allow workers to choose their job locations.

Subject to these limitations, we believe that the model estimated in this paper can be of use in suggesting the relative welfare gains from alternative slum improvement programs.

[25] Crane et al. (1997) include the owner's time to work on the right hand side of the hedonic price function. There is no reason why characteristics of the current owner should appear in the hedonic function. Time to work is not significant in their models.

Appendix. Construction of Variables Used in Commute Mode Choice Models

Out-of-vehicle travel time:

- Walking: Distance from home to job/0.067 (Equivalent to speed of 4km/hour)
- Rail: Distance to nearest rail station (from home and from job)/0.067
- Bus: Answer to "How far is the nearest bus stop?" (from work and from home) from household survey. (Midpoint of the selected range is used.)
- Two-wheeler: 0
- Car: 0

In-vehicle travel time:

- Walking: 0
- Rail, Bus, Two-wheeler, Car: Distance traveled/Average speed of the mode by distance category, short (1-5km) / medium (5-10km) / long(>10km). [Average speed of mode calculated for each distance category using (actual in vehicle time)/(distance to work) for persons who chose that mode. Those who traveled less than 1km is excluded to from the estimation of travel speed because of the relatively large error involved in distance traveled.]

Money cost:

- Walking : 0
- Rail, Bus: Calculated based on the fare tables and distance traveled. The fare tables are taken from http://www.indianrail.gov.in/ (rail) and the Mumbai Metropolitan Region Development Authority (bus).
- Two-wheeler, Car: Gas price (Rs. 37.74 /litre)/Gas mileage (24km/litre for two-wheeler and 10km/litre for car)*Distance

The distance from home to job is estimated as the distance between the worker's home (whose location is geo-reference in the survey) and his approximate work location. The work location is approximated by the centroid of the intersection of the section and pin code in which the job is located.[26] The distances to rail stations from the home and workplace have been calculated using the geo-referenced locations of train stations. The travel distance for rail is the network distance, calculated from actual rail network data.

The wage per minute is calculated as follows:

- Personal income per month/206/60 for full time workers (assuming 8 hours per day, 6 days per week)

[26] If the pin code (section) of the work place is unavailable, the centroid of the section (pin code) is used.

- Personal income per month/103/60 for non-full time worker (assuming they work half time)

References

Baker, Judy, Rakhi Basu, Maureen Cropper, Somik Lall and Akie Takeuchi. 2005. "Urban Poverty and Transport: The Case of Mumbai." World Bank Working Paper, March 2005.

Bayer, Patrick, Robert McMillan and Kim S. Rueben. 2004a. "What Drives Racial Segregation? New Evidence using Census Microdata," *Journal of Urban Economics* 56: 514-535.

Bayer, Patrick, Robert McMillan and Kim Rueben. 2004b. "An Equilibrium Model of Sorting in an Urban Housing Market." NBER Working Paper Series No. 10865. Cambridge, MA.

Bayer, Patrick, Stephen Ross and Giorgio Topa. 2004. "Place of Work and Place of Residence: Informal Hiring Networks and Labor Markets Outcomes." Mimeograph. Yale University.

Berry, Stephen. 1994. "Estimating Discrete-Choice Models of Product Differentiation," *RAND Journal of Economics* 25: 242-262.

Berry, Stephen, James Levinsohn and Ariel Pakes. 1995. "Automobile Prices in Market Equilibrium," *Econometrica* 63: 841-890.

Buckley, Robert and Jerry Kalarickal. 2004. "Shelter Strategies for Urban Poor: Idiosyncratic and Successful, but Hardly Mysterious." World Bank Policy Research Working Paper 3427.

Collier, Paul. 1998. "Social Capital and Poverty." Social Capital Initiative Working Paper No. 4. World Bank.

Crane, Randall, Armita Daniere and Stacy Harwood. 1997. "The Contribution of Environmental Amenities to Low-Income Housing: A Comparative Study of Bangkok and Jakarta." *Urban Studies* 34(9): 1495-1512.

Deaton, Angus, Duncan Thomas, Janet Neelin and Nikhilesh Bhattacharya. 1987. The Demand for Personal Travel in Developing Countries**.** Washington, D.C. World Bank. Policy Planning and Research Staff, Infrastructure and Urban Development Department.

Department for International Development. 2002. "The Value of Time in Least Developed Countries." I.T. Transport Ltd. Oxon, UK

Field, Erica and Michael Kremer. 2005. "Impact Evaluation for Slum Upgrading Interventions." Mimeograph. Harvard University.

Global Report on Human Settlements. 2003. *The Challenge of Slums*. United Nations Human Settlements Program. Earthcan Publications Ltd., London, UK

Jimenez, Emmanuel. 1983. "The Magnitude and Determinants of Home Improvement in Self-Help Housing: Manila's Tondo Project." *Land Economics* 59(1): 70-83.

Jimenez, Emmanuel. 1984. "Tenure Security and Urban Squatting." *The Review of Economics and Statistics* 66(4): 556-567.

Kapoor, Mudit, Somik Lall, Mattias Lundberg and Zmarak Shalizi. 2004. "Location and Welfare in Cities: Impacts of Policy Interventions on the Urban Poor." The World Bank. Policy Research Working Paper 3318.

Kaufmann, Daniel, and John M. Quigley. 1987. "The Consumption Benefits of Investment in Infrastructure: The Evaluation of Sites-and-Services Programs in Underdeveloped Countries." *Journal of Development Economics* 25(2): 263-284.

Kumar, A. 1991. "Delivery and Management of Basic Services to the Urban Poor: the Role of the Urban Basic Services, Delhi." *Community Development Journal* 26(1): 50-60.

Lerman, Steven R. 1975. "Location, Housing, Automobile Ownership, and Mode to Work: A Joint Choice Model." *Transportation Research Record* 610:6-11.

Malpezzi, Stephen and Stephen Mayo. 1987. "User Cost and Housing Tenure in Developing Countries." *Journal of Development Economics* 25: 197-220.

Mukhija, Vinit. 2001. "Upgrading Housing Settlements in Developing Countries: The Impact of Existing Physical Conditions." *Cities* 18(4): 213-222.

Mukhija, Vinit. 2002."An Analytical Framework for Urban Upgrading: Property Rights, Property Values and Physical Attributes." *Habitat International* 26: 553-570.

Munshi, Kaivan and Mark Rosenzweig, 2004. Traditional Institutions Meet the Modern World: Caste, Gender and Schooling Choice in a Globalizing Economy. Mimeo. Brown University.

Train, Kenneth. 2003. *Discrete Choice Methods with Simulation.* Cambridge, Cambridge University Press.

Table 1. Selected Household Characteristics in Mumbai, by Income Group

	Income Group (in rupees per month)					
Characteristic	< 5 k	5–7.5k	7.5–10k	10–20 k	>20 k	All HHs
Household size (mean)	4	4.4	4.6	4.6	4.4	4.4
Age of Head (mean)	38.2	39.4	41.1	42.9	45	40.4
Female Head (%)	8.8	3	3.9	3.2	1.3	4.5
Education (%)						
Primary or less	20.6	10.8	7.2	2.0	0.3	10.4
College or above	4.0	7.9	17.0	39.2	66.5	18.0
Occupation (%)						
Unskilled	33.9	21.0	11.1	3.5	1.3	17.9
Housing Category (%)						
Squatter settlement	52.2	45.3	34.3	16.1	6.2	37.2
Chawls	37.5	37.5	41.5	27.6	9.9	34.9
Cooperative Housing	5.2	9.6	17.1	47.6	78	21
Other	5.1	7.7	7.2	8.8	5.9	7.1
Housing Tenure (%)						
Less than 5 years	18.6	14.5	13.2	20.1	17.4	16.4
6-9 years	8.2	7.5	7.1	8.5	10.8	8
More than 10 years	34.5	35.3	34.7	31.3	46.6	35
Since birth	38.7	42.7	45	40.1	25.3	40.6
Within-household access to:						
Piped Water	48	64	75	92	99	69
Toilet	12	18	31	64	89	32
Kitchen	29	43	61	87	98	54

Table 2. Percent of Households in Different Types of Housing by Zone

	Zone						
	1	2	3	4	5	6	Average
Slum	19.2	36.8	35.1	16.9	78.9	47.3	38.7
Chawl/Wadi	52.0	39.9	37.5	50.2	7.3	24.0	35.2
Coop/Employer-Provided Housing	28.7	23.3	27.4	32.9	13.8	28.7	26.1

Table 3. Housing Characteristics by Housing Type and Zone

	Zone	Slum	Chawl	Coop/ Employer Provided	All Types
Kitchen in the unit	1	24%	59%	87%	60%
	2	26%	46%	87%	48%
	3	40%	41%	97%	56%
	4	55%	37%	89%	57%
	5	41%	63%	100%	50%
	6	34%	46%	94%	54%
	Average	37%	45%	92%	54%
Toilet in the unit	1	8%	42%	73%	45%
	2	6%	10%	65%	21%
	3	4%	18%	98%	35%
	4	13%	16%	88%	39%
	5	4%	6%	96%	16%
	6	5%	26%	91%	35%
	Average	5%	21%	86%	32%
Bathroom in the unit	1	38%	75%	96%	74%
	2	50%	80%	98%	73%
	3	61%	53%	98%	68%
	4	43%	47%	91%	61%
	5	28%	60%	98%	40%
	6	24%	54%	94%	51%
	Average	39%	60%	95%	61%
Water in the unit	1	36%	94%	99%	84%
	2	61%	93%	100%	83%
	3	74%	58%	98%	75%
	4	19%	48%	93%	58%
	5	41%	69%	100%	51%
	6	47%	67%	100%	67%
	Average	50%	69%	98%	69%
Size (sqft)	1	171	259	417	288
	2	147	208	325	212
	3	190	221	453	274
	4	163	223	492	302
	5	170	200	387	202
	6	182	231	426	264
	Average	172	226	428	258

Table 3. Housing Characteristics by Housing Type and Zone

	Zone	Slum	Chawl	Coop/ Employer Provided	All Types
Kitchen in the unit	1	24%	59%	87%	60%
	2	26%	46%	87%	48%
	3	40%	41%	97%	56%
	4	55%	37%	89%	57%
	5	41%	63%	100%	50%
	6	34%	46%	94%	54%
	Average	37%	45%	92%	54%
Toilet in the unit	1	8%	42%	73%	45%
	2	6%	10%	65%	21%
	3	4%	18%	98%	35%
	4	13%	16%	88%	39%
	5	4%	6%	96%	16%
	6	5%	26%	91%	35%
	Average	5%	21%	86%	32%
Bathroom in the unit	1	38%	75%	96%	74%
	2	50%	80%	98%	73%
	3	61%	53%	98%	68%
	4	43%	47%	91%	61%
	5	28%	60%	98%	40%
	6	24%	54%	94%	51%
	Average	39%	60%	95%	61%
Water in the unit	1	36%	94%	99%	84%
	2	61%	93%	100%	83%
	3	74%	58%	98%	75%
	4	19%	48%	93%	58%
	5	41%	69%	100%	51%
	6	47%	67%	100%	67%
	Average	50%	69%	98%	69%
Size (sqft)	1	171	259	417	288
	2	147	208	325	212
	3	190	221	453	274
	4	163	223	492	302
	5	170	200	387	202
	6	182	231	426	264
	Average	172	226	428	258

Table 4. Percentage Distribution of Workers Across Job Locations, by Zone of Residence

	Work location								
Home	At home	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Outside of GMR	Not fixed
Zone 1	8.5	76.0	5.4	4.1	0.9	1.1	2.9	1.2	0.1
Zone 2	6.2	20.3	60.4	6.1	1.6	1.5	1.0	2.8	0.0
Zone 3	5.0	6.7	5.0	73.1	4.2	2.0	0.7	0.3	3.0
Zone 4	8.8	10.2	4.3	21.2	47.8	0.5	0.8	3.1	3.2
Zone 5	2.1	9.0	7.8	6.7	0.9	54.6	6.7	4.7	7.7
Zone 6	4.4	13.3	8.1	7.7	15.1	3.6	37.6	5.4	4.9
Average	5.8	19.5	15.1	22.3	13.4	9.3	8.5	2.9	3.2

Table 5. Mean Commute Distance by Zone and Income (km)

Zone	<5k	5k-7.5k	7.5k-10k	10k-20k	>20k	All HHs
1	2.3	2.7	3.5	3.7	4.6	3.3
2	2.8	3.5	4.4	4.5	5.7	4.0
3	2.8	3.5	4.7	5.1	5.0	4.1
4	4.8	6.7	6.3	9.5	11.3	7.1
5	3.7	4.5	5.8	4.5	6.0	4.6
6	6.2	7.7	8.8	8.9	10.4	8.0
Average	3.9	4.9	5.7	6.1	7.7	5.3

Table 6. Commute Mode Chosen and Workers' Characteristics

Commute mode	Percent
Walk	49
Rail	16
Bus	17
Rail+Bus	6
2-wheel	9
Car	3
Personal characteristics	
Female	11
Have a child <10 years old	39
Female with child	3
Work in zone 1&2	40
Live in zone 1&2	30
Age	
<30	25
30s	33
40s	27
50s	13
>60	3
Personal Income / month	
<1000	2
1-5k	52
5-10k	34
10-15k	12
>2k	1

Table 4. Percentage Distribution of Workers Across Job Locations, by Zone of Residence

	Work location								
Home	At home	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Outside of GMR	Not fixed
Zone 1	8.5	76.0	5.4	4.1	0.9	1.1	2.9	1.2	0.1
Zone 2	6.2	20.3	60.4	6.1	1.6	1.5	1.0	2.8	0.0
Zone 3	5.0	6.7	5.0	73.1	4.2	2.0	0.7	0.3	3.0
Zone 4	8.8	10.2	4.3	21.2	47.8	0.5	0.8	3.1	3.2
Zone 5	2.1	9.0	7.8	6.7	0.9	54.6	6.7	4.7	7.7
Zone 6	4.4	13.3	8.1	7.7	15.1	3.6	37.6	5.4	4.9
Average	5.8	19.5	15.1	22.3	13.4	9.3	8.5	2.9	3.2

Table 5. Mean Commute Distance by Zone and Income (km)

Zone	<5k	5k-7.5k	7.5k-10k	10k-20k	>20k	All HHs
1	2.3	2.7	3.5	3.7	4.6	3.3
2	2.8	3.5	4.4	4.5	5.7	4.0
3	2.8	3.5	4.7	5.1	5.0	4.1
4	4.8	6.7	6.3	9.5	11.3	7.1
5	3.7	4.5	5.8	4.5	6.0	4.6
6	6.2	7.7	8.8	8.9	10.4	8.0
Average	3.9	4.9	5.7	6.1	7.7	5.3

Table 6. Commute Mode Chosen and Workers' Characteristics

Commute mode	**Percent**
Walk	49
Rail	16
Bus	17
Rail+Bus	6
2-wheel	9
Car	3
Personal characteristics	
Female	11
Have a child <10 years old	39
Female with child	3
Work in zone 1&2	40
Live in zone 1&2	30
Age	
<30	25
30s	33
40s	27
50s	13
>60	3
Personal Income / month	
<1000	2
1-5k	52
5-10k	34
10-15k	12
>2k	1

Table7. Multinomial Logit Model Estimation Results with Covariates

	1	2	3	4	5	6
Covariates	None	All	Female	Child	Age/ Age sq	Location
Cost/wage	-0.029	-0.025	-0.030	-0.027	-0.029	-0.028
	[10.38]***	[6.49]***	[9.76]***	[7.66]***	[10.01]***	[10.02]***
Out of veh time	-0.040	-0.042	-0.040	-0.040	-0.040	-0.042
	[31.03]***	[23.13]***	[29.63]***	[24.52]***	[30.98]***	[30.26]***
In-veh time: Rail	-0.001	-0.008	-0.0003	-0.005	-0.001	-0.004
	[0.36]	[1.97]**	[0.09]	[1.33]	[0.37]	[1.30]
In-veh time: Bus	-0.035	-0.040	-0.036	-0.036	-0.035	-0.038
	[12.79]***	[10.40]***	[12.26]***	[10.51]***	[12.71]***	[12.95]***
In-veh time: 2-Wh	-0.038	-0.043	-0.036	-0.044	-0.038	-0.039
	[7.42]***	[6.11]***	[6.77]***	[6.66]***	[7.41]***	[7.24]***
In-veh time: Car	0.003	-0.008	0.004	0.001	0.004	-0.002
	[0.48]	[0.82]	[0.51]	[0.08]	[0.57]	[0.28]
Const: Rail	-2.895	-2.723	-2.961	-2.698	-2.876	-2.731
	[24.88]***	[3.25]***	[23.94]***	[19.00]***	[3.54]***	[19.53]***
Const: Bus	-1.722	-1.733	-1.721	-1.688	-1.426	-1.892
	[19.82]***	[3.26]***	[18.73]***	[15.59]***	[2.78]***	[19.65]***
Const: Rail+Bus	-4.022	-3.744	-4.088	-3.849	-4.562	-3.676
	[28.39]***	[3.37]***	[27.29]***	[22.15]***	[4.33]***	[21.63]***
Const: 2-Wh	-0.394	-3.358	-0.305	-0.377	-2.939	-0.884
	[3.07]***	[2.98]***	[2.30]**	[2.25]**	[2.80]***	[5.64]***
Const: Car	-1.316	-6.741	-1.276	-1.362	-6.241	-1.385
	[5.83]***	[3.29]***	[5.45]***	[5.00]***	[3.17]***	[5.44]***
Const: Rail * Work CBD		-1.052				-1.160
		[2.43]**				[2.69]***
Const: Bus * Work CBD		-0.586				-0.713
		[1.40]				[1.70]*
Const: Rail+Bus * Work CBD		-1.070				-1.184
		[2.40]**				[2.66]***
Const: 2-Wh * Work CBD		-0.925				-0.951
		[1.70]*				[1.80]*
Const: Car * Work CBD		-0.365				-0.694
		[0.51]				[1.02]
Const: Rail * Live CBD		0.888				0.984
		[2.06]**				[2.29]**
Const: Bus * Live CBD		1.059				1.181
		[2.51]**				[2.80]***
Const: Rail+Bus * Live CBD		-0.356				-0.237
		[0.75]				[0.50]
Const: 2-Wh * Live CBD		1.776				1.819
		[3.24]***				[3.40]***
Const: Car * Live CBD		0.618				0.812
		[0.85]				[1.18]
Const: Rail * Age		0.103			-0.002	
		[0.23]			[0.00]	
Const: Bus * Age		-0.022			-0.124	
		[0.08]			[0.47]	
Const: Rail+Bus * Age		0.179			0.331	
		[0.31]			[0.60]	

Covariates	1 None	2 All	3 Female	4 Child	5 Age/ Age sq	6 Location
Const: 2-Wh * Age		1.687			1.573	
		[2.87]***			[2.87]***	
Const: Car * Age		2.857			2.577	
		[2.90]***			[2.70]***	
Const: Rail * Age^2		-0.016			-0.001	
		[0.28]			[0.02]	
Const: Bus * Age^2		-0.003			0.011	
		[0.08]			[0.34]	
Const: Rail+Bus * Age^2		-0.031			-0.046	
		[0.42]			[0.67]	
Const: 2-Wh * Age^2		-0.240			-0.221	
		[3.26]***			[3.24]***	
Const: Car * Age^2		-0.348			-0.314	
		[3.01]***			[2.82]***	
Cost/wage* Child		-0.010		-0.007		
		[1.52]		[1.22]		
Out of veh time* Child		-0.002		-0.001		
		[0.59]		[0.35]		
In-veh time: Rail * Child		0.014		0.012		
		[1.96]**		[1.75]*		
In-veh time: Bus * Child		0.003		0.003		
		[0.46]		[0.45]		
In-veh time: 2-Wh * Child		0.017		0.015		
		[1.51]		[1.47]		
In-veh time: Car * Child		0.013		0.004		
		[0.84]		[0.28]		
Const: Rail * Child		-0.617		-0.578		
		[2.31]**		[2.31]**		
Const: Bus * Child		-0.084		-0.095		
		[0.43]		[0.52]		
Const: Rail+Bus * Child		-0.545		-0.517		
		[1.68]*		[1.71]*		
Const: 2-Wh * Child		-0.269		-0.057		
		[0.96]		[0.22]		
Const: Car * Child		-0.216		0.192		
		[0.43]		[0.41]		
Cost/wage* Female		-0.001	0.004			
		[0.09]	[0.53]			
Out of veh time* Female		-0.005	-0.001			
		[0.80]	[0.30]			
In-veh time: Rail * Female		-0.009	-0.015			
		[0.59]	[1.18]			
In-veh time: Bus * Female		-0.003	-0.001			
		[0.21]	[0.12]			
In-veh time: 2-Wh * Female		-0.051	-0.007			
		[1.13]	[0.24]			
In-veh time: Car * Female		0.034	-0.002			
		[1.13]	[0.06]			
Const: Rail * Female		0.421	0.626			
		[0.92]	[1.64]			

Covariates	1 None	2 All	3 Female	4 Child	5 Age/ Age sq	6 Location
Const: Bus * Female		-0.043	-0.051			
		[0.12]	[0.17]			
Const: Rail+Bus * Female		0.668	0.649			
		[1.13]	[1.35]			
Const: 2-Wh * Female		-1.602	-2.876			
		[1.49]	[2.96]***			
Const: Car * Female		-1.604	-0.636			
		[1.62]	[0.63]			
Cost/wage*Female*Child		0.013				
		[0.79]				
Out of veh time*Female*Child		0.004				
		[0.38]				
In-veh time: Rail*Female*Child		-0.016				
		[0.53]				
In-veh time: Bus*Female*Child		-0.002				
		[0.08]				
In-veh time: 2-Wh*Female*Child		0.123				
		[1.28]				
In-veh time: Car*Female*Child		-23.197				
		[0.02]				
Const: Rail*Female*Child		0.054				
		[0.06]				
Const: Bus*Female*Child		-0.137				
		[0.20]				
Const: Rail+Bus*Female*Child		-0.648				
		[0.57]				
Const: 2-Wh*Female*Child		-8.136				
		[1.12]				
Const: Car*Female*Child		1088.130				
		[0.02]				
Pseudo R-squared	0.46	0.48	0.47	0.46	0.46	0.47
LL	-3284	-3167	-3251	-3276	-3270	-3229
Chisq	5600	5834	5664	5615	5627	5709
Value of time (as a multiple of wage) Male, no children under 10						
Out of veh time	1.38	1.64	1.36	1.51	1.37	1.49
In-veh time: Rail	0.04	0.33	0.01	0.20	0.04	0.15
In-veh time: Bus	1.20	1.57	1.19	1.37	1.20	1.35
In-veh time: 2-Wh	1.30	1.71	1.20	1.66	1.31	1.37
In-veh time: Car	-0.11	0.31	-0.12	-0.02	-0.14	0.08

Absolute value of z statistics in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 8. Estimation Result for Mode Choice Models: Multinomia Logit vs. Mixed Logit

	Multinomial Logit		Mixed Logit w/Triangular Distribution		Mixed Logit w/Normal, Log-normal Distribution *		
	Coef	t-value	Coef	t-value	Implied Coef	Parameter	t-value
Const:Rail(Mean)	-2.895	24.9	-3.109	-20.4	-3.425	-3.421	-90.0
Const:Rail(Band/Variance)			0.062	0.7	0.170	0.171	3.9
Const:Bus(Mean)	-1.722	19.8	-1.677	-15.5	-2.865	-2.917	-24.3
Const:Bus(Band/Variance)			0.006	0.1	4.604	4.575	8.1
Const:Rail+Bus(Mean)	-4.022	28.4	-4.135	-22.4	-4.730	-4.726	-94.3
Const:Rail+Bus(Band/Variance)			0.043	0.8	0.107	0.103	5.3
Const:2 wheeler(Mean)	-0.394	3.1	-0.404	-1.9	-0.482	-0.484	-4.1
Const:2 wheeler(Band/Variance)			3.725	1.6	0.990	1.014	2.9
Const:Car(Mean)	-1.316	5.8	-1.652	-5.5	-1.082	-1.039	-5.4
Const:Car(Band/Variance)			0.020	0.0	1.727	1.669	3.3
Cost(Mean)	-0.029	10.4	-0.052	-9.3	-0.050	-3.217	-56.2
Cost(Band/Variance)			0.071	5.6	0.002	0.430	4.5
Walk(Mean)	-0.040	31.0	-0.051	-20.3	-0.063	-2.826	-101.7
Walk(Band/Variance)			0.033	5.5	0.001	0.114	7.3
In:Rail(Mean)	-0.001	0.4	-0.002	-0.5	-0.002	-6.655	-45.4
In:Rail(Band/Variance)			0.043	4.2	0.000	1.014	6.7
In:Bus(Mean)	-0.035	12.8	-0.042	-10.1	-0.047	-3.100	-74.9
In:Bus(Band/Variance)			0.006	0.9	0.000	0.076	5.8
In:2 wheeler(Mean)	-0.038	7.4	-0.038	-4.8	-0.057	-3.040	-67.3
In:2 wheeler(Band/Variance)			0.015	0.1	0.001	0.357	6.0
In:Car(Mean)	0.003	0.5	0.024	2.0	-0.015	-4.285	-67.0
In:Car(Band/Variance)			0.010	0.6	0.000	0.252	4.5
LL	-3283.6		-3237.1		-3240.74		
Mean Value of time (as a multiple of wage)							
Walking	1.4		1.0		1.3		
Rail	0.0		0.0		0.0		
Bus	1.2		0.8		0.9		
Two Wheeler	1.3		0.7		1.1		
Car	-0.1		-0.5		0.3		

*Mode specific constant is assumed to be normally distributed and cost and time varicbles are assumed be log-normally distributed.

Parameter is the mean & variance of underlying Normal distribution. Implied coefficients are mean and variance of simulated β based on the estimate of q. This column is included so that we can compare the magnitude of coefficients for log normally distributed variables. q for these variables are mean of underlying normal distribution and thus need to be exponentiated and averaged to be comparable to the ones in logit and triangular distribution.

Table 9. Summary Statistics of Variables in Location Choice Model

	Mean	Sd. Dev	Distribution in population
Hicksian bundle (Rs. /month)	8229	7214	
Slum	0.39	-	
Coop	0.22	-	
Flat	0.20	-	
Good floor	0.81	-	
Good wall	0.96	-	
Good roof	0.42	-	
House size (sqft)	253	175	
Kitchen in house	0.53	-	
Toilet in house	0.30	-	
Bathroom in house	0.61	-	
Water in house	0.69	-	
1st earner commute distance (km)	5.7	7.3	
2nd earner commute distance (km)	5.0	6.5	
Logsum for the 1st earner	-2.6	2.0	
Logsum for the 2nd earner	-2.7	1.9	
<300m to rail track	0.20	-	
Zone2	0.17	-	
Zone3	0.23	-	
Zone4	0.23	-	
Zone5	0.13	-	
Zone6	0.12	-	
Neighbor with same religion*			
Hindu	79%	0.15	75%
Muslim	35%	0.19	17%
Christian	10%	0.10	4%
Sikh	6%	0.05	0%
Buddhist	11%	0.06	3%
Jain	5%	0.04	1%
Neighbor with same language			
Marathi	55%	0.17	48%
Hindi	33%	0.17	23%
Konkani	6%	0.05	2%
Gujarati	26%	0.14	12%
Marwari	6%	0.04	2%
Punjabi	5%	0.05	1%
Sindhi	6%	0.07	0%
Kannada	4%	0.04	1%
Tamil	11%	0.22	2%
Telugu	6%	0.08	1%
English	8%	0.06	1%
Neighbor's income (Rs./month)	8669	2361	

*First column: For Hindu households in the sample, the average % of Hindus in the neighborhood

Table 10. Estimation Results for Model of Location Choice Model

	MNL with distance to work		NL of mode choice and location choice	
	w/o hconst	w/hconst	w/o hconst	w/hconst
ln(Hicksian bundle)	1.73	2.68	1.68	2.68
	[19.35]**	[27.46]**	[18.69]**	[26.95]**
1st PC for house characteristics	0.19	0.26	0.18	0.25
	[19.07]**	[24.90]**	[17.49]**	[23.19]**
2nd PC for house characteristics	-0.07	-0.09	-0.07	-0.09
	[5.13]**	[6.20]**	[4.68]**	[5.73]**
Main earner commute***	-0.24	-0.25	0.81	0.86
	[50.64]**	[53.01]**	[69.16]**	[73.13]**
Secondary earner commute	-0.23	-0.23	0.64	0.68
	[25.70]**	[26.56]**	[29.20]**	[30.96]**
Within 0.3km from rial track	-0.03	-0.03	-0.28	-0.31
	[0.62]	[0.71]	[6.79]**	[7.42]**
zone==2	0.41	0.47	0.21	0.23
	[5.26]**	[5.96]**	[2.67]**	[2.82]**
zone==3	1.23	1.35	0.58	0.61
	[13.66]**	[14.66]**	[7.25]**	[7.54]**
zone==4	2.11	2.28	1.09	1.15
	[18.81]**	[19.65]**	[11.99]**	[12.46]**
zone==5	1.13	1.24	0.64	0.73
	[11.78]**	[12.69]**	[7.15]**	[7.99]**
zone==6	1.79	1.95	1.08	1.15
	[17.39]**	[18.28]**	[11.91]**	[12.41]**
Same religion	6.01	6.41	6.17	6.43
	[15.30]**	[16.19]**	[14.79]**	[15.33]**
Same religion sq	-3.24	-3.48	-3.59	-3.67
	[9.74]**	[10.48]**	[10.20]**	[10.46]**
Same language	8.58	8.97	7.98	8.55
	[21.96]**	[23.13]**	[19.46]**	[21.14]**
Same language sq	-6.36	-6.74	-5.40	-6.00
	[15.34]**	[16.45]**	[12.31]**	[13.96]**
Neighbor's income (in Rs. 1000)	0.00004	0.00005	0.00002	0.00
	[4.95]**	[5.77]**	[2.58]**	[3.35]**
Observations	386747	386747	386747	386747
Pseudo R-squared	0.23	0.26	0.29	0.33
LL	-14415	-13871	-13353	-12637
Chisq	8640	9956	10764	12668
Implied coefficient on original variables:				
Slum	-0.12	-0.16	-0.11	-0.16
	[18.35]**	[23.79]**	[16.94]**	[22.23]**
Coop	0.22	0.29	0.20	0.28
	[15.76]**	[20.39]**	[14.52]**	[19.01]**
Flat	0.23	0.30	0.21	0.29
	[15.17]**	[19.60]**	[13.96]**	[18.27]**
Good floor	-0.02	-0.01	-0.02	-0.01
	[0.84]	[0.44]	[0.80]	[0.43]
Good wall	-0.10	-0.10	-0.09	-0.10

	MNL with distance to work		NL of mode choice and location choice	
	w/o hconst	w/hconst	w/o hconst	w/hconst
	[2.30]*	[2.40]*	[2.12]*	[2.24]*
Good roof	0.14	0.19	0.13	0.18
	[18.39]**	[23.84]**	[16.97]**	[22.28]**
Size	0.11	0.15	0.10	0.15
	[18.35]**	[24.08]**	[16.77]**	[22.36]**
Kitchen	0.09	0.13	0.08	0.12
	[11.86]**	[16.14]**	[10.66]**	[14.80]**
Toilet	0.18	0.25	0.17	0.24
	[17.76]**	[23.02]**	[16.39]**	[21.50]**
Bathroom	0.09	0.13	0.08	0.12
	[10.97]**	[15.02]**	[9.85]**	[13.76]**
Water	0.08	0.11	0.07	0.10
	[9.15]**	[12.69]**	[8.19]**	[11.61]**
WTP (at HH Income of Rs.6250 /month)				
Main earner commute	-854	-586	3020	2017
Secondary earner commute	-815	-546	2383	1586
Same relig (1% point at 5% share)	205	141	216	142
Same language	287	193	277	186
Neighbor's income (in Rs. 1000)	143	109	84	68
Slum	-443	-383	-426	-366
Coop	792	678	761	648
Flat	820	700	788	670
Good floor	-61	-21	-62	-22
Good wall	-352	-240	-345	-233
Good roof	518	448	497	428
Size (at 200sqft)	2.0	1.8	1.9	1.7
Kitchen	328	295	313	282
Toilet	666	575	640	549
Bathroom	324	293	309	279
Water	280	256	267	244

* significant at 5%; ** significant at 1%

***In first two models, the commute is distance to work, for the next two models, logsum from mode choice model.

Table 11. Summary Statistics of Households in Targeted Area

	Section 79			Section 80		
	Mean	Sd. Dev	Distribution in population	Mean	Sd. Dev	Distribution in population
# in sample	80			43		
Hicksian bundle (Rs. /month)	5009	3199		5912	3652	
Flat	0.00	-		0.00	-	
Good floor	0.75	-		0.42	-	
Good wall	0.98	-		0.79	-	
Good roof	0.05	-		0.00	-	
House size (sqft)	141	66		161	71	
Kitchen	0.21	-		0.28	-	
Toilet	0.00	-		0.00	-	
Bathroom	0.10	-		0.07	-	
Water	0.26	-		0.23	-	
1st earner commute distance (km)	5.0	5.5		4.9	5.3	
2nd earner commute distance (km)	1.7	1.5		7.5	6.3	
Logsum for the 1st earner	-2.7	1.7		-2.7	1.9	
Logsum for the 2nd earner	-1.6	1.0		-3.6	2.1	
<300m to rail track	0.58	-		0.40	-	
Neighbor with same religion						
Hindu	73%	0.09	70%	61%	0.06	58%
Muslim	16%	0.03	15%	32%	0.14	35%
Christian			0%			0%
Sikh			0%			0%
Buddhist	17%	0.03	14%	13%	0.04	7%
Jain			0%			0%
Neighbor with same language						
Marathi	61%	0.08	55%	41%	0.10	26%
Hindi	20%	0.04	20%	48%	0.12	72%
Konkani	2%	0.00	3%			0%
Gujarati	2%	.	1%			0%
Marwari	14%	0.01	11%			0%
Punjabi			0%		.	0%
Sindhi			0%			0%
Kannada	1%	.	1%	1%		2%
Tamil	9%	0.00	5%			0%
Telugu			0%			0%
English			0%			0%
Neighbor's income (Rs./month)	6757	762		5454	497	

Table 12. Effects of Slum Upgrading Program

	Relocation Case1		Relocation Case2		In-situ Improvements	
Section	79	80	79	80	79	80
Total Compensating Variation (Rs. /month)						
Mean	560	-3821	2056	-2055	-467	-576
Std Dev	5237	6709	5244	6117	324	375
25%	-1170	-4356	-485	-2758	-672	-672
50%	1030	-1512	2383	-482	-269	-599
75%	3557	-1022	4650	609	-269	-269
Mean contribution						
House	-2227	-2527	-731	-761		
Commute	2216	-321	2216	-321		
Rail track	-362	-296	-362	-296		
Neighbor	933	-677	933	-677		
Characteristics of the new house						
Flat	YES		NO		Same as current	
Good floor	YES		YES		Same as current	
Good wall	YES		YES		Same as current	
Good roof	YES		YES		YES	
House size (sqft)	213		165		Same as current	
Kitchen	YES		NO		Same as current	
Toilet	YES		NO		Same as current	
Bathroom	YES		NO		Same as current	
Water	YES		YES		YES	
Characteristics of the new location common to both relocation cases						
Distance to bus (min walk)	5		Neighbor's language			
Distance to station (km)	1.2		Marathi	0.34		
Near rail track	NO		Hindi	0.60		
Neighbor's income	5838		Konkani	0		
Neighbor's religion			Gujarati	0		
Hindu	0.45		Marwari	0		
Muslim	0.45		Punjabi	0		
Christian	0.01		Sindhi	0		
Sikh	0		Kannada	0.02		
Buddhist	0.08		Tamil	0		
Jain	0		Telugu	0.01		
			English	0.01		

Figure 1. Map of Zones in Mumbai

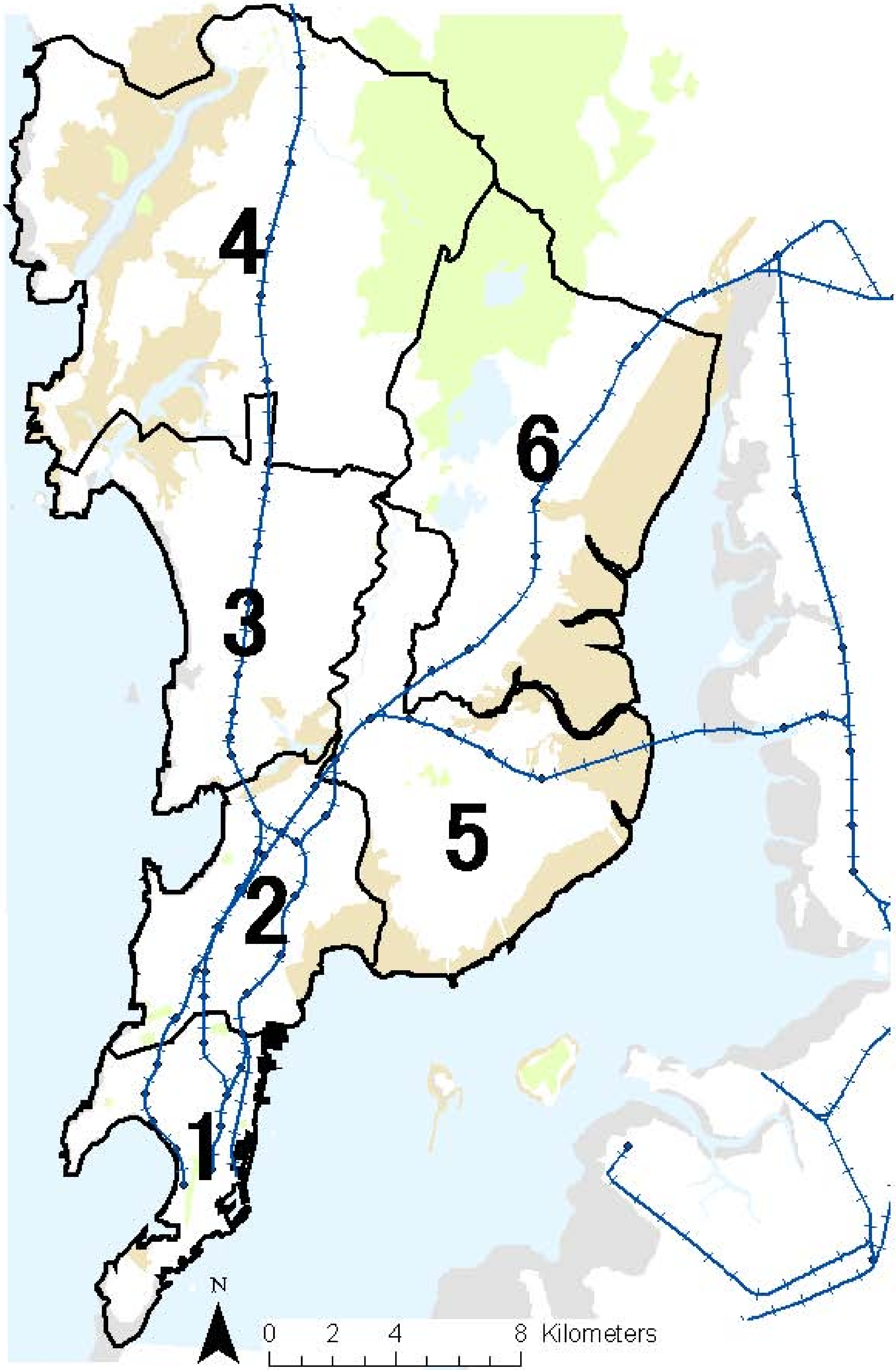

Figure 2. Location of Slum Households

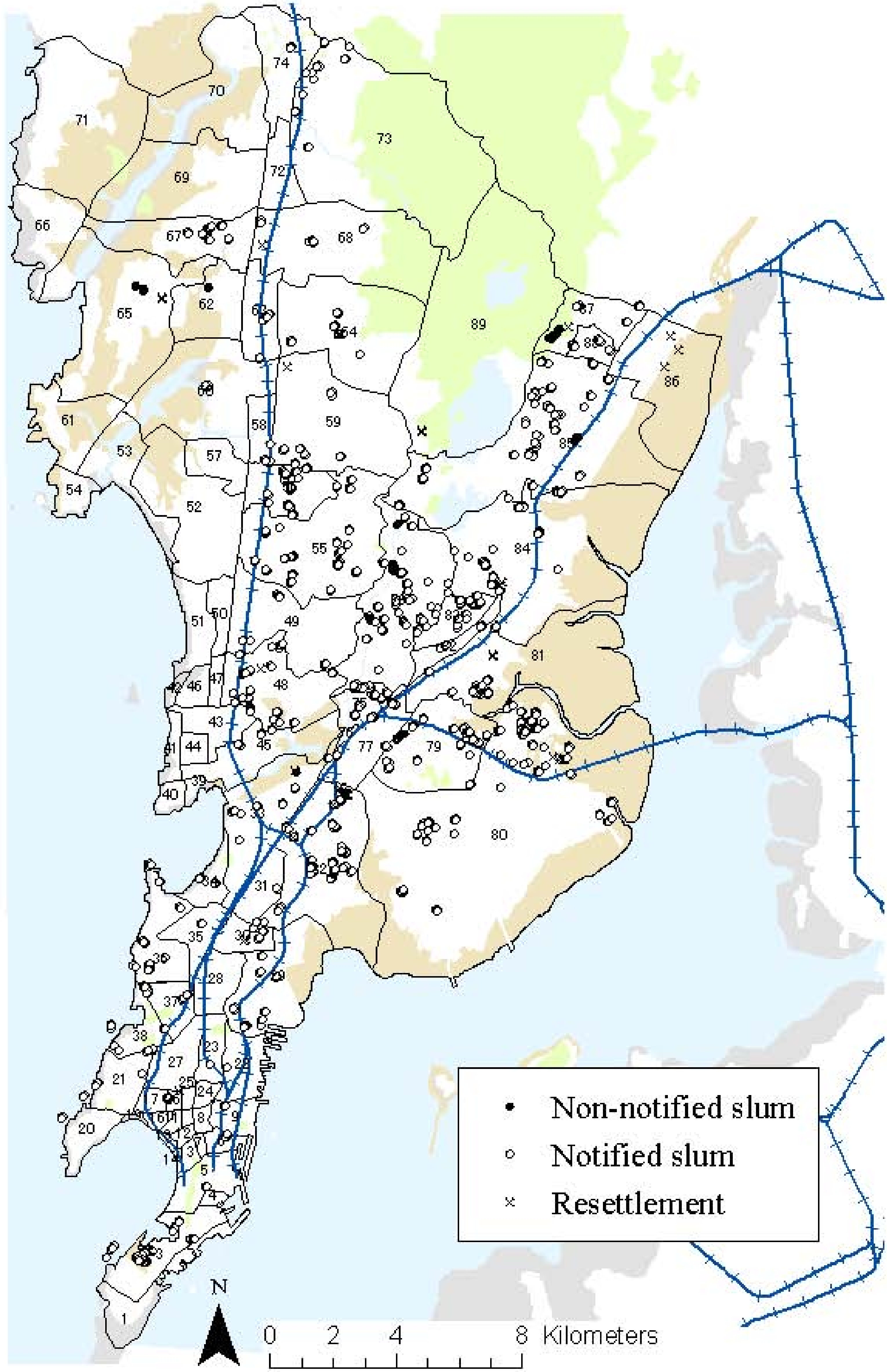

Figure 3. Location of Non-slum Households

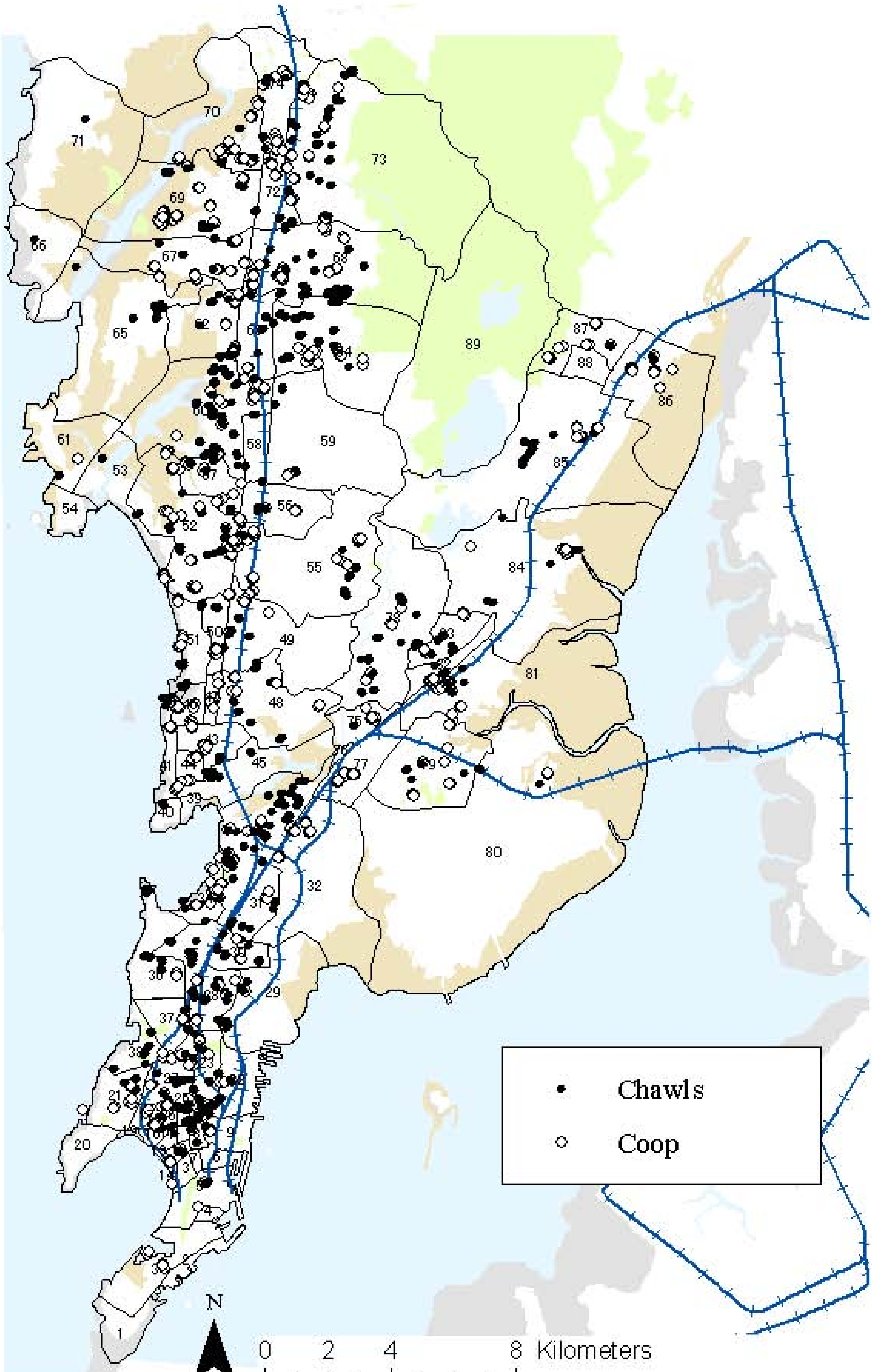

Figure 4. Sample Distribution fo One-way Commute Distance

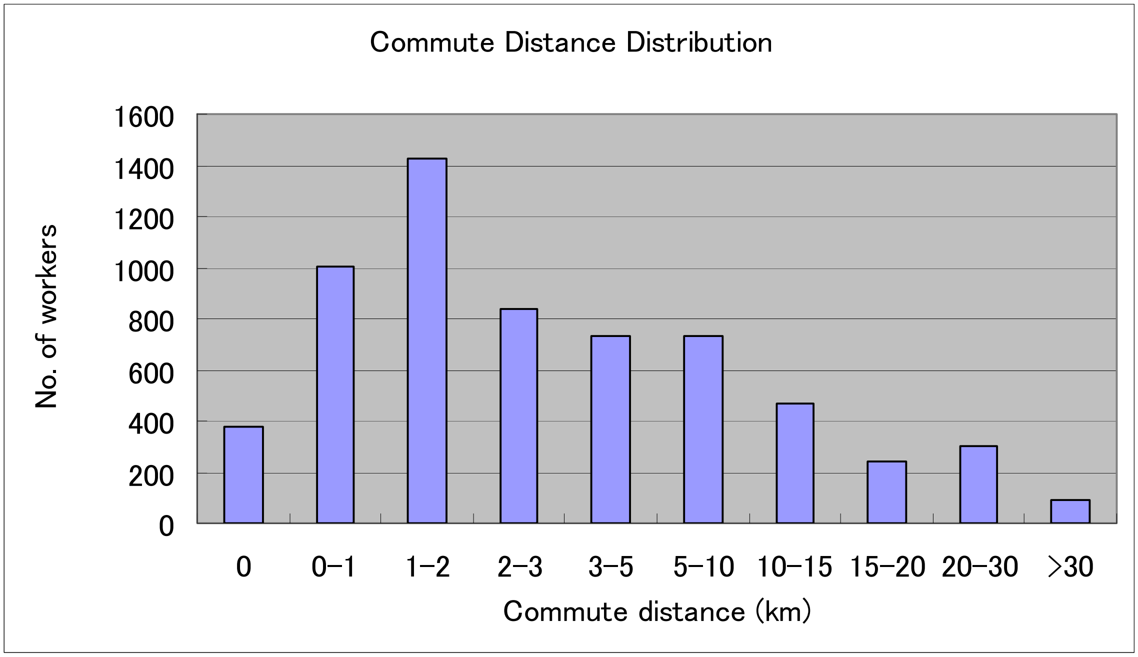

Figure 5. Target Households and Relocation Site of the Slum Upgrading Program

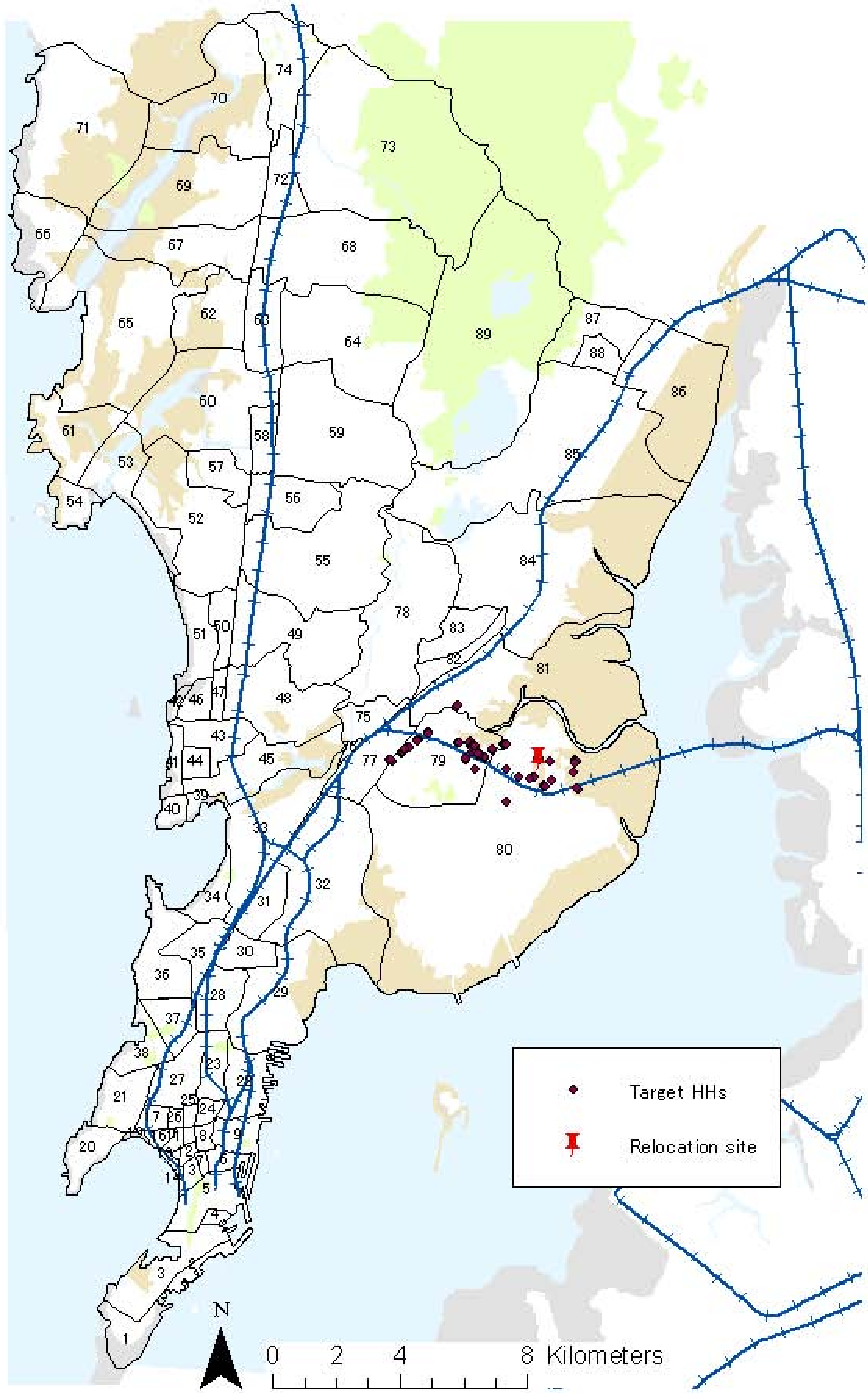

Table A1 Hedonic Rent Function Estimates

Dependent var=ln(rent)	1	2
Slum	-0.09	-0.09
	[4.34]***	[4.36]***
Coop	0.29	0.28
	[7.88]***	[7.78]***
flat	0.34	0.34
	[9.28]***	[9.33]***
Good floor	0.06	0.06
	[2.55]**	[2.63]***
Good wall	0.35	0.36
	[8.39]***	[8.44]***
Good roof	0.08	0.08
	[3.56]***	[3.33]***
Size	0.40	0.40
	[20.10]***	[20.18]***
Kitchen	0.06	0.07
	[2.91]***	[3.29]***
Toilet	0.10	0.10
	[3.80]***	[3.47]***
Bathroom	0.07	0.07
	[3.19]***	[3.16]***
Water	0.05	0.04
	[2.56]**	[2.11]**
Near rail track	-0.02	-0.03
	[1.22]	[1.45]
zone==2	-0.07	-0.08
	[1.60]	[1.78]*
zone==3	-0.13	-0.13
	[2.02]**	[2.07]**
zone==4	-0.22	-0.22
	[2.79]***	[2.80]***
zone==5	-0.20	-0.20
	[3.26]***	[3.22]***
zone==6	-0.25	-0.25
	[3.42]***	[3.41]***
Neighbor's income	0.00004	0.00004
	[11.12]***	[10.88]***
Ln(distnace to CBD)	-0.09	-0.09
	[2.83]***	[2.66]***
Near rail station		0.00
		[0.10]
Near bus stop		0.14
		[4.86]***
Vehicle accessible road		0.04
		[1.80]*
Constant	4.56	4.38
	[38.46]***	[35.53]***
Observations	4132	4132
Adjusted R-squared	0.639	0.641

Absolute value of t statistics in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Table A2. Summery of Mode Choice Model with Covariates

Covariate	None	Location		Year of educa-tion	HH income	Occupation			Female	Child <10	Age		Part time worker
		Work CBD	Live CBD			Skilled	Business owner	White collar			Age	Age squared	
Base													
Cost/Wage	--	--		-	--	--			--	--	--		--
Walk time	--	--		--	--	--			--	--	--		--
In veh time:Rail	0	0		0	0	0			0	--	0		-
In veh time:Bus	--	--		--	--	--			--	--	--		--
In veh time:2 wheel	--	--		--	--	-			--	--	--		--
In veh time:Car	0	0		0	0	0			0	0	0		0
Const: Rail	--	--		--	--	--			--	--	--		--
Const: Bus	--	--		--	--	--			--	--	--		--
Const: Rail+Bus	--	--		--	--	--			--	--	--		--
Const: 2 wheeler	--	--		--	--	--			--	--	--		--
Const: Car	--	--		-	--	0			--	--	--		--
Intertaction with				0	0								
Cost/Wage				++	0	-	0	0	0	0			0
Walk time				0	0	0	+	0	0	0			++
In veh time:Rail				0	0	0	0	0	0	+			++
In veh time:Bus				0	0	0	0	0	0	0			++
In veh time:2 wheeler				0	0	0	0	0	0	0			0
In veh time:Car				0	0	0	0	0	0	0			0
Const: Rail		--	++	++	0	0	--	++	0	--	0	0	0
Const: Bus		-	++	++	0	0	--	++	0	0	0	0	0
Const: Rail+Bus		--	0	+	++	0	--	++	0	-	0	0	0
Const: 2 wheeler		-	++	++	++	0	+	++	--	0	++	--	0
Const: Car		0	0	0	++	0	0	0	0	0	++	--	0

++ : Significant at 5% level with positive sign
+ : Significant at 10% level with positive sign
-- : Significant at 5% level with negative sign
- : Significant at 10% level with negative sign
0 : Not statistically significant at 5% level