Housing, Health and Happiness

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Abstract: Despite the importance of housing on well being, there has been little work assessing the causal impact of housing and housing improvement programs on health and welfare. In this paper we start to fill this gap by examining one aspect of housing, namely floor quality. We investigate the impact of a large-scale effort by the Mexican Government to replace dirt floors with cement floors on child health and adult happiness. We find that replacing dirt floors with cement floors significantly reduces parasitic infestations of young children, reduces diarrhea, reduces anemia and improves cognitive development. Finally, we also find that adults are substantially happier as indicated by satisfaction with housing and with quality of life, and have significantly less depression and perceived stress.

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1. Introduction

Housing along with food and water are considered basic needs. Inadequate sanitation and housing threaten the lives and health of some 600 million urban dwellers worldwide.[1] For this reason, most countries in the world devote substantial resources to slum upgrading and improving the housing quality of poor populations. For example, in the US, the Government spends more on housing subsidies than other better-known welfare programs such as food stamps and temporary assistance for needy families (Olsen, 2003). In the developing world, where urbanization is strongly associated to a rapid growth of slums and slum dwellers account for 45 percent of the urban population (World Bank, 2005), policies to improve the welfare of slum dwellers include upgrading slum housing in situ and relocating slum dwellers to better quality, low cost housing.

Despite the importance of housing on well being, there has been little work assessing the causal impact of housing and housing improvement programs on health and welfare.[2] An important exception is Katz et al. (2001) who examine short-run impacts of changes in residential neighborhoods on the well being of families residing in high-poverty housing projects who received housing vouchers through a random lottery in Boston, US.[3] Households offered vouchers experienced improvements in multiple measures of

[1] Clean water is critical to contain the spread of infectious and parasitic diseases (see, among others, the Cebu Team, 1991; Lavy et al., 1996 and Jalan and Ravallion, 2003) while the provision of sanitation also has significant health effects (Esrey et al, 1991, inter alia).

[2] See Thomson et al. (2001) for a critical survey of the existing literature.

[3] The economics literature on the benefits of slum improvements mainly consists of hedonic studies that estimate the market value of various improvements (see, among others, Crane et al., 1997 and Jimenez, 1983). Kaufman and Quigley (1987) instead estimate the parameters of household utility functions to directly asses the welfare gains of housing improvement (see also Takeuchi et al., 2005). While there is not much work on the causal effect of housing on health, there is substantial amount of work on other environmental influences such as water (e.g. Galiani

well being relative to a control group, including improved health among children and household heads.

In this paper, we examine one aspect of housing, namely floor quality. We investigate the impact of a large-scale effort by the Mexican Government to replace dirt floors with cement floors on child health and adult happiness. The program, called *Piso Firme*, offered households to 50 square meters of cement flooring. The program began implementation in 2001 and since then has provided cement floors to XXXX households. In order to identify the causal effects of replacing dirt floors with cement floors on child health and adult happiness we take advantage of a geographical discontinuity in the implementation of the program *Piso Firme*.

We find that replacing dirt floors with cement floors significantly reduces parasitic infestations of young children, reduces diarrhea, reduces anemia and improves cognitive development. Dirt floors provide a vector for parasites to infest young children since they are not easily cleaned thereby allowing feces to remain in the flooring material, especially in households that allow animals indoors. Parasites live and breed in fecal matter. Young children who play on the dirt floor and put their hands in their mouths are more likely to ingest fecal material than are children who play on cement floors. Each year more than 3 million children die from preventable parasitic diseases (World Bank, 2002). Among those that survive, parasites are associated with micronutrient malnutrition, leading particularly to iron-deficiency anemia (see, among others, Anderson and May, 1991). The parasites consume nutrients from children they infect, thus retarding their physical development. Parasites also destroy tissues and organs, cause abdominal pain, diarrhea,

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et al., 2005) and air pollution on health (e.g. Chay and Greenestone, 2005). See also Glaeser and Sacerdote (2000) for an analysis of the social consequences of housing.

intestinal obstruction, anemia and other health problems. Indeed, anemia is one of the world's most widespread health problems, especially among children. Anemia and malnutrition lead to slow cognitive development (see Luong TV, 2003) and thus impair learning (see, among others, Behrman, 1996; Nokes et al., 1992 and Pollit, 1990).

In a related and very interesting study, Kremer and Miguel (2004) evaluate a Kenyan project in which school-based mass treatment with deworming drugs was randomly phased into schools. They find that the program reduced school absenteeism in treatment schools by one-quarter. However, they did not find evidence that deworming improved academic test scores.

Finally, in our study, we also find that adults are substantially happier as indicated by satisfaction with housing and with quality of life, and have significantly less depression and perceived stress. The reasons that adults are happier may have to do both with the better environment that they live in and the fact that there children are healthier. These results are important as they indicate that housing has a significant effect on welfare that would not be captured by standard monetary welfare indicators such income, consumption or assets.

The worldwide health impact of such a hard floor policy is potentially large. World wide statistics in flooring…….In Mexico alone, XXX percent of all households have dirt floors and XXX of those in the bottom 20 percent of the income distribution (REF). The world impact World wide statistics in flooring

The rest of the paper is organized as follows. In the next section we present our identification strategy. Then, in section 3 we describe the dataset analyzed in the paper

while in section 4 we present the results to that analysis. Finally, in section 5 we outline our conclusions.

2. Identification Strategy

In order to identify the impacts of replacing dirt floors by cement floors on the treated population, we need to asses the counterfactual –i.e. what would have happened to the households in the treatment group had they not received treatment. In this study we exploit a geographical discontinuity in the implementation of the program to construct a comparison group that estimates the missed counterfactual of interest.

Piso Firme was implemented in the State of Coahuila, but not in the State of Durango. The twin cities of Gómez Palacio and Lerdo (in Durango) and Torreon (in Coahuila) startle the border of the States of Durango and Coahuila (see Figure I). There is no physical barrier across these cities, but rather neighborhoods spill across the two states without any indication as to which state the house resides. While economically they are effectively one city, they are split administratively between the two states. In principle, households residing near the border in these cities are likely to be very similar except for the influence of State policies. Thus, to the extent that the only important difference in State policies is *Piso Firme*, households residing near the border between these two States in the cities Gómez Palacio and Lerdo are likely to unbiased estimate the outcomes of interest of the households residing near the border in the city of Torreon had they not been exposed to treatment. Later we examine this identifying assumption by checking that the only difference in State policies that affected the specific outcomes of interest is exposure to *Piso Firme*.

In order to make treatment and control groups similar in the absence of the intervention, we combine the geographical discontinuity design outlined above with a matching procedure to draw our samples around the border of the States of Durango and Coahuila as follows:

First, we randomly drew the sample of treated households from administrative records of the universe of households that received *Piso Firme* in the city of Torreon in the State of Coahuila between 2001 and 2003.[4] Since data collection was conducted in the spring of 2005, this time frame provides us with a sampled of household treatments with 2 to 4 years of exposure to cement floors.

Second, we identified the census radius (AGEB) where our sample of treated households reside and calculated average pre-treatment characteristics at this census level using information gathered from the 2000 Decennial Census of Population for both these treated census radius and for all potential census radius in control areas in the cities of Gómez Palacio and Lerdo in the State of Durango.

Third, we matched, by mean of a minimum distance algorithm, sampled treated and potential control census radius using data on the following pre-treatment characteristics at the census radius level: (i) proportion of census blocks within each census radius with dirt floor, (ii) proportion of households with dirt floor, (iii) number of children between 0 and 5 years old and (iii) number of households. Specifically, we calculated the distance measure as the maximum of the absolute value differences between these four variables (*L-infinite* distance) for each possible pair of treatment and control census radius.

[4] An important characteristic of the treatment group is its almost full level of compliance. During a preliminary investigation at the beginning of 2005, we found that almost all houses had at least partial cement floors in Torreon, and administrative records also indicate that only a few households rejected the offer of cement floors during the role out of the program.

We selected as control areas those areas that were closest to the treated areas in terms of this distance measure. The sample of controls was only drawn from those census blocks within these specific areas that had dirt floor in 2000. Within these selected census blocks, only those households that satisfied an eligibility criteria explained below were finally selected as potential controls.

We imposed the following eligibility criteria on all surveyed households (i.e., treatment and control households): (i) being homeowner since this status was a condition for eligibility of *Piso Firme*; (ii) residence in the actual house since 2000; (iii) having had at least one room with dirt floor in 2000, and (iv) having at least one child no older than 6 years old at the time of interview.

3. Data Collection and Measurement

The survey was conducted by the Mexican National Institute of Public Health during the spring of 2005. The target sample size for the survey was 3,000 households equally split between treatment and control groups. Response rates, as it is usual in developing countries, were very high. In the treatment area, it was 92.6% yielding 1,390 completed surveys while in the control area it was 92.9% yielding 1,393 surveys. For these 2,783 households we have complete geographical location information for 2,755 households (99%), which is the sample we use in our empirical analysis.

The survey collected information on household demographic structure, socio-economic status, housing infrastructure, happiness and mental health, hygiene habits, health outcomes, nutritional outcomes, and cognitive development of children less than six years old. It also collected information on floor type for each room in the house in

order estimate the impact of offering *Piso Firme* on the prevalence of dirt floors, which is a necessary condition for the program to have an impact on health and happiness.

The child health outcomes included maternal reported diarrhea in children in the last four weeks, stool samples to determine the presence of various types of parasites in fecal matter, height and weight anthropometric statistics to measure stunting and wasting, blood from a finger prick to assess hemoglobin levels and anemia, and the Picture Peabody Verbal Test which measures verbal development of children 3 to 6 years old.

In order to measure the presence of intestinal parasites, we collected two stool samples from every child under 6 years old.[5] We identified ova for a number of parasites using standard parasite ova centrifuge concentration techniques on the fixed specimens with direct visualization (REF).[6]

We measured the height and weight for all children under 6 years old by personnel trained according to international recommendations (Habicht 1974; Lohman, Roche et al. 1989) using standard procedures and regularly calibrated portable scales and stadiometers. The measurement instruments were regularly recalibrated twice weekly in the field. Repeat measurements were taken on all children to monitor quality control. In accordance with World Health Organization guidelines, we converted these measurements to height for age and weight for height z-scores, which measure the

[5] In many studies of parasites, three samples are used per patient, however most of these studies are small sample sizes and are in clinical settings. The cost of collecting three in a large household survey was prohibitive. Also Morris et al (J Clin Micro, 2002) finds that in 96.8% of the cases two samples were sufficient to identify the presence of parasitoids.

[6] The ova included ascaris lumbricoides, blastocystis hominis, cryptosporidium parvum, chilomastix mesnili, endolimax nana, entamoeba coli, enterobius vermicularis, fasciola hepatica, entamoeba histolytica, giardia lamblia, hymenolepis diminuta, hymenolepis nana, iodamoeba butschlii, isospora belli, strongyloides stercoralis, taenia sp, trichiuris trichiura, trichomonas hominis, uncinarias. For the analysis, we grouped as protoza, worms or cryptosporidium. Protoza further subdivided into pathogenic and non-pathogenic.

number of standard deviations from age-sex standardized height of a healthy (U.S.) reference population.

In order to measure anemia, we collected blood samples by means of digital capillary punctures (i.e. finger prick). At the time of collection we placed one drop (10 µl) of blood in a portable photoreflectometer to measure the concentration of hemoglobin in the blood. During the fieldwork, the photometers were calibrated twice weekly, registering the measurements of the control tray at the beginning and end of each day. The hemoglobin results were immediately available in the household and enabled the survey team to inform the family whether the child was at risk of anemia. In addition, we provided children with hemoglobin values less than 9 g/dL with a ferrous sulfate treatment. For the purpose of analysis, according to international standards, we defined a child to be anemic if her hemoglobin level less than 11g/dL adjusted for altitude using standard adjustments.

Finally, we measured a child's cognitive development using the Picture Peabody Vocabulary Test (PPVT) applied to children 3 to 5 years old. We used the Spanish version of the PPVT, the Test de Vocabulario en Imagines Peabody (TVIP) (Dunn 1965). Based on the popular PPVT-R, the TVIP contains 125 translated items to assess the vocabulary of spanish-speaking and bilingual students. Items have been carefully selected through rigorous item analysis for their universality and appropriateness to Spanish-speaking communities. The TVIP is frequently used to evaluating the language development of Spanish-speaking preschool children, and older students (Munoz, Quilodran et al. 1989; Umbel, Pearson et al. 1992). We report the PPVT test results in

terms of the percentile of the distribution of Latin American outcomes after trimming symmetrically the bottom and top 2-percentile to control for outliers.

We measured happiness in several ways. First, we ask the female head of household about her satisfaction with floor quality, overall housing quality and quality of life. These responses to these questions allow very satisfied, satisfied, so-so and unsatisfied. We converted these responses to one very satisfied or satisfied and zero so-so or unsatisfied.

Secondly, we collected measures of depression and perceived stress for mothers of kids younger than six years old. Mothers were asked seven questions about the frequency of stress episodes and fifteen questions about the frequency of bad mood states. There were five available responses to these questions: never, hardly ever, sometimes, highly frequently, and always. We converted these responses to two different indicator variables equal to one if the mother reported having stress episodes highly frequently or always and bad mood episodes highly frequently or always, respectively.

4. Empirical Findings

In this section we present our findings. First, we provide evidence that support our empirical design and sampling strategy. Second, we present the effects of treatment on the outcomes variables of interest.

We used these data to estimate the impact of *Piso firme* using two approaches. The first approach asks the question of what was the impact of offering cement floors to households and is an "intent to treat" analysis. The statistical methods involve multivariate regression of the dependent variable on a variable indicating that the household resides in the treatment area and a set of controls. Since the sampling

stratified at the census block level, we estimated the models by feasible generalized least squares (random effects) to control for intercluster correlation at the census block.

The second approach asks the question of what was the effect of replacing a dirt floor with a cement floor. One of the problems with the intent to treat analysis is that while all of the households in the comparison group had dirt floors in 2000, some of them may have installed cement floors by the time of the survey. This implies that the intent to treat analysis is not comparing households with cement floors in the treatment group to households without cement floors in the comparison group, but rather a treatment group which installed cement floors faster than a comparison group. In order estimate the impact of replacing a dirt floor with a cement floor we use offered *Piso Firme* as an instrument for the share of a house's floors that are cement in an instrumental variables analysis.

4.1 Pre-intervention Characteristics and Sample Balance Results

We begin by showing that our sampling strategy was successful in constructing pre-intervention balanced comparison units at the census block level. We assigned to each household the 2000 census information corresponding to the census block where the household is located. We then computed a difference in means for a set of pre-intervention census variables between control and treatment households, clustering at the census block level. These results are presented in Table 2.

As it can be observed, the first three variables are the ones used in the first stage of our sampling strategy. Due to fieldwork operative restrictions, we slightly oversampled

census blocks with high proportion of dirt floor houses and high proportion of small kids in the control area. With the exception of the proportion of dirt floor, the nineteen pre-intervention census variables are not significantly different between treatment and control households, indicating that the observational units in our sample were similar before the program took place.

Next, we show that the treatment and comparison samples are well balanced when analyzing covariates from our survey. This in turn provides observational evidence in favor of our proposed design.

In Table 3 we provide the means of eighteen household characteristics, of which fourteen are not significantly different at conventional levels. Note that in the cases where the mean differences are significant, the statistical significance is not driven by large differences in the mean values, but rather by small standard errors. In fact, as we report below, the actual and percentage differences in the means of those characteristics are considerably small. More importantly, the small standard errors indicate that there is a large degree of homogeneity in the distribution of these characteristics.

Of particular interest is the fact that there was no difference in the self-reported proportion of rooms that had cement floors in 2000, prior to the Piso Firme intervention. This implies that the sample was balanced in terms of the type of houses Piso Firme targeted prior to program implementation.

Also there is no difference in the economic status of the household as measured by the log of the value of total consumptions per capita and the log of the value of total household assets. Also, note that there is no difference between the amounts of other transfers received by the households. This suggests that households were well balanced in

terms of economic resources prior to program implementation and that there were no state specific trends or anti-poverty programs that differentially affected the households in one state compared to the other state.

In terms of demographic structure, households in the comparison group are on average about one-quarter of a person (7.1%) larger than comparison households. Comparison household heads had about a quarter of a year (4.4%) more schooling, fathers were 5.5% more likely to be present, and mothers were 1.7 percent more likely to be present than in treatment households. However, as we discussed above, the differences are small and the significance has more to do with the size of the standard errors. There were no differences in the age of the head or in the characteristics of the spouse of the head.

In terms of water and hygiene, there was no difference in the presence of domestic animals, whether the animals lived inside, connection to municipal water, and whether the family washed hands after eliminating and before eating.

4.2 ITT: Program Effect, Reduced Form.

In this subsection we present the first set of regressions corresponding to the reduced form analysis. We study three groups of outcome variables: presence of firm floor, mother happiness and mental health, and children health.

Observe that the design of all the regression Tables is the same. By column, we present five models (labeled “Model 1” to “Model 5”) corresponding to alternative econometric specifications: Model 1 reports the regression with no controls and is therefore just the difference in means between the treatment and comparison samples;

Model 2 includes household demographic controls (number of family members, the age and years of schooling of the household head and spouse, and sex-age dummies); Model 3 further adds health environment and hygiene habits controls (number of domestic animals, whether the animals are allowed inside the house, whether the house is connected to municipal water, whether the municipal water is connected inside the house, whether the house has a water tank, and whether family members wash their hands after eliminating); Model 4 also incorporates economic covariates (the log of household consumption per capita and the log of assets); and, finally, Model 5 incorporates whether the households reported receiving other social transfers. By row, we present alternative outcome variables within the same category under study. In all cases, for each outcome variable we offer average level in the control group, estimated coefficient, clustered standard errors, and the percentage over the control group.

We first report the impact of offering *Piso Firme* on the presence of hard (non-dirt floors) in the house. Table 4 presents these effects using different measures constructed from our survey. This effect can be interpreted as the induced increment in firm floor due to the program. It is important to stress that in this study, these variables are interesting not only as outcome variables, but also because they constitute the first stage of the IV regressions presented below. In other words, this table summarizes alternative measures of the *Piso Firme* program take-up.

We use several measures of firm floors: the proportion of rooms that have firm floors, whether the kitchen has a firm floor, whether the room in which the family eats has a firm floor, whether the bathroom has a firm floor, and whether the room(s) in which the family sleeps has firm floors. In particular, the first of these variables (share of firm floor)

will be used below as instrument to estimate TOT. For now, we concentrate on the take-up effect of *Piso Firme*.

The comparison sample means reported in this table suggest that there was substantial regression to the mean as approximately 80 percent of the comparison households had installed hard floors regardless of the measure considered. We find strong positive effects of offering *Piso Firme* on actual hard floor in all cases. Regardless of the firm floor measure used, our results suggest an average increment of hard floor induced by the program of 25%, being particular stronger in the kitchen and sleeping areas of the house. These findings are robust to all specifications and confirm the fact that Piso Firme has virtually generated full coverage in the beneficiary population. As a final note, we highlight the estimated take-up rate of approximately 0.2 that will be important later in the TOT analysis.

Table 5 presents the results of the reduced form analysis for satisfaction and mother mental health. The degree of satisfaction with the quality of the house's floors is significantly higher in the treatment group with an estimated effect of 19.4 percentage points or a 31.3 percent difference off the comparison mean. Similar results were found for the level of satisfaction with the overall quality of the house and the quality of life, respectively. We find that the program increased the degree of satisfaction with house quality in 8.1 percentage points with respect to the control group, and the degree of satisfaction with life quality by 10.1 percentage points. The last two rows of the table present the effects of the program on mother's mental health. We find that the frequency of bad mood and stress episodes is significantly lower in the treatment group, with an

estimated effect that represents a 13.2 and 17.6 percent difference off the control mean, respectively.

Table 6 presents the results of the reduced form analysis for 0 to 5 year-old children's health outcomes. We find that the presence of the program reduces diarrhea, anemia, and parasites, increases cognitive development and has no effect on height, weight, respiratory diseases, and other diseases. As it can be observed, the presence of the program decreased the number of parasites in children by 6.2 percentage points relative to the control group, which represents a 20.7 percent reduction with respect to the control mean. The incidence of diarrhea also decreased by 2.4 percentage points, or by 17.9 percent with respect to the control mean. The program also reduced the incidence of anemia in the treatment group with an estimated effect of 8.1 percentage points or 20.5 percent difference off the comparison mean.

The effect of the program on children's cognitive development was found to be positive. The fourth row in Table 6 presents the estimated effect of the program on the Picture Peabody Verbal Test's results, measured in percentiles. We find that the treatment group scores 2.8 percentile points higher in this test than the control group, which represents an 8.7 percent increase with respect to the comparison mean. Finally, in the last four rows of the table we present the results on height, weight, respiratory diseases and other diseases. As it can be seen, the program seems not to have had a significant effect on any of these variables. In particular, the absence of significant effect on the presence of respiratory diseases and other diseases provides further evidence in favor of the particular transmission channels hypothesized above. These results can be interpreted as a robustness check of our design.

4.3 TOT: IV analysis, Firm Floor Effects.

Now we turn to the analysis of TOT. Here we estimate the effect of having firm floor on the alternative outcome variables. Recall that we use Piso Firme as an instrument since we assume it induced an exogenous change in the presence of firm floor and thus we are not estimating the impact of the program but rather the impact of having firm floor for this population (Imbens and Angrist 1994).

Table 7 presents the results for the same satisfaction and mother's mental health outcomes presented in Table 5. This time, the results present the estimated effect of having cement floors on the outcome variables, using the program eligibility as an instrument. We find much stronger results than those reported in Table 5. The level of satisfaction with the quality of floors, overall quality of the house and quality of life are significantly higher for those households that have a higher proportion of firm floors. Having firm floor increased satisfaction with floor quality by 106.5 percentage points, satisfaction with house quality by 43.1 percentage points and satisfaction with life quality by 54.1 percentage points. These estimated results represent a 171.9, 66.3 and 82.5 percent increase off the comparison mean, respectively. The last two rows of Table 7 present the results for mother's mental health. We find that a higher proportion of firm floors decrease the frequency of stress and bad mood episodes of mothers by 37.1 and 45.9 percentage points, respectively.

Finally, Table 8 presents the results for children's health outcomes. Again, the estimated results are significantly higher than those presented in Table 6. We find that having a higher proportion of rooms with firm floor decreases the number of parasites in

children by 30.5 percentage points relative to the control group, which represents a 101.3 percent reduction with respect to the control mean. The incidence of diarrhea decreased by 11.2 percentage points, or by 84.4 percent with respect to the control mean. The incidence of anemia also decreased for those households with higher proportion of firm floor rooms, with an estimated effect of 43.8 percentage points or 111.1 percent difference off the comparison mean.

We also find a positive effect on children's cognitive development. The fourth row in Table 8 presents the effect of having firm floors on the Picture Peabody Verbal Test's results, measured in percentiles. We find that the treatment group scores 15.3 percentile points higher in this test than the control group, which represents a 48.0 percent increase with respect to the comparison mean. Finally, in the last four rows of the table we present the results on height, weight, respiratory diseases and other diseases. Again, having firm floors seems not to affect any of these variables.

5. Conclusions

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References:

Anderson, R. and R. May, 1991, Infectious Diseases of Humans, Oxford University Press.

Behrman, J., 1996, "The Impact of Health and Nutrition on Education", *World Bank Research Observer* 11, 23-37.

Cebu Team, 1991, "Underlying and Proximate Determinants of Child Health: The Cebu Longitudinal Health and Nutrition Study", *American Journal of Epidemiology* 133, 185-201.

Chay, K. and M. Greenstone, 2005, "Does Air Quality Matter?", *Journal of Political Economy* 113, 376-424.

Crane, R., A. Daniere and S. Harwood, 1997, "The Contribution of Environmental Amenities to Low-Income Housing: A Comparative Study of Bangkok and Jakarta", *Urban Studies* 34, pp. 1495-1512.

Esrey, S., J. Potash, L. Roberts and C. Shiff, 1991, "Effects of Improved Water Supply and Sanitation on Ascariasis, Diarrhea, Dracunculiasis, Hookworm Infection, Schistosomiasis and Trachoma", *Bulletin of the World Health Organization* 69, 609-621.

Galiani, S., P. Gertler and E. Schargrodsky, 2005, "Water for life: The impact of the privatization of water supply on child mortality", *Journal of Political Economy* 113, 83-120.

Glaeser, E. and B. Sacerdote, 1999, "The Social Consequences of Housing", *Journal of Housing Economics* 9, 1-23.

(Habicht 1974; Lohman, Roche et al. 1989) Habicht, J-P. 1979. Measurement of Nutritional Impact. Geneva, Switzerland: WHO. PAHO Bull 1974;76:375–384 and World Health Organization. Standardization of anthropometric methods in the field.

Jalan, J. and M. Ravallion, 2003, "Does Piped Water Reduce Diarrhea for Children in Rural India?".*Journal of Econometrics* 112, 153-173.

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

Katz, L., J. Kling and J. Liebman, 2001, "Moving to Opportunity in Boston: Early Results of a Randomized Mobility Experiment", *Quarterly Journal of Economics* 116, 607-54.

Kaufmann, D. and J. Quigley, 1987, "The Consumption Benefits of Investment in Infraestructure: The Evaluation of Sites-and-Services Programs in Underdeveloped Countries", *Journal of Development Economics* 25, 263-84.

Kremer, M. and E. Miguel (2004): "Worms: Identifying Impacts on Education and Health in the Presence of Treatment Externalities", *Econometrica* 72, 159-217.

Lavy, V., J. Strauss, D. Thomas and P. De Vreyer, 1996, "Quality of Health Care, Survival and Health Outcomes in Ghana", *Journal of Health Economics* 15, 333-357.

Luong, T., 2003,

Nokes, C., S. Grantham-McGregor, A. Sawyer, E. Cooper and D. Bundy, 1992, "Parasitic Helminth Infection and Cognitive Function in Schoolchildren", Proc R Soc Lond. B Biological Sci 247, 77-81.

Morris et al (J Clin Micro, 2002

Ruiz-Argüelles G, Llorente-Peters A. 1981. Predicción algebraica de parámetros de serie roja de adultos sanos residentes en alturas de 0 a 2,670 metros. Rev Invest Clin 33:191–193.

Olsen, E., 2003, "Housing Programs for Low-Income Households", in R. Moffitt (ed.), Means-Tested Transfer Programs in the United States, National Bureau of Economic Research.

Pollit, E., 1990, Malnutrition and Infection in the Classroom, Unesco, Paris.

Takeuchi, A., M. Cropper and A. Bento, 2005, "The Welfare Effects of Slum Improvement Programs: The Case of Mumbai", mimeo Maryland.

Thomson, H., M. Petticrew and D. Morrison, 2001, "Health Effects on Housing Improvement: Systematic Review of the Evidence", *British Medical Journal*.

World Bank, 2002,

World Bank, 2005, World Development Indicators, World Bank.

Figure I: Geographical Discontinuity Design

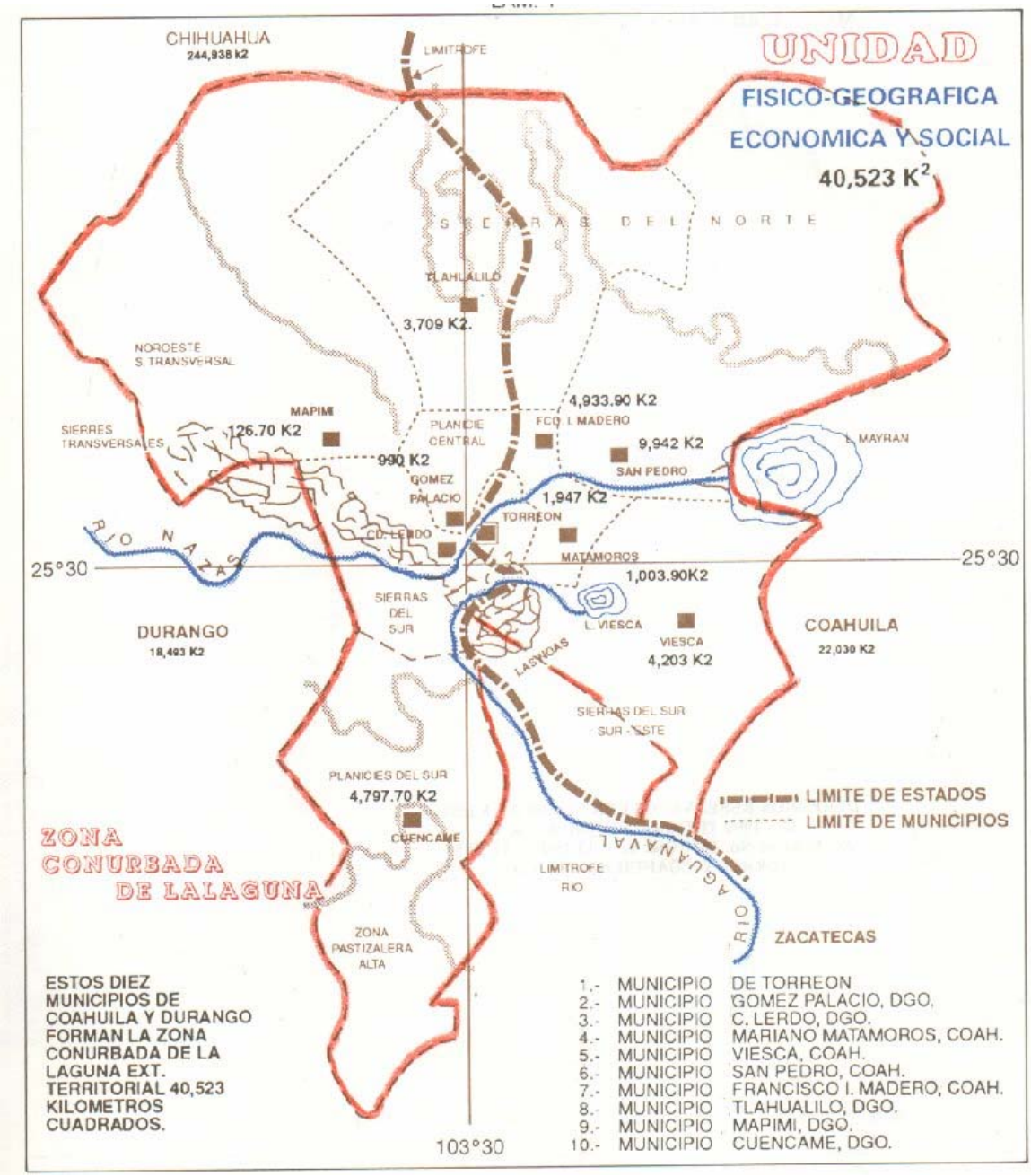

Table 1: Description of outcome variables

Variable Name	Description
Firm floor share	Ratio of rooms with cement floors to total number of rooms
Firm floor kitchen	Indicator equal to one if kitchen has cement floor
Firm floor dining room	Indicator equal to one if dining room has cement floor
Firm floor bathroom	Indicator equal to one if bathroom has cement floor
Firm floor sleep	Indicator equal to one if household head sleeps in a room with cement floor
Diarrhea	Indicator equal to one if the child had diarrhea in the last four weeks, as reported by the mother.
All parasites-count	Sum of indicators equal to one if the child's stool sample had positive amounts of ascaris lumbricoides, cryptosporidium parvum, chilomastix mesnili, endolimax nana, entamoeba coli, enterobius vermicularis, entamoeba histolytica, giardia lamblia, hymenolepis nana, iodamoeba butschlii, isospora belli, respectively.
Height-age	Height for age z-scores
Weight-height	Weight for height z-scores
Anemia	Indicator equal to one if the child's hemoglobin level are less than 11g/dL adjusted for altitude.
Peabody pct	Picture Peabody Verbal Test results in terms of the percentile of the distribution of Latin American outcomes. The bottom and top 2-percentiles were trimmed to control for outliers.
Respiratory disease	Indicator equal to one if the child had some respiratory disease in the last four weeks, as reported by the mother.
Other diseases	Indicator equal to one if the child had some other disease in the last four weeks, as reported by the mother.
Mother stress	Indicator equal to one if the mother reported having at least one stress episode highly frequently or always
Mother bad mood	Indicator equal to one if the mother reported having at least one bad mood episode highly frequently or always.
Satisfied quality floor	Indicator equal to one if the head of household reports to be satisfied or very satisfied with the quality of the house's floors.
Satisfied quality house	Indicator equal to one if the head of household reports to be satisfied or very satisfied with the overall quality of the house.
Satisfied quality life	Indicator equal to one if the head of household reports to be satisfied or very satisfied with the overall quality of life.

Table 2: Difference of means for census variables

Variable	Treatment mean	Control mean	Mean difference
Proportion dirt floor	0.240	0.326	-0.086*
	(0.034)	(0.034)	(0.048)
Proportion kids 0 to 5	0.747	0.782	-0.035
	(0.019)	(0.021)	(0.029)
Number households	18.750	19.556	-0.806
	(2.065)	(1.791)	(2.733)
Number people	82.402	85.405	-3.002
	(9.437)	(7.585)	(12.108)
Proportion rooms	2.106	2.055	0.050
	(0.075)	(0.081)	(0.110)
Proportion people per household	4.390	4.375	0.015
	(0.041)	(0.064)	(0.076)
Proportion households no bathroom	0.102	0.107	-0.005
	(0.011)	(0.015)	(0.019)
Proportion households no water	0.453	0.440	0.012
	(0.040)	(0.043)	(0.059)
Proportion working members	1.475	1.504	-0.029
	(0.031)	(0.032)	(0.044)
Proportion income-earning members	1.393	1.417	-0.024
	(0.029)	(0.026)	(0.038)
Proportion dropouts 5-15 years old	0.207	0.211	-0.004
	(0.010)	(0.016)	(0.019)
Proportion illiterate members	0.075	0.079	-0.004
	(0.006)	(0.006)	(0.009)
Average crowding index	2.570	2.625	-0.055
	(0.070)	(0.095)	(0.119)
Head's schooling level	6.035	5.894	0.141
	(0.094)	(0.145)	(0.173)
Proportion households no gas heater	0.037	0.052	-0.015
	(0.007)	(0.013)	(0.015)
Proportion households no fridge	0.252	0.297	-0.045
	(0.024)	(0.023)	(0.034)
Proportion households no washing machine	0.421	0.439	-0.018
	(0.026)	(0.022)	(0.034)
Proportion households no telephone	0.854	0.878	-0.024
	(0.013)	(0.013)	(0.019)
Number of observations	1,101	1,379	2,480

Note: This table was computed using only those households for which block level (manzana) census information was available.

Table 3: Difference of means for independent variables

Variable	Obs treatment	Treatment mean	Obs control	Control mean	Mean difference
Household size	1362	3.083	1393	3.310	-0.227**
		(0.069)		(0.059)	(0.091)
Head educ	1360	6.133	1391	6.408	-0.275
		(0.136)		(0.115)	(0.179)
Spouse educ	1207	6.338	1211	6.479	-0.141
		(0.150)		(0.108)	(0.185)
Head age	1362	37.547	1393	37.120	0.427
		(0.409)		(0.491)	(0.639)
Spouse age	1362	29.645	1393	28.772	0.874
		(0.475)		(0.406)	(0.624)
Domestic animal	1362	0.181	1393	0.180	0.001
		(0.015)		(0.013)	(0.020)
Animal house	1362	0.020	1393	0.015	0.005
		(0.004)		(0.003)	(0.005)
Water-ext	1362	0.970	1393	0.977	-0.007
		(0.005)		(0.005)	(0.007)
Water-int	1362	0.511	1393	0.546	-0.035
		(0.029)		(0.022)	(0.036)
Wash hands	1362	3.754	1393	3.716	0.038
		(0.057)		(0.059)	(0.082)
Proportion working members	1362	0.403	1393	0.396	0.007
		(0.008)		(0.005)	(0.009)
Per capita working hours	1362	13.393	1393	13.491	-0.098
		(0.209)		(0.212)	(0.301)
Per capita labor income	1362	991.018	1393	1007.917	-16.899
		(78.588)		(107.256)	(132.850)
Per capita HH Valor transferencias progr	1361	16.187	1392	12.604	3.583
		(2.094)		(1.222)	(2.404)
Log-consumption	1362	8.070	1393	8.046	0.024
		(0.021)		(0.017)	(0.027)
Log-assets	1362	11.576	1393	11.578	-0.001
		(0.002)		(0.002)	(0.003)
Firm floor share 2000	1362	0.330	1393	0.327	0.003
		(0.020)		(0.021)	(0.029)
Age-Children 0to5	1940	2.643	2112	2.579	0.064
		(0.032)		(0.032)	(0.045)
Gender-Children 0to5	1940	0.492	2112	0.517	-0.024*
		(0.011)		(0.007)	(0.013)
Mother present	1940	0.959	2112	0.943	0.016*
		(0.006)		(0.007)	(0.009)
Father present	1940	0.763	2112	0.722	0.041**
		(0.011)		(0.015)	(0.019)

Note: This table includes all households and invidividuals available in our dataset.

Table 4: Firm Floor Measures
FGLS Regression of firm floor measures on program dummy

Dependent Variable	Control Mean	Model 1	Model 2	Model 3	Model 4	Model 5
	0.828	0.202***	0.196***	0.200***	0.199***	0.200***
Firm floor share		[0.011]	[0.010]	[0.010]	[0.010]	[0.010]
		24.399	23.697	24.128	24.024	24.151
	0.797	0.255***	0.248***	0.251***	0.250***	0.253***
Firm floor kitchen		[0.015]	[0.014]	[0.014]	[0.014]	[0.014]
		31.945	31.152	31.533	31.423	31.694
	0.812	0.210***	0.205***	0.208***	0.207***	0.209***
Firm floor dining room		[0.014]	[0.014]	[0.014]	[0.014]	[0.014]
		25.846	25.207	25.605	25.444	25.746
	0.854	0.105***	0.098***	0.103***	0.101***	0.102***
Firm floor bathroom		[0.013]	[0.013]	[0.013]	[0.013]	[0.013]
		12.277	11.472	12.012	11.864	11.908
	0.785	0.238***	0.238***	0.241***	0.240***	0.240***
Firm floor sleep		[0.015]	[0.015]	[0.015]	[0.015]	[0.015]
		30.271	30.275	30.707	30.595	30.588

Notes: Model 1: no controls; Model 2: age & demographic controls;

Model 3: age, demographic & health habits controls; Model 4: age, demographic, health habits & economic controls;

Model 5: age, demographic, health habits,economic and federal programs controls.

Reported results for Model 1 through Model 5: estimated coeffcient, standard error & percentage of control mean.

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

Table 5: Satisfaction and Mother's Mental Health Measures
FGLS Regression of satisfaction and mother's mental health measures on program dummy

Dependent Variable	Control Mean	Model 1	Model 2	Model 3	Model 4	Model 5
	0.619	0.199***	0.194***	0.195***	0.195***	0.194***
Satisfied quality floor		[0.034]	[0.033]	[0.033]	[0.033]	[0.033]
		32.201	31.296	31.453	31.491	31.309
	0.65	0.090***	0.080***	0.082***	0.082***	0.081***
Satisfied quality house		[0.029]	[0.024]	[0.022]	[0.021]	[0.021]
		13.895	12.358	12.593	12.618	12.38
	0.656	0.112***	0.101***	0.101***	0.101***	0.101***
Satisfied quality life		[0.024]	[0.018]	[0.018]	[0.018]	[0.018]
		17.085	15.335	15.448	15.377	15.34
	0.569	-0.063*	-0.062*	-0.071**	-0.075***	-0.075***
Mother bad mood		[0.034]	[0.033]	[0.028]	[0.027]	[0.027]
		-11.093	-10.942	-12.427	-13.234	-13.172
	0.485	-0.086***	-0.087***	-0.084***	-0.085***	-0.085***
Mother stress		[0.024]	[0.020]	[0.019]	[0.019]	[0.019]
		-17.627	-17.854	-17.278	-17.434	-17.596

Notes: Model 1: no controls; Model 2: age & demographic controls;

Model 3: age, demographic & health habits controls; Model 4: age, demographic, health habits & economic controls;

Model 5: age, demographic, health habits,economic and federal programs controls.

Reported results for Model 1 through Model 5: estimated coeffcient, standard error & percentage of control mean.

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

Table 6: Children's Health Measures
FGLS Regression of health outcomes on program dummy - Children 0 to 5

Dependent Variable	Control Mean	Model 1	Model 2	Model 3	Model 4	Model 5
	0.301	-0.065***	-0.061***	-0.062***	-0.061***	-0.062***
All parasites-count		[0.022]	[0.022]	[0.022]	[0.022]	[0.022]
		-21.633	-20.255	-20.582	-20.339	-20.703
	0.133	-0.019	-0.020*	-0.023**	-0.024**	-0.024**
Diarrhea		[0.016]	[0.011]	[0.011]	[0.011]	[0.011]
		-14.479	-14.852	-17.238	-17.64	-17.862
	0.394	-0.090***	-0.083***	-0.080***	-0.080***	-0.081***
Anemia		[0.026]	[0.021]	[0.015]	[0.015]	[0.015]
		-22.842	-21.065	-20.224	-20.213	-20.541
	31.939	2.668**	2.670**	2.689**	2.664**	2.803**
Peabody pct		[1.284]	[1.239]	[1.239]	[1.238]	[1.239]
		8.352	8.359	8.419	8.34	8.777
	-0.505	0.107	0.033	0.033	0.033	0.037
Height-age		[0.065]	[0.040]	[0.040]	[0.040]	[0.040]
		-21.207	-6.48	-6.441	-6.506	-7.379
	0.209	0.086*	0.041	0.041	0.041	0.044
Weight-height		[0.045]	[0.044]	[0.044]	[0.044]	[0.044]
		40.919	19.785	19.435	19.5	21.112
	0.365	0.021	0.017	0.016	0.016	0.015
Respiratory disease		[0.030]	[0.015]	[0.015]	[0.015]	[0.015]
		5.791	4.578	4.464	4.352	4.144
	0.044	0.001	0.003	0.005	0.005	0.005
Other diseases		[0.010]	[0.007]	[0.006]	[0.006]	[0.007]
		2.09	7.93	10.517	10.675	11.403

Notes: Model 1: no controls; Model 2: age & demographic controls;

Model 3: age, demographic & health habits controls; Model 4: age, demographic, health habits & economic controls;

Model 5: age, demographic, health habits,economic and federal programs controls.

Reported results for Model 1 through Model 5: estimated coeffcient, standard error & percentage of control mean.

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

Table 7: Satisfaction and Mother's Mental Health Measures
Instrumental Variables Regression - Instrument: program dummy

Dependent Variable	Control Mean	Model 1	Model 2	Model 3	Model 4	Model 5
	0.619	1.093***	1.079***	1.070***	1.075***	1.065***
Satisfied quality floor		[0.118]	[0.094]	[0.092]	[0.092]	[0.091]
		176.575	174.284	172.843	173.578	171.959
	0.65	0.474***	0.437***	0.434***	0.438***	0.431***
Satisfied quality house		[0.105]	[0.123]	[0.118]	[0.121]	[0.128]
		72.858	67.131	66.712	67.382	66.276
	0.656	0.587***	0.542***	0.543***	0.545***	0.541***
Satisfied quality life		[0.117]	[0.120]	[0.121]	[0.124]	[0.124]
		89.49	82.643	82.727	83.035	82.489
	0.569	-0.360*	-0.355*	-0.368**	-0.374**	-0.371**
Mother bad mood		[0.184]	[0.196]	[0.174]	[0.176]	[0.179]
		-63.258	-62.398	-64.621	-65.792	-65.181
	0.485	-0.474***	-0.476***	-0.449***	-0.460***	-0.459***
Mother stress		[0.175]	[0.175]	[0.166]	[0.172]	[0.166]
		-97.618	-98	-92.571	-94.835	-94.536

Notes: Model 1: no controls; Model 2: age & demographic controls;

Model 3: age, demographic & health habits controls; Model 4: age, demographic, health habits & economic controls;

Model 5: age, demographic, health habits,economic and federal programs controls.

Reported results for Model 1 through Model 5: estimated coeffcient, standard error & percentage of control mean.

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

Table 8: Children's Health
Instrumental Variables Regression - Instrument: program dummy

Dependent Variable	Control Mean	Model 1	Model 2	Model 3	Model 4	Model 5
	0.301	-0.309***	-0.301***	-0.301***	-0.299***	-0.303***
All parasites-count		[0.107]	[0.111]	[0.109]	[0.110]	[0.109]
		-102.67	-100.275	-100.042	-99.479	-100.916
	0.133	-0.083*	-0.095*	-0.108**	-0.111**	-0.112**
Diarrhea		[0.049]	[0.052]	[0.050]	[0.050]	[0.050]
		-62.367	-71.443	-80.991	-83.084	-83.969
	0.394	-0.435***	-0.448***	-0.433***	-0.436***	-0.437***
Anemia		[0.108]	[0.122]	[0.119]	[0.118]	[0.115]
		-110.495	-113.677	-109.965	-110.686	-110.946
	31.939	14.775**	14.972**	14.831**	14.692**	15.349**
Peabody pct		[7.128]	[7.034]	[6.923]	[6.918]	[6.886]
		46.261	46.878	46.437	46	48.057
	-0.505	0.544*	0.044	0.031	0.026	0.051
Height-age		[0.319]	[0.318]	[0.319]	[0.322]	[0.319]
		-107.776	-8.79	-6.211	-5.163	-10.119
	0.209	0.387*	0.197	0.189	0.19	0.205
Weight-height		[0.203]	[0.210]	[0.206]	[0.206]	[0.206]
		184.954	94.135	90.247	90.683	97.966
	0.365	0.109	0.093	0.086	0.083	0.079
Respiratory disease		[0.109]	[0.130]	[0.122]	[0.120]	[0.121]
		29.696	25.34	23.459	22.847	21.503
	0.044	0.019	0.018	0.017	0.019	0.019
Other diseases		[0.038]	[0.034]	[0.036]	[0.034]	[0.036]
		42.868	41.646	38.318	42.937	43.439

Notes: Model 1: no controls; Model 2: age & demographic controls;

Model 3: age, demographic & health habits controls; Model 4: age, demographic, health habits & economic controls;

Model 5: age, demographic, health habits,economic and federal programs controls.

Reported results for Model 1 through Model 5: estimated coeffcient, standard error & percentage of control mean.

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