Characterizing Slums and Slum-Dwellers: Exploring Household-level Indonesian Data

by

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May 2012

Abstract

The paper aims to provide descriptive evidence regarding slums and slum-dwellers in Indonesia. It exploits the rich stock of household-level information available in the Indonesian Family Life Survey (IFLS) conducted in 1993-94. It studies the correlations between socio-economic attributes of households and slum-like dwelling characteristics such as quality walls, floors, etc. of the structure; supply of electricity, water, sanitation and other basic services; as well as cleanliness in and around the dwelling. A set of probit regressions estimates the probability that a household with certain attributes lives in a dwelling with slum-like characteristics. Another set of probit regressions estimates the relative willingness-to-pay for certain dwelling characteristics of certain household-types. These latter regressions show that income and, more interesting, education are important determinants of willingness-to-pay. These effects are in line with the results from the former regressions, which estimate higher probabilities for poor and less-educated households to be living in slum-like dwellings. The results on willingness-to-pay based on family size are mostly ambiguous, though the former set of regressions clearly indicate that larger families are less likely to live in slum-like dwellings. Lastly, the paper explores the relationship between dwelling quality and mental health of individuals living in dwellings with certain characteristics.

KeyWords: developing countries, Indonesia, slums, slum-dwellers, housing quality, willingness-to-pay, mental health

*I am deeply grateful to Jan Brueckner (advisor) for his guidance, patience and careful edits of drafts; and to Ken Small and Manisha Shah for their comments and suggestions.

1 Introduction

About 1 billion people, or 32 per cent of the world's current urban population, live in slums. UN-Habitat (2009) defines a slum as a run-down area of a city characterized by sub-standard housing and squalor and lacking in tenure security.[1] This percentage is much higher, at 37 per cent, for developing countries. It is highest in sub-Saharan Africa at 62 per cent and reaches 43 per cent in South Asia and 37 per cent in Eastern Asia. Due to rising populations, especially in urban areas, the number of slum-dwellers is estimated to grow to 2 billion by 2030. These figures clearly indicate the importance of expending research effort toward understanding slums and slum-dwellers, across all areas of social science, including economics and, specifically, housing economics.

This paper contributes to the literature by providing new descriptive evidence regarding slum housing in Indonesia. It exploits the rich household- and individual-level data from the Indonesian Family Life Survey (IFLS1) collected during 1993-94. The main goal is to analyze the correlations between socio-economic attributes of households (like income, education, family size, marital status, religion, etc.) and various slum-like dwelling characteristics (quality of the dwelling structure, provision of utility services and living conditions). Despite such analysis being of obvious interest to both reserchers and policy-makers, there is little literature studying the links between dwelling characteristics and household attributes.

This paper studies the correlations between household attributes and dwelling characteristics across Indonesia at various levels of analysis. First, the study carries out a preliminary hedonic estimation using rent data to gauge the value of various dwelling characteristics. The dwelling characteristics fall under three broad categories: dwelling structure (number of rooms, type of floor, walls, roof, toilet facility, etc.), provision of utility services (electricity, water, sewage and garbage), and living behaviour (measures of level of cleanliness and hygiene maintained in and around the dwelling). The hedonic regression indicates that dwelling structure and provision of utility services are significant

determinants of rental value for dwellings.

The paper further explores the data to estimate the probability that a household with a specific set of attributes lives in a dwelling with slum-like characteristics. To carry out this analysis, the paper defines slum-like dwellings based on the three broad categories of dwelling characteristics. Then, probit regressions of binary variables relating the presence of a slum-like dwelling characteristic to socio-economic attributes of the occupying household are carried out. As expected, the results indicate that lower income households have a higher probability of living in slum-like dwellings. Interestingly, after controlling for income, education emerges to be a significant determinant of housing quality in most regressions. Households with an educated head of household have a lower probability of living in slum-like dwellings. Some other significant determinants include family size, percentage of children and percent of school-attending members in the household.

Furthermore, the paper estimates the willingness-to-pay for dwelling characteristics, conditional on a household's socio-economic attributes. In this stream of literature, there exists some prior work using data from a range of developing countries. Some examples include Follain, Lim, and Renaud (1982) on Korea; Follain and Jimenez (1985) on Phillipines, Columbia and Korea; Gross (1988) on Columbia; and Daniere (1994) for Egypt and Phillipines. Another stream of work (Lall, Lundberg, and Shalizi, 2008; Takeuchi, Cropper, and Bento, 2008) uses willingness-to-pay estimates to calculate the benefits of alternative slum improvement policies in different Indian cities. These studies use different techniques for analysis, each with its own set of benefits and problems.

Estimates of willingness-to-pay are usually derived using the hedonic method (Rosen, 1974). Alternatively, polytomous choice models are used to estimate coefficients of the consumers utility function (Quigley, 1976). This paper uses yet another method developed by Ellickson (1981), which estimates the coefficients of the consumer's bid-rent function to draw conclusions on relative willingness-to-pay for dwelling characteristics across household-types. A brief discussion on the details of these various approaches is

carried out in Section 5.

The willingness-to-pay calculations in this paper indicate that rich households have a higher willingness-to-pay for better dwelling charactertistics than poor households, holding education and family size constant. Also, holding income and family size constant, more-educated households have a higher willingness-to-pay for better dwellings than less-educated households.

The results of these exercises are in line with each other. In particular, the higher willingness-to-pay for better dwellings of rich households translates to a higher probability of rich households living in better quality dwellings. Similarly, the higher relative willingness-to-pay of more-educated households translates to a higher probability of such households living in better dwellings. The results for family size, however, are less clear-cut.

Lastly, the paper explores the rich dataset to study the relationship between dwelling quality and health, including mental health. It uses information on a general health indicator and mental health indicators for temper, sadness and anxiety. A set of probit regressions relate these indicators to a range of dwelling characteristics, controlling for socio-economic household attributes. Again, education emerges as a significant variable, with an educated household head reducing the probability of bad general health by nearly 18%. The main characteristics resulting in poor mental health are foliage roofs, lack of electricity and water supply. A counter-intuitive result from the regressions is that individuals living in dwellings with dirt floors experience better health. Importantly, the evidence also suggests that maintaining clean and hygenic surroundings is essential for good mental health.

2 Data description

This paper uses household level data from the first wave of the Indonesian Family Life Survey (IFLS1) conducted in 1993-94.[2] It covers a sample of 7,224 households (or

30,000 individuals) spread across 13 of the 27 provinces on the islands of Java, Sumatra, Bali, West Nusa Tenggara, Kalimantan, and Sulawesi. Together, these provinces encompass approximately 83% of the Indonesian population and much of its heterogeneity.[3] Figure 1 presents a map that identifies the 13 Indonesian provinces included in the IFLS.

This paper uses data from the books in the survey titled Household Roster and Household Economy, which cover demographic and socio-economic characteristics for each of the 7,224 survey households. Importantly for this paper, the data include extensive information on indicators of dwelling quality for each household. The data have been provided as survey responses by a representative member (typically, the household head) for each selected household. The paper also uses data from the book in the survey titled Adult Information, which has detailed reports of education, health, employment and migration for each adult member of the survey households.

Tables 1 and 2 summarize the key socio-economic characteristics of the survey households. Table 1 presents descriptive statistics for households like income, consumption expenditures, rent. It also includes statistics for number of rooms per person, average age of adults (18 years and above) in the household, number and percentage of household members (below age 25 years) currently attending school, and percent of children (12 years and younger) in the household. Table 2 presents an overview of the discrete variables of the survey households. It shows that of the 7,224 households, 83% are male-headed families, around 86% families are islamic by religion; and only about 25% of household heads are high-school graduates and only some 4% household heads have a university degree. The paper categorizes persons 18 years and above as adult members of the household, which reveals that about 8% of adults have a university degree and more than 39% are high-school graduates. Given that 20% of household heads are aged 60 years and above and nearly 40% are aged 50 years and above, these figures reflect the substantial education improvements made in Indonesia over the past two decades. Table 1 lists 1,730 households as 'rich', which has been defined as households with higher than the mean income of the survey households. It also lists 40% of households as rural, which

is defined as at least one household member having worked on a farm in the past year.

Table 3 summarizes very detailed data on dwelling characteristics for the survery households. Of 7,210 households for whom the data are available, 77.6% own the dwelling they occupy. The paper views the detailed data on dwelling characteristics in three broad catergories: (1) "dwelling structure", which includes number of rooms, type of floor (marble, cement, wood, dirt), walls (cement, wood, bamboo), roof (concrete, wood, tiles, foliage), toilet facility (own, public, none) and quality of ventilation; (2) "utility-services", namely electricity and telephone connections, water provision, sewage disposal and garbage collection facilites; (3) "living behaviour", which includes measures of the level of cleanliness and hygiene maintained in and around the dwelling[4], such as the presence of surrounding waste, trash and puddles; quality of yard, and congestion. The survey provides data for each of the above-mentioned variables except congestion. A dwelling is said to be characterized by 'congestion' if the number of persons per room is more than one.

The following sections carry out an analysis of the relationship between household and dwelling characteristics using various regression models.

3 Value of dwelling attributes

As a first step, the paper carries out a simple first-stage hedonic regression to estimate the value of various dwelling characteristics. The dependent variable is the natural log of monthly rent. The renting households in the sample provide the amount of monthly rent paid whereas the owning households were directly asked the rental value of the house they own. The specification is

$$ln(rent_{ip}) = h_i'\alpha + d_p'\delta + \epsilon_{ip} \tag{1}$$

where h_i is the vector of dwelling characteristics for each household i and d_p is a set of dummy variables ($p = 1, 2, \ldots 13$) to capture the province-level fixed effects. Table 4

provides the list of 13 Indonesian provinces covered by the survey.

Table 5 presents the results of this regression. The results indicate that a rural dwelling earns about 15% lower rent than an urban dwelling. In general, dwellings with better structural characteristics like more rooms, good-quality floors and stronger walls earn more rent. For example, a dwelling with ceramic floors earns 41% more rent and one with cement floors earns 14% more rent than a dwelling with dirt floors. A dwelling with a built-in toilet earns 17% more rent than a dwelling which does not have such a facility. The coefficients related to utility services are highly significant, indicating that dwellings with electricity and water connections and provision of sewage disposal and garbage collection facilities earn higher rents. Interestingly, characteristics related to 'living behaviour' are not significant determinants of rent, which makes sense. However, proponents of the importance of neighbourhood effects on rents may argue otherwise.

4 Probability of living in a slum-like dwelling

This section begins to explore the relationship between various dwelling characteristics and socio-economic characteristics of households. It asks the question: what is the probability that a household with attributes x_j lives in a dwelling with slum-like characteristics s_i.

First, the paper looks at the data to define slum-like characteristics. These are based on the three broad categories of dwelling characteristics defined earlier. For the structural characteristics, a dwelling is slum-like if it has a dirt floor, a soft bamboo wall, a roof made of foliage leaves, has no built-in toilet or has poor ventilation. In the context of utility services, slum-like dwellings have no electricity connection, no water supply inside the house, no sewage disposal or garbage collection facilities. And lastly, in the case of living behaviour, a dwelling is slum-like if it is surrounded by human and animal waste, trash or puddles; is near a stable; has an unkempt yard; or if it is characterized by congestion. Note that s_i is a sub-set of a dwelling characteristics h_i that are slum-like.

For example, a dwelling can have a ceramic floor, cement floor, wood floor or dirt floor, all of which are included in h_i. Of these, a dirt floor is a slum-like characteristic and, hence, is a part of s_i.

The paper carries out a set of probit regressions of binary variables relating the presence of a slum-like dwelling characteristic to socio-economic attributes of the occupying household. For any slum-like characteristic s, the estimating equation is

$$Pr\ (s = 1\ /\ x_j) = \Phi(s'\ \beta_s) \tag{2}$$

where x_j is a vector of socio-economic variables for household j that determines the presence of slum-like characteristics and β_s is a coefficient vector for slum-like characteristic s.

The socio-economic atributes include household income; binary variables representing if the household lives in a rural area, if the head of the household is male, if the head is married, the head's religion (Islamic, Christian, Hindu, Buddhist with the dropped religion being 'other'), if the head is educated (high-school and above); the total number of persons in the household, the average age of adults (18 years and above), the percentage of children (12 years and below) and the percentage of studying members (25 years and under going to school) in the household. The full sample consists of 7,224 households while each regression might have fewer hosueholds depending on missing observations. But almost all regressions include over 6000 households.

Tables 6, 7 and 8 present the maximum likelihood estimates for each slum-like characteristic under the three broad categories of dwelling structure, utility services and living behaviour. The results indicate no significant differences in the results across the three catergories indicating the same household characteristics that are significant in determining the probability of a household living in a slum-like structure are also significant in determining the quality of utility services as well as the living behaviour indicators for dwellings. Thus, the discussion of results will reference Tables 6, 7 and 8

simultaneously.

First, the coefficients on rural household are statistically significant and positive for several slum-like structural characteristics, implying that rural households have a higher probablity of living in slum-like dwellings with dirt floors, foliage roofs, poor ventilation and no access to a private toilet. Further, rural households are more likely to lack utility services: 26% more likely to have no electricity, 18% more likely to have no water supply, 23% more likely to have no functioning system for sewage disposal and 29% more likely to have no proper garbage collection facilities.

On the other hand, the coefficient on income for each slum-like characteristic is significant and negative, indicating the expected outcome that higher income results in a lower probablity of living in a slum-like dwelling.[5] Thus, a higher income household is less likely to live in dwelling with a dirt floor, a soft bamboo wall or a foliage roof. It is also less likely to have no built-in toilet or to live in a poorly ventilated dwelling. Naturally, high income households also have a higher probability of having electricity and water connections as well as well-functioning sewage disposal and garbage collection facilities.

Another household attribute that emerges to be a significant across all regressions is an educated head of the household, a head who is at least a high-school graduate. An educated head significantly lowers the probability of the household living in a slum-like dwelling. Such households are around 15-30% less likely to live in a slum-like structure, about 20% more likely to enjoy good utilities and 6-20% more likely to maintain clean surroundings.

Family size is another significant factor determining the probability of dwelling conditions, with large families having lower probabilities of living in slum-like dwellings. The probability of households living in slum-like dwellings rises with a higher percentage of children (12 years and younger) in the household. On the other hand, it falls with a higher percentage of studying members in the household, again indicating education to be an important factor affecting dwelling quality.

It is interesting to note the significance of religion in these regressions. The results suggest that no Buddhist household lives in a dwelling with bamboo walls or with a foliage roof. Additionally, Buddhist households are significantly more likely to have better utility provisions in their dwellings. Lastly, not a single Buddhist household has waste or trash lying in or around the dwelling. It is likely that religious practices dictate a certain way-of-life for Buddhist households, which is reflected in the data. It is important to note here that less than 2% of the households are Buddhist.

5 Willingness-to-pay for dwelling characteristics

This section takes a different approach in studying the relationship between household attributes and dwelling characteristics. It aims to explore the question: what is the willingness-to-pay for various dwelling characteristics of a household with certain socio-economic attributes?

It is conventional in housing economics and real estate literature to use hedonic price functions (Rosen, 1974) to estimate consumer's demand for dwelling characteristics. Such a treatment is infeasible in the current context due to the existence of many discrete variables in the dataset. Another alternative would be the use of models of residential choice within the multinomial logit framework (Quigley, 1976), again aimed at deriving consumer demand functions. Such models can be interpreted as exploring what type of dwelling a household with a specified set of characteristics is most likely to occupy. An alternative model proposed by Ellickson (1981) exploits the structure of the bidding process for dwellings. It responds to the question: what is the probability that a dwelling with a specified set of characteristics will be occupied by a particular type of household?[6]

This paper adopts the method proposed by Ellickson (1981), outlined briefly in this paragraph. A household-type t's bid-rent function V_t gives the price for a dwelling with characteristics h_i that will yeild utility level u_t. For estimation purposes, assume a linear, stochastic bid-rent function $V_t = h_i'\gamma_t + \epsilon_t$, where γ_t is the coefficient vector for

household-type t and ϵ_t is the random disturbance reflecting differences in taste among households of type t. For purposes of determining the probability that a given dwelling will be occupied by a household of type t, the relevant variable is the maximum bid from a household of type t, denoted by $V_t^* = h_i'\gamma_t + \epsilon_t^*$. Being the maximum from among the i.i.d. errors ϵ_t for households of a given type, the error term ϵ_t^* follows the extreme value distribution. Therefore, the probability that a dwelling with characteristics h_i will be occupied by a household of type t (being the highest bidder) is given by

$$Pr\ (t/h_i) = \frac{exp(h_i'\gamma_t)}{\sum_k exp(h_i'\gamma_k)} \tag{3}$$

Thus, the bidding approach results in a multinomial logit model, and the parameters of the bid-rent functions for different household-types can be estimated using the maximum likelihood method.

At this point, it is important to make a note regarding the empirical estimation of the multinomial logit model. In order to identify the parameters, equation (3) is normalized by multiplying and dividing throughout by $exp(-h_i\gamma_1)$, where γ_1 is a vector of coefficients for the first household-type. Following this normalization, the estimated parameters of the multinomial logit model give the bid-rent functions' coefficients relative to the first (reference) group. Thus, the results from the maximum likelihood technique provide estimates of the "relative willingness-to-pay" for various dwelling attributes, relative to the reference group. This can be viewed as a limitation of the Ellickson method. Lerman and Kern (1983) show that Ellickson's method can be easily extended to estimate the actual levels of the willingness-to-pay coefficients of the bid-rent function by making use of rent data. For the purposes of this paper, rent data are not used and the discussion is carried out bearing in the mind that the estimates represent relative willingness-to-pay.

To define household-types, this paper classifies households based on three attributes: income, education and family size.[7] A 'rich' household (R) is one whose household income is greater than the mean annual income (around 5,600 thousand Indonesian Rupiah or

approximately 600 USD) of the survey households; otherwise it is categorized as a 'poor' household (P). There are 1,730 rich households in the sample, which constitute about 27% of the survey households. Next, a household is categorized as 'educated' (E) if the head of household is at least a high-school graduate; otherwise it is classified as an 'uneducated' household (U). About 32% of the households have an educated head. Lastly, a 'large' household (L) is one with family size greater than the mean family-size (more than 4 persons per household); otherwise it is a 'small' household (S). About 47% of the survey households are small. This three-way classification results in 8 household-types, the details of which are presented in Table 9. These 8 household-types are used for estimation of the multinomial logit model.

Before beginning a discussion of the results, note that it is usual in the literature to treat owners and renters as separate groups. Ellickson (1981), in the data section studying residential choice in the San Francisco Bay area, presents all results separately for these groups. In this paper, as a robustness check, the multinomial logit regression has also been run separately for owners (78% of the entire sample). Compared to an analysis using the full sample, the coefficients vary only slightly and the significance levels remain exactly the same, so that the analysis stands to gain nothing from presenting results separately. Thus, the following discussion is based on results for entire set of households, including owners and renters.

Table 10 presents the results of the maximum likelihood estimation of the multinomial logit model. The reference group on which the model is normalized is the poor-uneducated-large (P-U-L) household-type. The dwelling attributes included are structural characteristics (number of rooms; good-quality floors, walls and roof; and own-toilet) and utility services (availability of water and electricity connections; provision of garbage collection and sewage disposal facilities). The living-behaviour characteristics are not included in this analysis since these characteristics were shown to have no effect on rent. Note that in this section and in the related tables (10) - (13), the binary varibles represent 'good' dwelling characteristics. Thus, 'floor' takes value 1 when the dwelling

has a marble/cement/wood floor and 0 when it has a dirt floor; 'wall' takes value 1 when the dwelling has a cement/wood wall and 0 when it has a soft bamboo wall; 'roof' takes value 1 when the dwelling has a concrete/wood/tiled roof and 0 when it has a foliage roof; and 'toilet' takes value 1 when the dwelling has an built-in toilet and 0 when it does not, so the residents use public toilets or defecate in a river/creek/yard. Similarly, the 'electricity', 'water', 'sewage' and 'garbage' take value 1 when the dwelling has access to these facilities and 0 when it does not.

The coefficients presented in Table 10 have no direct interpretation. What is of primary relevance is a comparison of willingness-to-pay for different dwelling characteristics across the various household-types. More specifically, it is interesting to ask the question: are rich households more willing to pay for a particular dwelling characteristic compared to poor households? Or are differences in willingness-to-pay prominent between educated and uneducated households? What are the differences in willingness-to-pay for various characteristics between large and small families? To answer these questions, the paper carries out simple Wald-tests for differences between coefficients.

The procedure is best described using an example. Let's assume we are interested in knowing whether rich households have a higher willingness-to-pay for more rooms than poor households, holding education and family size constant. To answer this question, the paper carries out the following procedure. First, four t-tests are conducted, each comparing the coefficient of 'rooms' across household-types: (1) R-E-S and P-E-S, which compares rich and poor households that are educated and small; (2) R-U-S and P-U-S, which compares rich and poor households that are uneducated and small; (3) R-E-L and P-E-L, which compares rich and poor households that are educated and large; and (4) R-U-L and P-U-L, which compares rich and poor households that are uneducated and large. The results of the t-tests are used to make inferences regarding the statistical significance of the difference in coefficients. If they are not statistically significant, it can be concluded that there is no difference in the willingness-to-pay for more rooms between rich and poor households. On the other hand, if the difference is statistically significant,

then the coefficients are looked at more closely. If the magnitude of the coefficient is larger for rich compared to poor households, it can be concluded that rich households have a higher willingness-to-pay for more rooms than poor households, a result that we can expect.

This procedure is repeated for each dwelling characteristic like good-quality floors, strong walls, a sturdy roof and different utility services. In turn, this entire procedure is also repeated to study differences in willingness-to-pay between educated and uneducated households as well as between small and large family-sizes. The conclusions following the t-tests and the comparisons outlined above are presented in Tables 11, 12 and 13. In the tables, a 'zero' indicates that the difference between coefficients is not statistically significant. A 'plus' sign in Tables 11, 12 and 13, respectively, indicates that higher willingness-to-pay for a good dwelling characteristic by rich compared to poor households, educated compared to uneducated households and large compared to small households. The few 'minus' signs across these tables indicate the few unexpected outcomes of the comparisons.

Specifically, Table 11 presents the results of these comparisons between rich and poor households, holding education and family size constant. The table for differences in willingness-to-pay between rich and poor households has many zeroes, indicating no difference after controlling for education and family size. However, some differences exist and they indicate that rich households have a higher willingness-to-pay than poor households for certain characteristics like number of rooms, better floors and some utility services.

Interestingly, Table 12, which compared differences in coefficients based on education, holding income and family size given, shows significant differences in willingness-to-pay between educated and uneducated households across most dwelling characteristics. The first column of the table indicates that, for rich and small families, more-educated households have a higher willingness-to-pay for every dwelling characteristic than uneducated households.

Almost all differences are statistically insignificant in Table 13, which compares large- and small-sized households within the different income and education categories. This result is at first surprising since family size emerged as a significant variable in the previous section, which showed the probabilities of large-sized households living in dwellings with certain characteristics. A possible explanation could be that, once income and education are controlled, the significance of family-size is limited. This table also has a few 'minus' signs indicating no overall definitive pattern of preferences between large- and small-sized families.

6 Health Indicators

This section further explores the extensive IFLS dataset, which includes details regarding the physical and mental health of respondents. The urban economics literature has been expanding its horizons to study impact of urban planning on human behaviour and health. Some like Seskin (1979), Chappie and Lave (1982) and Portney and Mullahy (1990) have looked at the effects of air quality on respiratory diseases while some others like Ewing, Schmid, Killingsworth, Zlot, and Raudenbush (2008) and Eid, Overman, Puga, and Turner (2008) have looked at the relationship between sprawl and obesity. However, the relationship between dwelling quality and health is still underexplored in the economic literature. Several studies in the fields of medicine and psychology do provide evidence that dwelling quality affects health, especially mental health.

Evans, Wells, and Moch (2003) provide a detailed review of the existing research and also discuss methodological issues related to studying the link between dwelling quality and mental health. They discuss the literature as belonging to four broad categories: dwelling type (single-family detached versus multiple units, low-rise versus high-rise buildings); floor level of dwelling; overall dwelling quality (e.g., structural quality, maintenance, and upkeep); and dwelling quality, dwelling type, and floor level with respect to childrens well-being. The studies look at very specific indicators of mental health as well as detailed

measures of dwelling quality.

The IFLS data provides an opportunity to explore this relationship between dwelling quality and health. The health-related questions in the data range from a direct question: generally, how is your health?; more specific questions related to physical strength and stamina (can you carry a heavy load?, can you walk 5 kilometers?, can you bow, squat, kneel?, etc.); illness symptoms (like headaches, flu, asthma, etc); and mental health (insomnia, fatigue, temper, sadness and anxiety). This paper explores the data on the question on general health and a subset of mental health indicators: temper, sadness and anxiety. The analysis is carried out using individual-level data from Book III of IFLS1, titled Adult Information. Probit regressions for these indicators are carried out to estimate the probability of occurence of each indicator given a range of dwelling characteristics and controlling for socio-economic household attributes.[8] The standard errors are clustered around households to control for within group correlation.

Tables 14 and 15 present the results of the probit regressions for general and mental health indicators. Again, in this section and in the related tables, the binary variables represent 'good' dwelling characteristics, as explained in detail in the willingness-to-pay section. The binary general and mental health indicators take value 0 when the individual is healthy and 1 when the individual suffers poor health. Thus, for Table (14) the dependent variable is 0 when the individual reports being 'very healthy' or 'fairly healthy' and 1 when the individual reports being 'in poor health' or 'very sick'. Similarly, in Table (15), the variables 'temper', 'sadness' and 'anxiety' take value 0 when the individual has 'never' felt these emotions in the past four weeks and take value 1 when the individual reports feeling these emotions 'often' or 'sometimes' in the past four weeks.

The results indicate that while a male household head has no effect of general health, a male head reduces the probability of poor mental health by nearly 30%. Next, worse general health prevails in households with older adults, an expected result. On the other hand, individuals living in households with a larger percentage of children below 12 years and younger are less likely to experience bad general health, though there is a small but

significant chance of tempers flaring easily in such households. Again, education emerges as a significant variable, with an educated household head reducing the probability of bad general health by nearly 18%. Interestingly, education is not a significant determinant of mental health. Furthermore, having a larger family size seems to have a significant impact on the probability of bad general health as well as anger and sadness. This result emerges despite the other controls of age and percentage of children in the household, indicating that congestion in living conditions impacts physical as well as mental health.

Now, consider the main variables of interest: dwelling characteristics. A very interesting result is that the quality of floors in the dwelling has a significant effect on the health of individuals living in it. The result is counter-intuitive, indicating that individuals living in dwellings with a dirt floor have a lower probability of not only suffering from bad health but also of experiencing anger and anxiety. Cattaneo, Galiani, Gertler, Martinez, and Titiunik (2012) arrive at the opposite result in a study on Mexico, where replacing dirt floors with cement floors appears to significantly improve physical health and happiness, especially for children. On the other hand, individuals living in dwellings with a foliage roof have a higher probability of suffering from poor physical and mental health. This result is in line with Hopton and Hunt (1996), who find evidence of dwelling dampness to be associated with mental distress in disadvantaged areas of Scotland.

The provision of utility services like electricity and water supply seems to have a significant impact on physical health. While having access to electricity in the dwelling reduces the probability of bad general health, having tap water in the house appears to increase the probability of bad general health. Further, electricity supply turns out to not be significant in the mental health regressions, but having tap water continues to be associated with poor mental health. A possible explanation for the seemingly contradictory result on water could be contamination of tap water, resulting in poor health. Interestingly, while having waste and garbage lying in and around the house does not affect general health, the mental health regressions show that such poor living conditions increase the probability of feeling sadness. Thus, there is evidence that maintaining

clean and hygenic surroundings might be essential good mental health. Lastly, the results suggest that having a stable near the house reduces the probability of household members experiencing bad temper; maybe having animals near the dwelling helps maintain a pleasant atmosphere in the household.

Overall, this paper finds strong links between dwelling quality and physical as well as mental health. The results point to impacts that could be considered by urban planners and policy makers in evaluating and designing housing policy.

7 Conclusion

The main goal of this paper has been to analyze the correlations between socio-economic attributes of households and various slum-like dwelling characteristics using data from a sample of Indonesian households. Various regression specifications were used to understand these correlations at different levels of analysis. The hedonic regressions find that better quality dwellings, both in terms of structure and utility services, enjoy higher rents. The probit regressions relating dwelling characteristics to household characteristics indicate income, education and family size raise the probability of households living in better quality dwellings. The willingness-to-pay analysis points toward income- and education-based differences, with rich and educated households willing to pay more for better dwelling characteristics. Thus, the results from these varied approaches are in line with each other. Lastly, regressions of health indicators show dwelling characteristics (after controlling for socio-economic household attributes) are significant determinants of physical and mental health.

A Appendix

Table 1: **Descriptive Statistics for Key Continuous Variables**

Variable	Obs.	Mean	Std. Dev.	Min	Max
hh_income_annual (in 100,000 Rupiah)	6390	55.9	125.0	-999	1982
hh_expenditures_annual (in 100,000 Rupiah)	7047	67.6	193.9	-40	1963
hh_rent_monthly (in 1,000 Rupiah)	5992	38.3	73.7	0	900
family_size	7224	4.6	2.2	1	20
number_rooms	7205	4.7	2.3	0	30
rooms_per_person	7204	1.3	1.1	0	25
adult_age	7197	39.6	11.7	18	92
head_age	7211	45.6	14.4	14	93
studying_members	7224	1.1	1.3	0	19
studying_percent	7224	21.6	22.0	0	100
child_percent	7224	25.7	21.5	0	83

Table 2: Frequency of Discrete Variables: Household Attributes

Variable	Variable = 1	Total Obvs.	Percent
rurual_hh	2,803	7,180	39.0
rich_hh	1,730	6,390	27.1
head_male	6,060	7,224	83.9
head_married	5,981	7,224	82.8
head_islamic	6,223	7,224	86.1
head_christian	526	7,224	7.3
head_hindu	318	7,224	4.4
head_buddhist	113	7,224	1.6
adult_noschool	698	7,224	9.7
adult_someschool	2,936	7,224	40.6
adult_highschool	2824	7,224	39.1
adult_diploma	215	7,224	3.0
adult_university	520	7,224	7.2
head_noschool	1,387	7,224	19.2
head_someschool	3,566	7,224	49.4
head_highschool	1847	7,224	25.6
head_diploma	141	7,224	2.0
head_university	271	7,224	3.8

Table 3: **Frequency of Discrete Variables: Dwelling Characteristics**

Variable	Variable = 1	Total Obvs.	Percent
own_house	5,593	7,210	77.6
occupy_house	982	7,210	13.6
rent_house	635	7,210	8.8
congestion*	2,857	7,226	39.5
marble_floor	191	7,168	2.7
cement_floor	4,235	7,168	59.1
wood_floor	1,226	7,168	17.1
dirt_floor	1,516	7,168	21.1
cement_wall	3,592	7,087	50.7
wood_wall	2,139	7,087	30.2
bamboo_wall	1,356	7,087	19.1
concrete_roof	56	7,175	0.8
wood_roof	117	7,175	1.6
tiles_roof	6,563	7,175	91.5
foliage_roof	439	7,175	6.1
electricity	5,002	7,212	69.4
telephone	322	7,205	4.5
water	1,905	6,858	27.8
own_toilet	3,519	7,208	48.8
public_toilet	993	7,208	13.8
ditch_toilet	1,825	7,208	25.3
yard_toilet	871	7,208	12.1
running_sewage	3,283	6,787	48.4
clogged_sewage	490	6,787	7.2
river_sewage	1,407	6,787	20.7
yard_sewage	1,607	6,787	23.7
garbage_collector	1690	6,883	24.6
garbage_burned	2,077	6,883	30.2
garbage_thrown	3,116	6,883	45.3
no_waste	6,494	7,186	90.4
no_trash	6,038	7,184	84.0
no_puddles	6,377	7,178	88.8
no_stables	5,520	7,163	77.1
ventilation	4,851	7,170	67.7
yard_quality	4,394	7,135	61.6
yard_size	4,254	7,170	59.3

*congestion = 1 if rooms_per_person < 1

Table 4: **List of Indonesian Provinces covered by IFLS**

Province Name	**Frequency**	**Percent**
Sumatera Utara (North Sumatera)	563	7.8
Sumatera Barat (West Sumatera)	351	4.86
Sumatera Salatan (South Sumatera)	349	4.84
Lampung	274	3.8
Dki Kakarta	729	10.1
Jawa Barat (West Java)	1,106	15.33
Jawa Tehgah (Central Java)	879	12.18
Di Yogyakarta	478	6.62
Jawa Timur (East Java)	1,043	14.45
Bali	340	4.71
Nusa Tenggara Selatan (South Kalimantan)	407	5.64
Kalimantan Selatan (South Kalimantan)	323	4.48
Sulawesi Selatan (South Sulawesi)	374	5.18
Total	**7,216**	**100**

Table 5: **Hedonic Regression of ln(monthly rent)**

rural_hh	-0.1557***	**rooms**	0.1103***	**own_toilet**	0.1698***
	(0.0392)		(0.0087)		(0.0412)
own_house	0.1385*	**marble_floor**	0.4075***	**public_toilet**	-0.0347
	(0.0622)		(0.1160)		(0.0544)
occupy_house	0.0389	**cement_floor**	0.1401**	**ventilation**	0.0776
	(0.0691)		(0.0542)		(0.0397)
single_unit	-0.0379	**wood_floor**	0.0220	**yard_quality**	0.0658
	(0.0515)		(0.0689)		(0.0387)
single_level	-0.1590*	**cement_wall**	0.2676***	**yard_size**	0.0472
	(0.0662)		(0.0550)		(0.0359)
electricity	0.1416**	**wood_wall**	0.1397*	**no_waste**	0.0046
	(0.0445)		(0.0552)		(0.0626)
water	0.1656***	**concrete_roof**	0.4931*	**no_puddles**	-0.0343
	(0.0430)		(0.1951)		(0.0586)
sewage	0.0763*	**wood_roof**	0.3287*	**no_stable**	0.0636
	(0.0377)		(0.1361)		(0.0426)
garbage	0.2279***	**tiles_roof**	0.1825*	**_cons**	8.3788***
	(0.0470)		(0.0742)		(0.1568)

Estimates for all province dummies are significant.
N = 7870; standard errors in parentheses; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$
List of ommitted variables/base outcomes: urban house, rent house,
multi-unit, multi-level, dirt floor, bamboo wall, foliage roof,
no electricity supply, no water connection, no toilet access,
no running sewage connection, no garbage collection, poor ventilation,
unkempt yard, small yard, waste, puddles and stables around the house

Table 6: **Probit Regressions of Structural Slum Characteristics**

Slum-Characteristic → **Household Attributes ↓**	**dirt floor**	**bamboo wall**	**foliage roof**	**no toilet**	**no ventilation**
rural_hh (d)	0.0799	-0.0028	0.0326	0.1024*	-0.0409
	(0.0421)	(0.0244)	(0.0242)	(0.0434)	(0.0368)
hh_income	-0.0325***	-0.0276**	-0.0101	-0.0417***	-0.0334***
	(0.0081)	(0.0103)	(0.0060)	(0.0102)	(0.0057)
head_male (d)	-0.0286	-0.0176	0.0044	-0.0146	0.0050
	(0.0354)	(0.0431)	(0.0121)	(0.0207)	(0.0370)
head_married (d)	0.0119	0.0032	-0.0090	-0.0224	-0.0351
	(0.0251)	(0.0177)	(0.0199)	(0.0358)	(0.0302)
head_islamic (d)	0.0603	0.0473	0.1372**	0.2073*	-0.0157
	(0.0558)	(0.0760)	(0.0507)	(0.0966)	(0.0472)
head_christian (d)	-0.0527	-0.0406	0.9796***	0.1714	0.0406
	(0.0822)	(0.0802)	(0.0085)	(0.1597)	(0.0585)
head_hindu (d)	0.0087	-0.0573	0.9701***	0.2331*	-0.2298***
	(0.1015)	(0.0724)	(0.0120)	(0.0937)	(0.0487)
head_buddhist (d)	-0.1231*	#	#	-0.2471	0.0700
	(0.0533)			(0.1336)	(0.0607)
adult_age	0.0013	0.0019***	-0.0004	-0.0018*	0.0002
	(0.0007)	(0.0005)	(0.0004)	(0.0007)	(0.0008)
child_percent	0.0024***	0.0024***	0.0011**	0.0041***	0.0024***
	(0.0004)	(0.0005)	(0.0003)	(0.0006)	(0.0004)
head_educated (d)	-0.1908***	-0.1665***	-0.0421*	-0.2952***	-0.1577***
	(0.0353)	(0.0231)	(0.0166)	(0.0359)	(0.0216)
studying_percent	-0.0014**	-0.0023***	-0.0010**	-0.0030***	-0.0026***
	(0.0005)	(0.0005)	(0.0004)	(0.0007)	(0.0006)
family_size	-0.0220***	-0.0171***	-0.0006	-0.0250***	-0.0130*
	(0.0056)	(0.0038)	(0.0016)	(0.0065)	(0.0055)
N	**6344**	**6190**	**6266**	**6382**	**6347**

Marginal effects; standard errors in parentheses; standard errors clustered around provinces
* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; (d) for discrete change of dummy variable from 0 to 1
#: head_buddhist = 1 predicts failure perfectly

Table 7: **Probit Regressions of Lack of Utility Services**

Slum-Characteristic → **Household Attributes ↓**	**no electricity**	**no water**	**no sewage**	**no garbage**
rural_hh (d)	0.2677***	0.1862***	0.2347***	0.2895***
	(0.0622)	(0.0455)	(0.0444)	(0.0594)
hh_income	-0.0632***	-0.0361***	-0.0290*	-0.0235***
	(0.0141)	(0.0088)	(0.0114)	(0.0058)
head_male (d)	0.0131	-0.0121	0.0032	-0.0342
	(0.0466)	(0.0266)	(0.0239)	(0.0235)
head_married (d)	-0.0759	0.0133	-0.0262	0.0320
	(0.0513)	(0.0274)	(0.0320)	(0.0281)
head_islamic (d)	0.1224	-0.1537	-0.1175	-0.0351
	(0.0996)	(0.0813)	(0.1331)	(0.0652)
head_christian (d)	0.2944	-0.2427	-0.1226	-0.1556
	(0.1565)	(0.1536)	(0.1342)	(0.1227)
head_hindu (d)	-0.0128	0.0253	0.1076	-0.0010
	(0.1112)	(0.1189)	(0.1142)	(0.0715)
head_buddhist (d)	-0.1760	-0.6102***	-0.4159***	-0.5499**
	(0.0926)	(0.1229)	(0.1108)	(0.2049)
adult_age	0.0003	-0.0010	0.0017**	0.0007
	(0.0010)	(0.0007)	(0.0006)	(0.0006)
child_percent	0.0042***	0.0027***	0.0029***	0.0028***
	(0.0005)	(0.0005)	(0.0005)	(0.0007)
head_educated (d)	-0.2000***	-0.2021***	-0.2048***	-0.1823***
	(0.0210)	(0.0239)	(0.0254)	(0.0266)
studying_percent	-0.0032***	-0.0021***	-0.0024***	-0.0006*
	(0.0007)	(0.0004)	(0.0005)	(0.0003)
family_size	-0.0149**	-0.0247***	-0.0128**	-0.0121***
	(0.0047)	(0.0042)	(0.0046)	(0.0033)
N	**6385**	**6061**	**5995**	**6074**

Marginal effects; standard errors in parentheses; standard errors clustered around provinces
* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; (d) for discrete change of dummy variable from 0 to 1

Table 8: **Probit Regressions of Slum-like Living Behavior**

Slum-Characteristic → Household Attributes ↓	**congestion**	**waste**	**puddles**	**unkempt yard**	**stables**
rural_hh (d)	0.0066 (0.0378)	0.0315* (0.0131)	0.0160 (0.0278)	0.0065 (0.0340)	0.1825*** (0.0272)
hh_income	-0.0534*** (0.0098)	-0.0158** (0.0054)	-0.0140*** (0.0037)	-0.0289*** (0.0062)	-0.0252* (0.0122)
head_male (d)	0.0493 (0.0502)	0.0241 (0.0124)	0.0095 (0.0158)	0.0595* (0.0241)	0.0148 (0.0269)
head_married (d)	-0.0452 (0.0461)	-0.0393*** (0.0111)	-0.0155 (0.0184)	-0.0860** (0.0290)	0.0180 (0.0217)
head_islamic (d)	0.1172 (0.0763)	-0.0447 (0.1129)	-0.1633 (0.1347)	-0.1217 (0.1500)	-0.1431 (0.1017)
head_christian (d)	0.1852 (0.1328)	0.0179 (0.0940)	-0.0628 (0.0450)	-0.0661 (0.1469)	-0.0697 (0.0575)
head_hindu (d)	0.2010 (0.1201)	-0.0148 (0.0754)	-0.0934** (0.0286)	-0.2665** (0.0968)	-0.0626 (0.0636)
head_buddhist (d)	0.0039 (0.0902)	#	-0.0821* (0.0384)	-0.0174 (0.1455)	-0.1892*** (0.0271)
adult_age	-0.0062*** (0.0011)	0.0006 (0.0005)	-0.0016* (0.0007)	0.0005 (0.0009)	0.0024*** (0.0005)
child_percent	0.0049*** (0.0006)	0.0012*** (0.0003)	0.0003 (0.0002)	0.0027*** (0.0006)	0.0005 (0.0005)
head_educated (d)	-0.1866*** (0.0150)	-0.0648*** (0.0087)	-0.0215* (0.0086)	-0.1165*** (0.0192)	-0.0932*** (0.0151)
studying_percent	-0.0026*** (0.0005)	-0.0009*** (0.0003)	-0.0005 (0.0003)	-0.0024*** (0.0004)	-0.0007 (0.0006)
family_size	0.1623*** (0.0127)	0.0002 (0.0018)	0.0022 (0.0024)	0.0047 (0.0032)	0.0013 (0.0024)
N	**6387**	**6276**	**6353**	**6320**	**6339**

Marginal effects; standard errors in parentheses; standard errors clustered around provinces
* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; (d) for discrete change of dummy variable from 0 to 1
#: head_buddhist = 1 predicts failure perfectly

Table 9: **Household types for MNL model of Willingness-to-Pay**

hh_code	**hh_type**	**Frequency**	**Percent**	**Cumulative**
1	**P-U-L**	1691	26.46	26.46
2	**R-U-L**	407	6.37	32.83
3	**P-E-L**	380	5.95	38.78
4	**R-E-L**	629	9.84	48.62
5	**P-U-S**	2028	31.74	80.36
6	**R-U-S**	257	4.02	84.38
7	**P-E-S**	561	8.78	93.16
8	**R-E-S**	437	6.84	100.00
	Total	**6390**	**100**	

R=Rich, P=Poor; E=Educated, U=Uneducated; L=Large family, S=Small family

Table 10: **Willingness-to-Pay for Dwelling Characteristics**

Characterictics ↓	**Household Types**						
	R-U-L	**P-E-L**	**R-E-L**	**P-U-S**	**R-U-S**	**P-E-S**	**R-E-S**
rooms	0.0938*	0.0455	0.2285***	-0.1756***	-0.0544	-0.1991**	0.0969*
	(0.0397)	(0.0426)	(0.0372)	(0.0353)	(0.0656)	(0.0626)	(0.0422)
floor	0.7108**	0.9001**	3.6171***	-0.2002	0.9327**	0.6490***	1.0221***
	(0.2471)	(0.2920)	(0.7118)	(0.1194)	(0.2902)	(0.1942)	(0.2236)
wall	0.3972	0.8831***	0.4892	-0.2582**	0.2676	0.3182*	0.7948
	(0.3270)	(0.1575)	(0.3163)	(0.0856)	(0.3111)	(0.1442)	(0.4310)
roof	0.8305*	0.1310	0.6551	0.5292**	0.2187	0.3501	1.4016*
	(0.4123)	(0.2010)	(0.5031)	(0.1618)	(0.5466)	(0.2072)	(0.6801)
toilet	0.5557***	0.6887***	1.2098***	0.1974**	0.5048*	0.6586***	1.1612***
	(0.0953)	(0.1714)	(0.1982)	(0.0615)	(0.2076)	(0.1843)	(0.2880)
electricity	0.9192***	0.3460	0.7920***	0.1705	0.5994*	0.4578*	0.8211**
	(0.2215)	(0.2097)	(0.1968)	(0.0967)	(0.3040)	(0.1854)	(0.2596)
water	0.3439	0.0227	0.5777***	-0.0905	-0.0778	0.0878	0.1251
	(0.2401)	(0.1624)	(0.1690)	(0.1233)	(0.2121)	(0.1093)	(0.1939)
sewage	0.1800	0.3120	0.4007**	-0.0383	0.0101	0.2651	0.5805***
	(0.1388)	(0.2067)	(0.1476)	(0.1059)	(0.1578)	(0.1441)	(0.1733)
garbage	0.6765**	0.8775***	1.1178***	0.2356*	0.5479*	0.7471***	1.3498***
	(0.2392)	(0.1900)	(0.1560)	(0.1115)	(0.2219)	(0.2220)	(0.1945)
no_stable	0.3054	0.3448	0.5719***	0.0513	0.2033	0.2678*	0.7471**
	(0.2218)	(0.2105)	(0.1188)	(0.0789)	(0.1968)	(0.1061)	(0.2617)
_cons	-5.1183***	-4.4796***	-9.3305***	0.5814***	-3.6634***	-2.4044***	-7.5266***
	(0.5326)	(0.4104)	(0.8118)	(0.1646)	(0.5444)	(0.2195)	(0.8179)

N = 5264; Base hh_type = PUL; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$
standard errors in parentheses; standard errors clustered around provinces
R=Rich, P=Poor; E=Educated, U=Uneducated; L=Large family, S=Small family

Table 11: **Relative Willingness-to-Pay based on Income**

Education → / **Family Size →**	**Educated** **Small**	**Uneducated** **Small**	**Educated** **Large**	**Uneducated** **Large**
rooms	+	-	+	+
floor	0	+	+	0
wall	0	+	0	+
roof	0	0	0	+
toilet	+	0	+	0
electricity	0	0	+	0
water	0	0	0	+
sewage	+	0	0	+
garbage	+	0	0	0
no_stable	0	+	0	+

0: no difference between rich and poor
+: rich willing to pay more than poor
-: poor willing to pay more than rich

Table 12: **Relative Willingness-to-Pay based on Education**

Income → / **Family Size →**	**Rich** **Small**	**Poor** **Small**	**Rich** **Large**	**Poor** **Large**
rooms	+	0	+	+
floor	+	+	+	0
wall	+	+	+	+
roof	+	0	-	+
toilet	+	+	+	0
electricity	+	0	-	0
water	+	+	+	+
sewage	+	+	+	+
garbage	+	0	+	0
no_stable	+	+	+	+

0: no difference between educated and uneducated
+: educated willing to pay more than uneducated
-: uneducated willing to pay more than educated

Table 13: **Relative Willingness-to-Pay based on Family Size**

Income → / **Education →**	**Rich** **Educated**	**Poor** **Educated**	**Rich** **Uneducated**	**Poor** **Uneducated**
rooms	+	+	+	-
floor	+	0	0	0
wall	0	0	0	+
roof	0	0	0	-
toilet	0	0	0	0
electricity	-	0	0	0
water	0	0	0	+
sewage	0	0	0	+
garbage	0	0	0	0
no_stable	0	0	0	-

0: no difference between large and small families
+: large families willing to pay more than small families
-: small families willing to pay more than large families

Table 14: **Probit Regression of Indicator of General Health**

Household Attributes ↓		**Dwelling Characteristics ↓**	
head_male	-0.0597	**rooms**	-0.0123
	(0.0840)		(0.0104)
head_married	-0.2043*	**floor**	0.1918***
	(0.0832)		(0.0484)
head_islamic	-0.1748	**wall**	0.0074
	(0.1806)		(0.0493)
head_christian	0.0817	**roof**	-0.3624***
	(0.1900)		(0.0658)
head_hindu	-0.1732	**toilet**	-0.0073
	(0.1943)		(0.0396)
head_buddhist	-0.2031	**electricity**	-0.1483***
	(0.2297)		(0.0428)
adult_age	0.0191***	**water**	0.1671***
	(0.0017)		(0.0458)
child_percent	-0.0049***	**sewage**	-0.0689
	(0.0010)		(0.0400)
head_educated	-0.1789***	**garbage**	-0.0669
	(0.0449)		(0.0496)
studying_percent	-0.0028**	**no_stable**	-0.0283
	(0.0009)		(0.0414)
family_size	0.0533***	**_cons**	-1.2150***
	(0.0094)		(0.2201)

N = 10,709; Marginal effects; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$
standard errors in parentheses; standard errors clustered around households

Table 15: **Probit Regressions of Mental Health Indicators**

Mental Health → Household Char. ↓	temper	sadness	anxiety	Mental Health → Dwelling Char. ↓	temper	sadness	anxiety
head_male	-0.2767**	-0.2687**	-0.2954**	**rooms**	-0.0048	-0.0241**	-0.0011
	(0.0855)	(0.0830)	(0.0974)		(0.0085)	(0.0088)	(0.0107)
head_married	0.0069	-0.1717*	-0.0259	**floor**	0.1524**	0.1209*	0.2709***
	(0.0884)	(0.0838)	(0.0987)		(0.0485)	(0.0477)	(0.0606)
head_islamic	-0.0968	-0.0802	-0.3756	**wall**	0.0907	0.0015	0.0050
	(0.2552)	(0.1858)	(0.2548)		(0.0488)	(0.0471)	(0.0594)
head_christian	0.3583	0.2639	0.0649	**roof**	-0.1139	-0.2363***	-0.1581*
	(0.2606)	(0.1938)	(0.2619)		(0.0681)	(0.0642)	(0.0795)
head_hindu	-0.2836	-0.3327	-0.5568*	**toilet**	-0.0515	-0.0468	-0.0486
	(0.2653)	(0.2033)	(0.2726)		(0.0374)	(0.0382)	(0.0466)
head_buddhist	0.0866	-0.2593	-0.1678	**electricity**	0.0198	-0.0766	-0.1020*
	(0.2825)	(0.2394)	(0.2999)		(0.0428)	(0.0419)	(0.0516)
adult_age	-0.0039*	-0.0001	-0.0049*	**water**	0.1150**	0.1106*	0.1662**
	(0.0017)	(0.0016)	(0.0021)		(0.0426)	(0.0447)	(0.0520)
child_percent	0.0030**	-0.0008	0.0012	**sewage**	0.0707	0.0834*	0.0276
	(0.0009)	(0.0009)	(0.0011)		(0.0379)	(0.0385)	(0.0471)
head_educated	0.0482	-0.0306	0.0614	**garbage**	-0.0729	-0.1427**	-0.0886
	(0.0400)	(0.0415)	(0.0484)		(0.0467)	(0.0473)	(0.0558)
studying_percent	0.0005	-0.0002	0.0011	**no_stable**	0.1097**	0.0714	0.1164*
	(0.0008)	(0.0009)	(0.0010)		(0.0409)	(0.0400)	(0.0521)
family_size	0.0378***	0.0281**	-0.0218*	**_cons**	-1.0312***	-0.4465*	-0.7412*
	(0.0084)	(0.0087)	(0.0109)		(0.2828)	(0.2219)	(0.2970)

N = 10, 713; * p < 0.05; ** p < 0.01; *** p < 0.001

Marginal effects; standard errors in parentheses; standard errors clustered around households

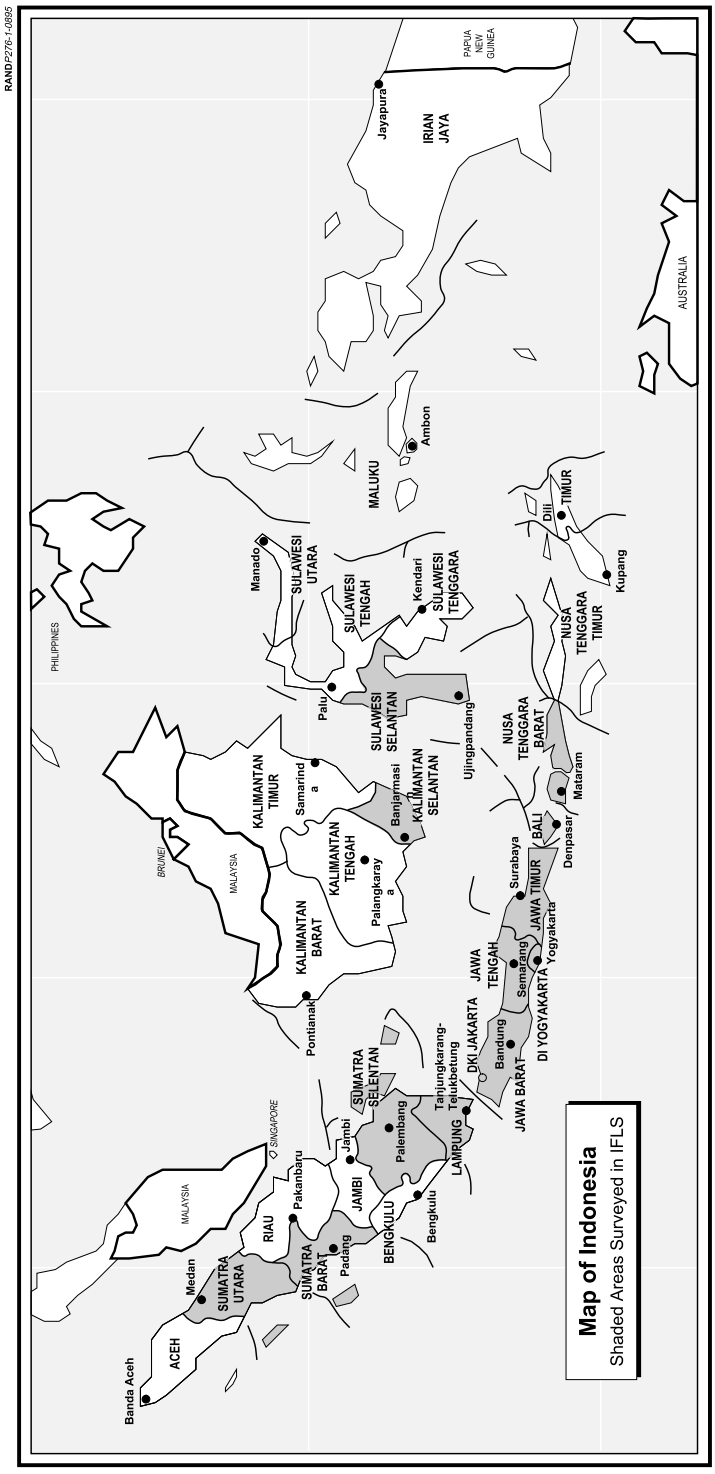

Figure 1: Map of Indonesia

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Notes

[1]This paper studies all aspects of slum-like characteristics described by the UN-Habitat, except lack of tenure security, data on which are hard to find.

[2] IFLS is an on-going longitudinal survey with four waves of data collection being completed so far. IFLS1 was conducted by RAND Corporation in collaboration with Lembaga Demografi, University of Indonesia. IFLS2 and IFLS2+ were conducted in 1997 and 1998, respectively, by RAND in collaboration with UCLA and Lembaga Demografi, University of Indonesia. IFLS2+ covered a 25% sub-sample of the IFLS households. IFLS3, which was fielded in 2000 and covered the full sample, was conducted by RAND in collaboration with the Population Research Center, University of Gadjah Mada. The fourth wave of the IFLS (IFLS4), fielded in 2007-2008 covering the full sample, was conducted by RAND, the Center for Population and Policy Studies (CPPS) of the University of Gadjah Mada and Survey METRE.

[3]The IFLS sampling scheme is stratified on provinces, followed by a random selection of 321 enumeration areas (EAs) within each of the 13 provinces. It over-samples urban EAs and EAs in smaller provinces to facilitate urban-rural and Javanese-non-Javanese comparisons. Households within a selected EA are, again, randomly selected by field teams. Twenty households were selected from each urban EA, while

thirty households were selected from each rural EA. This strategy minimizes expensive travel between rural EAs and reduces intra-cluster correlation across urban households, which tend to be more similar to one another than do rural households. The final sample of 7,224 partially or fully completed households consists of 3,436 households in urban areas (90.7 percent partial/full completion rate), and 3,788 households in rural areas (95.9 percent partial/full completion rate). (Frankenberg, Karoly, Gertler, Peterson, and Wesley, 1995)

[4]Note here that the term 'in and around' the dwelling as described in the IFLS data documentation pertains to an household's own living behaviour. It refers to waste and trash within the dwelling or around in the front- and back-yards, with no clear reference to the dwelling's neighbourhood quality.

[5]Each of the regressions has been run using consumption instead of income figures. Interestingly, the data on income and consumption matches up rather closely. Hence, not surprsingly, the regression results and almost the same. The same factors continue to be significant and the coefficients change very marginally. However, the main difference is that while income is highly significant (at 99%) in almost all regressions, consumption is either not significant or significant at only 95%. A choice has been made to present the income-based results. The primary reason is that in this dataset the income figures appear to be better collected compared to the consumption figures. In detail, expenditure figures are collected at different levels of aggregation and need to be manipulated to obtain uniformity. So, food expenditures (a substantial portion of the consumption) are weekly data; non-food expenditures are collected at both yearly and monthly level but as expected do not match up and education expenditures are partly monthly and partly annual. All these factors makes the use and reliability of consumption data questionable.

[6]An added advantage of this methodology in the current context is that it does not use rent or house value data, which is highly unreliable for developing countries.

[7]The selection of these catergories was primarily based on interest in these particular variables and the choice justified based on these variables emerging as significant in the set of probit regressions determining the probability of a household with certain attributes living in a dwelling with certain characteristics. Another significant variable in those regressions is religion. The multinomial logit regressions have also been run using a religion-based classification, which are not presented here since the results are not very interesting.

[8]These regressions do not use household income and the dummy variable for rural households so as to avoid problems related to reverse causality of these variables with health indicators.