Essays on Household Behavior in Developing Economies

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Abstract

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This dissertation consists of three essays in development economics. I explore various household behaviors in developing economies, using India and Tanzania as examples. The first two chapters focus on urban slums to capture the inequality within cities and to evaluate the impact of an intervention during urbanization. The third chapter investigates the influence of an inheritance law reform on child labor.

The first chapter, which is a joint work with Claus Pörtner, examines the differences in child health across rural, urban non-slum and slum areas. The developing world is rapidly becoming more and more urban, but our understanding of the differences between urban and rural areas is still limited, especially in the important area of child health and its determinants. Simple averages show clearly that child health in India is worst in rural areas and best in urban areas—with slums in between—but it is unclear exactly what accounts for these differences. We examine the determinants of these differences and to what extent the same mechanisms affect child health in different areas using the 2005-06 National Family Health Survey (NFHS-3) data from India. Once we control for environmental conditions and wealth status, the urban advantage in child health disappears and slum children fare substantially worse than their rural counterparts. We also examine the impact of maternal education on child health across rural, urban, and slum areas and find that the positive effect of mother's education on child health is significantly stronger in rural areas than in

cities and almost entirely absent in slums. Potential explanations for these results, such as school quality and migration, are explored, but these are unlikely to fully explain the differences in health.

The second chapter, which is a joint work with Aidan Coville, evaluates the impact of a slum upgrading project in Tanzania. Developing countries spend significant amounts of their budgets annually on slum upgrading activities, with the broad objectives of alleviating poverty, improving health and well-being and strengthening the social fabric within these communities in a holistic and integrated manner. Rigorous evidence on the impact of these programs is sparse. Isolating the causal impact of these interventions presents a challenge, since the outcomes of interest are often correlated with the site selection for upgrading, and randomized controlled trials are not usually feasible for practical implementation reasons. While rigorous research is beginning to emerge on the effects of slum upgrading on diarrhea, acute respiratory illness (ARI) and the crowding out of private investments, very little is known about the broader impacts of the upgrading process that serve to motivate these interventions in the first place. This paper evaluates the Community Infrastructure Upgrading Program (CIUP) financed by the World Bank with the aim of improving the lives of slum dwellers in Dar es Salaam, Tanzania through targeted investments in community infrastructure such as roads, drainage systems and streetlights. We find that the CIUP interventions increased household sizes and decreased out-migration, halved diarrhea rates for children under 5, and increased female school enrollment rates, but did not have significant impacts on employment, business operations, income and expenditure, private investment or social cohesion. We review possible confounding factors that influence the reliability of these estimates and present the results in light of these methodological constraints.

The third chapter examines the relationship between female autonomy and child labor in India. Many children in developing countries are engaged in various forms of child labor. It is important to understand the determinants of child labor and to evaluate its

welfare implications. Intra-household bargaining has been considered an important factor in household decision-making for investment in children. This paper uses the Hindu Succession Act Amendment (HSAA) in India as a source of exogenous variation in woman's bargaining power and information from the 2005-06 National Family Health Survey (NFHS-3) to study the effect on child labor. I find that the increase in mothers' bargaining power is associated with a lower probability of child labor, and this negative impact is especially strong for teenage daughters. A daughter of 12 to 14 years old is less likely to be working by 30 percentage points and is less likely to do family work by 20.6 percentage points if her mother is exposed to the HSAA. The HSAA also shows differential impact on families with different sizes and wealth status.

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DEDICATION

To my parents.

Chapter 1

WHAT EXPLAINS DIFFERENCES IN CHILD HEALTH BETWEEN RURAL, URBAN, AND SLUM AREAS? EVIDENCE FROM INDIA

1.1 Introduction

Health affects current well-being and is a crucial determinant of future outcomes at both individual and societal levels. This is especially the case for child health, which is a key indicator for future labor productivity and economic growth. For developing countries, we know a good deal about what determines health in rural areas, but we have much less information about determinants of health in urban areas while the developing world is rapidly becoming more urban. The urban population in the developing world is projected to increase from 2.7 billion in 2011 to 5.1 billion in 2050 (United Nations 2012). A major unanswered question is whether or not this increase in urban population will improve child health in developing countries. To answer this question and to understand how urbanization affects our policy choices, we need to understand the differences in determinants of child health between rural and urban areas.

This paper utilizes recent data from India that cover rural, urban, and slum areas to examine what explains differences in health for children across these areas and how the determinants of child health differ across the three areas. The data come from the Indian 2005-06 National Family Health Survey (NFHS-3). NFHS-3 has detailed information on child health from rural, urban, and slum areas and covers a sufficiently large sample to allow us to examine differences across these areas. Simple averages show clearly that children in urban areas are significantly healthier than slum children, who in turn are significantly healthier than rural residents. This may, however, simply reflect differences in household characteristics between areas. We therefore examine what the main drivers are behind these differences in health by studying the impact of wealth, environmental conditions, and household characteristics on child health. Maternal education is often mentioned as the key driver of improved child health, with increased maternal education having a strong positive effect on child health. Hence, we focus in depth on whether the effect of maternal education on child health differs between the three areas.

When examining the issue of child health, it is important to consider slums in addition to rural and urban areas. Slums are often considered the first stop for people moving from rural areas in search of new opportunities, but most existing data usually exclude slum areas because they are considered illegal settlements. When slums are included in the data collection, the sample size is often too small to allow any reasonable slum-specific estimates (Fotso 2007). A simple definition of a slum is "a heavily populated urban area characterized by substandard housing and squalor" (UN-HABITAT 2003). More specifically, a slum is an area that has one or more of the following characteristics: inadequate access to safe water, inadequate access to sanitation and other infrastructure, poor structural quality of housing, overcrowding, and insecure residential status. In NFHS-3, the definition of a slum is a compact area of at least 300 people—or about 60 to 70 households—living in poorly built congested tenements, in an unhygienic environment, usually with inadequate infrastructure, and lacking in proper sanitary and drinking water facilities.

India is in many ways the ideal country to study differences in health across rural, slums, and urban areas. Approximately 31 percent of India's population lives in urban areas with a large and rapidly-growing slum population (Burra 2005). According to the Indian government (Housing and Urban Poverty Alleviation Minister Kumari Selja in 2010), India's slum-dwelling population had risen from 27.9 million in 1981 to 75.26 million in 2001 and is expected to increase to 93.06 million in 2011. In India's largest city, Mumbai, more than half of the population resides in urban slums even though slums occupy only about 8.75 percent of the city's land, and the number of slum dwellings has grown 40 percent since 1995 (Murthy 2012).

Our main contribution in this paper is that we analyze an important question that has received limited attention in the literature; namely, how child health and its determinants vary across rural, urban, and slum areas, whereas the prior literature has generally focused solely on one type of area. Specifically, this allows us to begin understanding how the impact of maternal education varies across areas, something that has important policy applications given the increasing urban and slum population. Contrary to prior studies, we use a data set that has sufficient number of observations to identify any potential differences across areas.

We show that simple averages of child health, as measured by height-for-age and weight-for-height Z-scores and survival, are best in urban areas, followed by slum areas and finally by rural areas. Once we control for environmental conditions and wealth status, however, the urban advantage in child health disappears and slum children fare substantially worse than their rural counterparts. We also find that the positive effect of mother's education on child health is significantly stronger in rural areas than in cities and is almost entirely absent in slums. There is weak evidence that school quality plays a role in the absence of an effect of maternal education in slums, but neither quality nor selective migration can fully explain the differences in health.

1.2 Literature Review

With the number of poor and undernourished living in urban areas is increasing more quickly than in rural areas, the locus of poverty and malnourishment is gradually shifting from rural to urban areas (Haddad et al. 1999). Urbanization has traditionally been linked to development and development with health, but the growth of slums is now often associated with poor health (Vlahov et al. 2007).[1] From the late 1970s to the early 1990s, infant mortality underwent a much slower decline in cities of one million or more residents than in towns and villages in developing countries of Latin America, Africa and the Near East, while infant mortality has risen substantially in small and medium-sized cities of sub-Saharan Africa (Brockerhoff and Brennan 1998). Recently, in two urban slums in Nairobi, close to 40 percent of children were found to be stunted (Abuya et al. 2012).

Comparing children across rural, urban and slum areas in Bangladesh, children from slum areas are significantly more likely to have serious behavioral problems (Mullick and Goodman 2005). Data from Ahmedabad, the largest city in Gujarat, India, indicate that the

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[1] Basta (1977) made one of the earliest attempts to use slums as a way to capture the intra-urban differences of nutrition and health but only had limited descriptive information for four cities in Philippines, India and Pakistan.

child health conditions in urban slums are worse than the national average, in terms of child mortality, immunization rates and other indicators, but the greater availability of health practitioners is an advantage for slum children over their rural counterparts. Slums often turn out to be stable and homogeneous communities rather than chaotic agglomerations (Fry et al. 2002).

The poor environment and resulting conditions can be the main threat to health for slum dwellers. For example, the inadequate distance between wells and pit latrines and slum dwellers' poor sanitary practices can lead to contamination of water sources (Kimani-Murage and Ngindu 2007). In Indonesian slums, conditions such as a lack of garbage service, a poorly-kept yard, and the presence of stagnant water around the dwelling are associated with a greater incidence of sickness (Brueckner 2013). Sickness is, however, not related to toilet access, an outside water source, the presence of a sewer connection, poor ventilation, the presence of waste and trash, or the proximity of a stable. Households living in dirt-floored dwellings have a lower incidence of sickness.

To the extent that urbanization is believed to be a force for better health, it is clear that the health benefits of urbanization are not uniformly distributed. Children of both rich and poor families benefit from urban living, but the rich gain more (Dye 2008). In both urban and rural areas, children from the poorest households stand a greater risk of being undernourished than their counterparts in the most privileged households, but the socioeconomic inequality in stunting is significantly larger in urban areas (Fotso 2006). Child malnutrition in sub-Saharan Africa is lower in urban than rural areas, but these urban-rural gaps are abolished in almost all Sub-Saharan African countries when community socioeconomic status, household wealth and maternal education are controlled for (Fotso 2007).

The influence of the urban environment on health is clearly complex. Controlling for socioeconomic status, environmental conditions are strongly related to child mortality in Egypt and Brazil, to stunting in Ghana and Egypt and to diarrhea prevalence in Brazil and Thailand (Timaeus and Lush 1995). In addition, the effect of improved water and toilet facilities on child health may vary between individuals and populations depending on parental education (Stephens 1984). In Ghana, the presence of piped water and private latrines is associated with lower child mortality, but the advantages of better sanitation facilities are severely limited when mothers are not educated. Marx et al. (2013) argue that slums can be poverty traps because slums' living conditions lead to extremely poor health and low levels of human capital. They show that the prevalence of underweight, stunting, and wasting is greater in the slum outskirts of Sierra Leone's capital Freetown than in rural areas nationwide. Overall, we can see that using a simple urban-rural dichotomy to characterize child health may be misleading. Examining the rapidly growing urban slum population can be one way to understand the health inequality within cities.

1.3 Theoretical Framework

Following Rosenzweig and Schultz (1983), we assume that the preference ordering of a household j over a composite consumption good X_j, a composite health environment good Y_j, and a vector $\mathbf{H_j} = (H_{1j}, H_{2j}, \ldots, H_{ij}, \ldots, H_{nj})$ over the health of the n children in the household, can be represented by a utility function

$$U_j = U(X_j, Y_j, \mathbf{H_j}). \tag{1.1}$$

Child health is determined by the health environment good Y_j, a child specific health input I_{ij} that does not affect parental utility directly, and a child health endowment μ_{ij}. The health environment composite good Y_j consists of goods that affect both utility and child health directly. This may, for example, be smoking, the number of children in the household, the level of household sanitation, or the source of water. Child specific health inputs might be nutritional intake and individual care. In this case, the child health production function is

$$H_{ij} = \Gamma(Y_j, I_{ij}, \mu_{ij}). \tag{1.2}$$

The budget constraint of the household is given by

$$M_j = X_j + p_Y Y_j + p_I \mathbf{I_j}, \tag{1.3}$$

where M_j is household income, p_Y and p_I are the prices of the health environment good and the child specific health inputs relative to the price of the non-health consumption goods, and $\mathbf{I_j}$ is a vector of the child specific health inputs. Both household income and input prices are assumed to be exogenous to the household.

From maximization of (1.1) subject to the health production function (1.2) and the budget constraint (1.3), the reduced form household demand functions for the composite goods X, Y, and I are

$$D_c = D(p_Y, p_I, M_j, \mu_{\mathbf{j}}), \qquad c = X, Y, I. \tag{1.4}$$

Reduced form household demand functions for health inputs were among the principal objects of study in the empirical analyses of household health in the 1970's. Following Rosenzweig and Schultz (1983), however, later studies have concentrated on estimating the underlying technical relationships embedded in the health production function (1.2). This is also what we examine here, focusing specifically on how Y impact child health.

1.4 Data and Estimation Strategy

The data come from the 2005–06 National Family Health Survey (NFHS-3). NFHS-3 is the third in a series of national surveys; earlier NFHS surveys were carried out in 1992–93 (NFHS-1) and 1998–99 (NFHS-2). We use only NFHS-3 because the first two survey did not disaggregate urban into slums and non-slums. All three surveys were conducted under the stewardship of the Ministry of Health and Family Welfare, Government of India, with the International Institute for Population Sciences, Mumbai, serving as the nodal agency.

Within each state, the urban and rural samples were drawn separately and, unless oversampling was required to permit separate estimates for urban slum and non-slum areas, the sample within each state was allocated proportionally to the size of the state's urban and rural populations. The same sample design was adopted in all states. The rural sample was selected in two stages, where Primary Sampling Units (PSUs) were selected with a probability proportional to population size at the first stage, followed by the random selection of households within each PSU in the second stage. In urban areas, a three-stage procedure was followed. In the first stage, wards were selected with a probability proportional to population size. In the next stage, one PSU was randomly selected from each sample ward. In the final stage, households were randomly selected within each selected PSU.

Each PSU in eight large cities (Chennai, Delhi, Hyderabad, Indore, Kolkata, Meerut, Mumbai, and Nagpur) were classified as a slum or non-slum by two different measures: according to the census and as identified by the survey supervisor. We consider an area a slum if it has been identified as such either by the census or by the survey supervisor.[2] We restrict our sample to the seven states that have slum samples in order to make the rural, slums, and urban samples more comparable. The seven states with slum samples are Delhi, Uttar Pradesh, West Bengal, Madhya Pradesh, Maharashtra, Andhra Pradesh, and Tamil Nadu.

1.4.1 Estimation Strategy

We can think of Y_j in (1.2) as also capturing both where the household lives and the characteristics of the area in which it lives. To understand the determinants of child health, we begin by estimating the following:

$$H_{ij} = \alpha + \mathbf{A}_j\beta_1 + \mathbf{C}_{ij}\beta_2 + \epsilon_{ij}, \tag{1.5}$$

where H_{ij} is the health status of child i in household j. We use height-for-age Z-scores as the main indicator for child health. A child with a Z-score of zero is exactly at the mean of the comparison population in terms of height-for-age, while children with negative Z-scores are shorter than average. The results of weight-for-height Z-scores are also reported in the basic estimation for comparison.[3] $\mathbf{A}_j$ captures the area of residence of the household, divided into three exclusive areas: rural, urban non-slum, and urban slum areas. $\mathbf{C}_{ij}$ is a vector of personal characteristics of that child, including gender and age in months. This specification shows how the three areas compare in terms of child health controlling for child

[2] The replications of the main results by using the census identification and the supervisor identification are available upon request.

[3] We do not use the information on diarrhea, cough, and fever because of the noisiness of these self-reported variables.

gender and age.

For all models we also analyze boys and girls separately to explore potential gender differences. All results make use of the provided weights to account for oversampling of slum areas. Furthermore, we use robust standard errors clustered at PSU level throughout.

The second specification considers basic parental and household characteristics.

$$H_{ij} = \alpha + \mathbf{A}_j\beta_1 + \mathbf{C}_{ij}\beta_2 + \mathbf{P}_j\beta_3 + \epsilon_{ij}, \tag{1.6}$$

where $\mathbf{P}_j$ is a vector of parental characteristics, including mother's and father's level of education, and mother's height, household religion, caste, and fixed effects for state and the month of survey being conducted.[4]

To examine how the household wealth and the local environment are correlated with children's health conditions, we estimate:

$$H_{ij} = \alpha + \mathbf{A}_j\beta_1 + \mathbf{C}_{ij}\beta_2 + \mathbf{P}_j\beta_3 + \mathbf{W}_j\beta_4 + \mathbf{R}_j\beta_5 + \epsilon_{ij}, \tag{1.7}$$

where $\mathbf{W}_j$ is a vector of the household's wealth status and $\mathbf{R}_j$ is a vector of area characteristics for household j. For each area characteristic variable we use the "minus-i" method: $R_j = \frac{1}{n-1}\sum R_{-j}$, where $-j$ indicate that the sum is over all other households in the primary sampling unit (PSU) except for j. Thus, R_j is the average living condition in the PSU excluding household j. This approach is often used to deal with endogeneity issues (Aizer 2010). The advantage of this approach is that, by construction, area characteristics are no longer correlated with the unobserved characteristics of the individual household. Household wealth is captured using the NFHS-constructed wealth index, described in detail below.

Another measure of child health is child mortality. We estimate the effects of individual, household, and area characteristics on child mortality using the Cox proportional hazard model in which the instantaneous hazard rates of death is specified for child i, at age t

[4]The father's height is not included because the information is missing for more than half of the children in our sample.

measured in months, conditional on still being alive at age t, as:

$$\lambda(t \mid \mathbf{X}_{ijt}) = \lambda_0(t) \exp(\mathbf{X}_{ijt}\beta). \tag{1.8}$$

The baseline hazard, $\lambda_0(t)$, is a nonparametric, time-varying function. X_{ijt} is a vector of regressors that combined the explanatory variables in the previous specifications. In addition to being of interest in its own right, the child mortality results also provides an indication of whether differential mortality across areas lead to a mortality selection problem for our height-for-age and weight-for-height results. Say, that we have two equally low-health children, but that the likelihood of a child dying at that level of health is higher in rural areas than in urban areas. That would lead us to overestimate the health status of children in rural areas because the weakest children are no longer observed in the sample. In other words, this would make the unhealthy areas seem less bad than they are.

A potentially important issue here is endogenous migration. For example, if households believe that living in slums is bad for their children's health, those who care more about child health are more likely to move away from slums. Similarly, urban dwellers that do poorly in their economic lives may be more likely to move to slums, and rural people seeking ways to improve their living conditions may see slums as a first step toward living in the urban non-slum areas. This implies that unobservable household characteristics, place of residence, and child health may be correlated, which would bias the estimated effects. Unfortunately, NFHS-3 does not provide much information about migration. The only questions available are how long the respondent has been living continuously in the current PSU, and if the respondent has moved at one point, was the last previous place of residence in a city, in a town, or in the countryside. This makes it difficult to control for selective migration. To examine whether selective migration based on preferences for child health is important, we present results by migration status as sensitivity checks, estimating separately for children of women who have always lived in the current area and for those who have moved at one point in their lives.

1.4.2 Variables and Descriptive Statistics

Table 1.1 presents descriptive statistics by area of residence: rural, slums, and urban non-slums. We limit the sample to children less than five years of age because anthropometric information is not available for older children. The two Z-scores used as dependent variables are height-for-age and weight-for-height. Height-for-age Z-score is generally considered the better measure of children's long-term health. Weight-for-height Z-score is also presented here and in some of the later analyses for a more comprehensive examination of child health. The table also shows individual, household, and area characteristics.

As expected, the overall health status of children in the sample is poor. The average height-for-age Z-score is -1.77, which means that the average child in the sample is close to being stunted. Clearly, children in rural areas on average do worst, with a height-for-age Z-score of -1.99, while slum children have an average height-for-age Z-score of -1.59, and urban children are the healthiest with a height-for-age Z-score of -1.48. The differences between the three areas are all statistically significant.[5] Hence, despite the common view of slums as being detrimental to health, the children do surprisingly well according to the simple averages, although still worse than urban children. Weight-for-height shows a similar pattern, but the differences are less distinct than for height-for-age. The differences between rural and both slum and urban are both statistically significant, but the difference between slum and urban is not.[6]

The natural sex ratio at birth is around 105 boys per 100 girls.[7] This means that, in the absence of sex selective abortions and differential mortality between boys and girls, we should expect 48.8 percent of the sample to be girls. The percentage of girls in rural areas is only slightly lower than the expected number. In urban areas, 47.4 percent of the people in the sample are girls, whereas only 46.4 percent are girls in slum areas. This might provide some indication of the use of sex selective abortions in urban and slum areas, although given

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[5] The t-statistic between rural and slum is 11.24, between rural and urban it is 16.14, and between slum and urban it is 2.63.

[6] The t-statistic between rural and slum is 7.47, between rural and urban it is 10.24, and between slum and urban it is 1.34.

[7] For a detailed discussion of sex ratios at birth and an analysis of sex selective abortions in India see Pörtner (2013).

the small sample size, these numbers should not be overinterpreted.[8]

Corresponding to the height differences between children, mothers are, on average, tallest in urban areas, followed by slum areas, and finally by rural areas. Intriguingly, the average level of education of both mothers and fathers in urban non-slums and slum areas are similar, and both are substantially higher than in rural areas.[9] There is less than a year's difference in the average education levels between slum areas and urban areas for both mothers and fathers.

Given the common perception that slums are mainly populated by a transient population, it is interesting that 28 percent of the slum children's mothers are born in the same PSU as they are surveyed in. This is higher than both urban–where 22 percent have never moved–and rural, where only 14 percent are living where they were born. The low number for the rural population is most likely the result of the Indian practice of exogamy, where a woman marries into a household in another village and becomes part of her husband's household. The high number of non-migrant mothers is also consistent with the very new argument: slum in developing countries nowadays are not a transitory phenomenon characteristic of fast-growing economies (Marx et al. 2013), and many people live in slums for generations.

The dominant religion is Hinduism: 85 percent of children in rural areas and around 70 percent of slum and urban children are Hindu. Slums and urban areas have a higher proportion of Muslims than rural areas, with around 25 percent in slums and urban areas and 13 percent in rural areas. The remainder is comprised of Christians and others (Sikhs, Buddhists, Jains, Jews, no religion, and others). There is also a substantial number of children in one of the historically-disadvantaged groups: around 77 percent of rural, 59 percent of slum, and 60 percent of urban children fall into this category.

The wealth index is constructed in NFHS-3 based on 33 assets and housing characteristics by principle components analysis.[10] Not surprisingly, rural is the poorest among the three

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[8] See Pörtner (2013) for a discussion of the issues associated with estimating the use of sex selective abortions from small sample sizes.

[9] For the estimations below, we use a set of dummies to capture parental education rather than having them enter linearly. The dummies are for 1–4 years, 5–7, 8–9, 10–11, and 12 plus years of education.

[10] Each asset was assigned a weight (factor score) generated through principle components analysis, and

areas, with close to 60 percent the children belonging to a household that is among the bottom 40 percent of Indian households in terms of wealth. Urban areas have the highest proportion in the top category (category 5), with 47 percent of children in that category, but interestingly, slums are not far behind with 38 percent in the top category. Furthermore, 78 percent of children in slums belong to one of the top two groups, while only 75 percent of children in urban areas are in the top two. Hence, although children in slums are, on average, poorer than children in urban areas, this difference is much smaller than what we originally expected.

The bottom half of Table 1.1 shows the area characteristics. These characteristics fall into three categories: environment, assets, and wealth. Environment includes characteristics that are thought to broadly reflect the healthiness of the living conditions of the area. These include water access, captured by the average time to fetch water and whether an improved source of drinking water is available, access to improved cooking fuel, sharing a toilet with ten or more households, access to improved toilet facilities, and the average number of people per room. Assets include improved building materials (floor, wall, and roof), radio, television, refrigerator, bicycle, motorcycle/scooter, car, telephone (land-line and mobile), watch, cart, and computer. Area wealth is captured by the percentage of households in each of the five wealth categories. For each household, area characteristics are calculated as the average of households in the PSU, excluding the household itself as described in Section 1.4.1.

The time to fetch water is essentially identical across urban and slum areas at around six minutes, which is about half the time it takes on average in rural areas. We follow the official NFHS-3 report for the definition of access to improved sources of drinking water. In addition to water piped into the dwelling, yard or plot, an improved drinking water source includes water available from a public tap or standpipe, a tube well or borehole, a protected dug

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the resulting asset scores were standardized in relation to a standard normal distribution with a mean of zero and a standard deviation of one. The sum of the scores of the assets possessed by each household resulted in that household's wealth index factor or score. The sample was then divided into population quintiles, with each quintile given a rank from one (poorest) to five (wealthiest). In NFHS-3, the wealth index has been developed for the whole sample and for the country as a whole. Thus, at the national level, 20 percent of the household population is in each wealth quintile although this is not necessarily true at the state level.

well, a protected spring, rainwater, and bottled water. Following this definition, around 96 percent of households in urban and slum areas have access to an improved source of drinking water, with rural areas only slightly behind at 87 percent. Access to improved cooking fuel is important because smoke from solid cooking fuels is a serious health hazard (International Institute for Population Sciences (IIPS) and Macro International 2007).[11] Interestingly, the proportion of households that use improved cooking fuels is higher in slums than in urban areas, with 79 percent in slums and 70 percent in urban areas. Rural areas are far behind, with only 7 percent using an improved cooking fuel. At 19 percent, slums have the highest percentage of households sharing toilets with ten or more other households, probably because most slum dwellers rely on public toilets in the community. In urban areas, 6 percent of households share with 10 or more households, while less than 1 percent do so in rural areas. About three-quarters of of households in slums and urban areas have access to improved toilets, while only 17 percent in rural areas have similar access. Finally, slums and rural areas have essentially the same number of people per room at 3.7, with urban households having an average of 3.3 people per room. Although number of people per room does provide some indication of crowding, it fails to capture the fact that dwellings in slums areas are located much closer together than in either urban or rural areas. Ideally, having information on the number of people per square kilometer would be a better measurement, but that is not available in our data. Unfortunately, because NFHS-3 does not provide information about the exact location of survey areas, it is not possible to match PSU location with secondary data.

As expected, given the distribution of wealth discussed above, slums and urban areas are relatively similar in terms of assets holdings and wealth distribution, while households in rural areas generally have fewer assets and less wealth. As for housing, there are more households in slum ares than in urban areas that have improved building material, although the differences are not large. The same goes for television. Hence, even though the general perception of slums is one of squalor and poor living conditions, these descriptive statistics paint a somewhat different picture. There are relatively wealthy slum residents who have

[11] Solid cooking fuels include coal/lignite, charcoal, wood, straw, shrubs, grass, agricultural crop waste and dung cakes. We consider electricity, natural gas, biogas and kerosene as improved cooking fuel.

high education levels, and slum children, although they clearly are worse off than children in urban areas, do not lag far behind in terms of health and certainly are in better health than rural children. Now, the question is whether or not these simple averages provide an adequate description of child health and its determinants. Therefore, we turn to our estimation of the child health production function.

1.5 Determinants of Child Health

Table 1.2 presents the results for our estimation of the health production function as described above for child height-for-age Z-scores. Columns 1 to 7 show the results for different sets of control variables, beginning with a specification that only includes child age and sex and ending with a specification that includes all variables. The results are shown both for girls and boys combined and for each sex separately. To ease interpretation only the main results for the differences between areas are presented here.[12]

The simplest specification, column (1), which includes only age dummies, shows that children in urban slums have better health than rural children, and children in urban areas are the healthiest. Compared with rural children, slum children have, on average, a 0.386 higher height-for-age Z-score, and for urban children it is 0.435 higher. Both are statistically significant at the 1 percent level. Controlling for parental education, mother's height, and state and survey month fixed effects in column (2) substantially reduces the urban health advantage and there is now no statistically significant difference between children's health in rural and slum areas. When including further variables, shown in columns (3) through (7), there is generally a statistically significant negative effect on child health from being in a slum. This means that when controlling for household wealth and area characteristics, in addition to standard individual and parental characteristics, children in slums are actually significantly shorter than their counterparts in rural areas. In the full specification, column (7), holding all other factors that we can observe constant, a slum child is 0.18 standard deviations shorter than a rural child.

The difference between boys and girls in terms of height-for-age is not significant when

[12] Full results are available upon request.

we pool girls and boys together. When we estimate using the sample of boys only, there is no significant difference between urban and rural in columns (3) through (7), although both slums and urban areas have a negative effect relative to urban areas. Furthermore, where the dummy for slum in the combined estimates were about twice the size of the urban dummy, there is little difference between urban and slum when looking only at boys' health. The estimates for girls show only a very small difference between child health in rural and urban areas for columns (3) through (7). The effect of slums relative to rural is, however, substantial for girls, although it is only statistically significant for the specification with area assets, column (5). The large effect in the full model, where slum girls are 0.23 standard deviation shorter than rural girls, could be an indication of more discrimination against girls in slums, although this result has to be interpreted with care since the effect is not statistically significant.

Table 1.3 shows the same specification as for Table 1.2 but with weight-for-height Z-score as the dependent variable. In the literature on child health, the results for height-for-age are often stronger than for weight-for-height. That being said, the results for weight-for-height are strikingly similar to the results for height-for-age. The basic specification shows an advantage in child health over rural children for both slums and urban children with the strongest effect for urban children. The differences between slum, urban, and rural areas are, however, not statistically significant in the specifications that include area characteristics.

1.5.1 Mortality Across Areas

To examine how child mortality differs by area we expand the sample above to also include children who have died before their fifth birthday but who would have been surveyed for height and weight if they had been alive. A total of 1,143 children born within the last five years of the survey have died, making the total sample 16,760 children ever born. As expected, the mortality rate is highest in rural areas where 8.3 percent of children have died. For those born in slums, 5.3 percent have died, and 5.1 percent of urban births did not survive. Figure 1.1 shows non-parametric Kaplan-Meier that do not control for any of the explanatory variables but which does account for the weights provided in the data. As expected, the majority of mortality is concentrated within the first months of life, and for urban and slums, essentially all of the mortality occurs within the first two years of life, with slums showing a further decline in survival after age 2. Survival, using the weighted data, is actually slightly better in slums than in urban areas, although the difference is small.

Table 1.4 follows the same specifications as height-for-age and weight-for-height to further examine how child mortality differs by area, except that the age of the child is incorporated directly into the baseline hazard. The coefficients presented are hazard ratios. Hence, a coefficient less than 1 indicates that there is a lower risk of death compared to the reference group, whereas a coefficient greater than 1 indicates that there is a higher risk than the reference group. For the pooled sample of boys and girls in the simplest specification, where there are no explanatory variables, we see a hazard that is more than 40 percent lower for children in slums and urban areas than in rural areas, and this effect is statistically significant different from 1. The main difference from the height-for-age and weight-for-height results is that including additional explanatory variables does not materially reverse this pattern. Urban children have around 20 to 25 percent lower mortality hazard than rural children with the same characteristics and this effect is statistically significant in all models. Slum children have a similar advantage, or even higher, but the effect is barely outside the normal significance interval for the full model in column (7).

Estimating using all children, girls appear to be slightly more likely to die than boys before their fifth birthday, but the difference is never statistically significant. This does, however, hide some substantial differences that can be seen from the separate estimates for boys and girls. For boys in slums, there is an elevated risk of dying compared to rural boys in the full model, with a close to 20 percent higher hazard rate, but the effect is never statistically significant, and in some of the specifications mortality is lower for boys in slums than for boys in rural areas. Girls show a distinctly different pattern from boys. In all specification, girls from both slums and urban areas are substantially less likely to die than girls from rural areas. What is more, girls from slums have lower mortality than girls from urban areas in all specifications. In the complete model, column (7), the hazard for slum girls is 70 percent lower than the hazard for rural girls, whereas urban girls have only slightly more than 40 percent lower hazard. Both of those differences are statistically significant.

The mortality results do complicate the story. Using the pooled sample, slum children do significantly worse than rural children in terms of health for the full model, but they also have lower mortality, and although the lower mortality is not statistically significant, it is very close. Hence, it is possible that part of the explanation for the worsened health outcomes in slum areas when we take into account composition effects is due to mortality selection. Imagine a situation where there was no difference in predicted health between a slum child and a similar rural child, but that among the low health children there was a higher likelihood of dying in rural areas than in slum areas. In that case, we could end up in a situation like this because of the mortality selection. If more children survive in slums than in rural areas, this would make the rural children appear to be more healthy when compared with the slum children. In principle, it is possible that there could be mortality selection for urban children as well, but there are no statistically significant differences between rural and urban children in terms of height-for-age and significantly lower mortality for urban children compared with rural children.

A further complication arises from the different results by sex. Boys in slums have higher mortality and worse health as compared with rural boys, although none of these differences are statistically significant. In urban areas, boys have slightly worse health but lower mortality risk. But again, none of these effects is statistically significant. The implication is that it is hard to see evidence of selective mortality driving the health results for boys.

Girls have substantially worse health in slums, although the effect is not statistically significant at the normal levels, but also substantially and statistically significant lower mortality in the full models. There is little difference between urban and rural in terms of health but significantly lower mortality for girls. Hence, it is possible that part of the reason why we are observing poorer health outcomes in slums is due to the much lower mortality among girls in slums relative to rural girls. Of course, this interpretation is further complicated by the fact that the sex ratios are most biased against girls in slum areas.[13] To the extent that this is an outcome of sex selective abortions rather than an artifact of sampling, and given the small sample size, which is a very real concern, we can think of the poorer health outcomes for girl as evidence of discrimination against girls, but that clearly does not explain the much lower mortality that we observe. To further probe the estimated differences between rural, slum, and urban areas and what is behind them, we turn to the effects of mother's education.

1.5.2 Maternal Education and Child Health

Maternal education has consistently been shown to have a positive effect on child health (Behrman and Deolalikar 1988; Berhman 1990; Strauss and Thomas 1995; Lam and Duryea 1999; Glewwe 1999). The exact mechanisms behind the positive effect of maternal education on child health is still under exploration, but are generally thought to work through income, information, or health knowledge (Thomas et al. 1991; Glewwe 1999; Kovsted et al. 2003). Across all our specifications in the above sections, maternal education is significantly correlated with improved child health.[14]

Understanding whether there are differential effects of maternal education between areas may help explain the results found above. We therefore estimate the following equation:

$$H_{ij} = \alpha + \mathbf{A}_j\beta_1 + \mathbf{M}_j\beta_2 + \mathbf{A}_j\mathbf{M}_j\beta_3 + \mathbf{C}_{ij}\beta_4 + \mathbf{P}_j\beta_5 + \mathbf{W}_j\beta_6 + \mathbf{R}_j\beta_7 + \epsilon_{ij}, \tag{1.9}$$

where $\mathbf{M}_j$ is a vector of the categorical variable for mother's education levels and $\mathbf{A}_j$ is the vector of area dummies. The remaining explanatory variables are the same as in the original specification.

Table 1.5 presents the estimation results where the effect of mother's education is allowed to vary by area. Column (1) shows results for the pooled sample, whereas columns (2) and (3) show results for girls and boys estimated separately. The excluded category in the estimations is rural women with no education. The interactions between area and education

[13] In the mortality slum sample 46.2 percent are girls, which is very close to the 46.4 percent for the health estimation sample.

[14] Full results of our estimations are available upon request.

level show the estimated effect of that level of education relative to having no education in each of the three areas. Hence, the dummy for slum shows the effect of living in a slum for a child whose mother has no education relative to a child living in rural areas whose mother also has no education in slums. Slum interacted with 1–4 years of education then shows the effect for children living in slums of having a mother with 1–4 years of education relative to having a mother with no education.

Children of mothers with no education are worse off in both slums and urban areas than in rural areas, although these differences are not statistically significant. As expected, given the prior literature, there is a positive effect of maternal education for all levels except 1–4 years of education for rural children, and the effect is statistically significant from 8 years of maternal education and up. For slum areas there is, however, no statistically significant effect of maternal education on child health. Furthermore, the coefficients are generally small, or even negative, except for the effect of 12-plus years of maternal education, but even here the estimated effect is lower than for the same level of education in rural areas. In urban areas, there is a positive effect from 5 years of education and up, and a substantial and statistically significant effect of having 12-plus years of education. This large effect is possibly the result of the larger number of women in this category who have university degrees in urban areas relative to rural areas.

Estimating the effects of maternal education by the sex of the child show somewhat diverging patterns between boys and girls. For rural children, there appears to be a slightly more positive effect of maternal education on boys than on girls, although among the best-educated women there is a larger effect of education on girls than on boys. In slums there is also a mostly similar effect of increasing mother's education for boys and girls, but the lack of statistical significance makes it difficult to draw any strong conclusions. Interestingly, for urban children the health gradient of maternal education is stronger for girls than for boys. None of the interactions are statistically significant for boys, whereas the girls show statistically significant effect from the 5–7 years of education group and up.

A potential issue here is the relatively small cell sizes in the data. There are, for example, 606 children in rural areas, 154 in slums, and 217 in urban areas who have a mother with 1–4 years of education. Although this education level is by far the smallest, it does point to the potential problems with trying to determine the effect of maternal education. Another potential issue is that the other variables are not allowed to vary by area, and that could potentially impact the education effects. We did estimate each the same set of models for each area separately, and the results are essentially the same and have the same significance levels.[15]

A potential explanation for the differential impact of mother's education across areas is that the quality of education varies across areas. If there are differences in quality, an equal number of years of schooling may not yield the same benefit in terms of child health. Quality of education is difficult to measure directly, so to proxy for quality we use literacy of the mother and the household wealth status as dependent variables.

We estimate the following equation:

$$Q_j = \alpha + \mathbf{A}_j\beta_1 + \mathbf{M}_j\beta_2 + \mathbf{A}_j\mathbf{M}_j\beta_3 + \beta_4 X_j + \epsilon_j, \tag{1.10}$$

where Q_j is the quality proxy for mother j and X_j is a vector of mother characteristics, which includes mother's age and age squared, household religion, caste and state. The results are reported in Table 1.6.

Columns (1) and (2) show the result for the relation between mother's education and household wealth. The dependent variable is wealth index constructed by the NHFS-3 that we use as an explanatory variable above. To the extent that quality of educational investment is transformed into higher wealth status we can tell whether similar education level translate into similar wealth outcomes across areas. Column (1) shows OLS result where we treat the wealth index as a continuous variable and column (2) shows the ordered Logit results. Higher education levels are clearly associated with higher wealth status. The wealth gradient for education is higher in rural and urban areas than in slums, but part of the explanation for this is that it is likely that women with no education in slums have significantly higher wealth status than women with no education in urban and especially rural areas. This means that women with medium levels of education (some primary and completed primary) actually live in higher wealth households in slums than in both rural

[15] The results are available upon request.

and urban areas.

Another approach to establishing whether there are differences in the amount of human capital acquired by going to school a specific number of years is to look at the mother's literacy. In NFHS-3, rather than relying on self-reported literacy, the respondent was shown a sentence and the enumerator assessed her ability to read and write it. Women with 6 or more years of education were assumed to be literate and were therefore not given the literacy test during the survey. Hence, columns (3) and (4) show the results when limiting the sample to only women with less than 6 years of education. The sample consists of 3,982 rural, 828 slum, and 1,159 urban women. Just over 15 percent of rural women are literate, compared to 27 percent in slums and 25 percent in urban areas. Column (3) shows linear probability model results, whereas column (4) shows Logit results.

As for wealth, there appears to be a slightly lower gradient for literacy in terms of being literate, but interestingly, significantly more women with no education are literate in slums than in urban and rural areas. Despite the higher base level in slums, if we look only at women with 5 years of education, it is about 7 percent less likely that a women in a slum is literate compared to a woman in either rural or urban areas, but this difference is not statistically significant. Hence, the result makes it hard to conclude that there is a lower quality of education in slums compared to rural and urban areas. Women with some education are better off in terms of wealth in slums, but appear to have somewhat lower literacy skills.

1.5.3 How Sensitive are the Results to Migration?

Part of the problem in establishing the effect of living in different areas and the effect of maternal education between these areas is the possibility of selective migrations, either in or out of specific areas, based on unobservables. As we explain above, there is no good way to directly address migration because of data limitation. What we can do is to examine to what extent the results above are driven by either those who have never moved and/or by those who have migrated. This exercise is complicated by the fact that there is substantial marriage migration in India, which means that the sample of non-migration will be small.

In other words, those who do not migrate might be different along other (unobservable) dimensions, and we might therefore substitute one selection problem for another. With these caveats, Table 1.7 presents the results for the full models of child health and mortality split by mothers who have never moved and women who were not born in the area in which they were surveyed.

Based on height-for-age results it appears that the negative effect of slums is due to the children whose mothers were not born in the area of survey. The only statistically significant effect is for girls in slums with migrant mothers, although there is also a negative coefficient on slum for boys of migrant mothers. What makes the picture more muddled is that the results for weight-for-height are essentially the complete opposite: In slums, boys of non-migrant mothers do statistically significantly worse than boys of migrant mothers, and there is no statistically significant effect for girls at all. In terms of survival, girls have much better survival chances in slums and urban areas than in rural areas, and that effect holds for both migrants and non-migrants. Boys of non-migrants mothers have substantially higher mortality risks in slums and urban areas compared to rural areas, whereas boys of migrant mothers have lower mortality risk in slums and urban areas compared with rural areas. However, here the small sample size problem is especially acute. For non-migrant mothers there are a total of 204 deaths (113 boys and 91 girls) among 3,203 children across all areas.

Table 1.8 presents results when the effect of mother's education is allowed to vary by area, split by migrant and non-migrants and by sex of the child. What is interesting here is that children of migrant women in slums appear to do relatively poorly for all education levels. The gradient is at best very low and at worst even negative. Furthermore, this pattern is relatively stable between boys and girls. Children of non-migrant women, on the other hand, show a more positive effect of increasing education.

Table 1.9 shows OLS regression of the relation between mother's education and wealth and literacy by area estimated by migration status. There are no discernable differences in the wealth gradient or the literacy gradient for education between migrants and non-migrants. Hence, there is no substantial evidence that differences between migrants and non-migrants are the driving force behind the negative effects on health for children in slums relative to rural children.

1.6 Conclusion

Child health is an important indicator of economic development as children's health has long-term impacts on their health and productivity as adults. With the rapid urbanization of the developing world, understanding the differences in child health across areas – and the determinants for child health – is an important undertaking and potentially has important policy implications in both the short and the long term.

Simple averages from the third round of India's National Family Health Survey show that child health is worst in rural areas and best in urban areas, with slums in between. This runs counter to the common belief that slums are very unhealthy. Another aspect of the distribution between rural, slums, and urban areas that runs counter to common perceptions is that slum residents are only slightly less well-off compared to urban residents, and that the education levels for women are comparable. Clearly, the simple averages on height-for-age of children do not take into account this composition effect of parental characteristics, and the composition of the population may obscure or even swamp the negative or positive health effects of specific areas.

When we control for wealth and environment variables, however, we find that urban children are not really doing better than rural children, and that children in slums fare substantially worse. These findings confirm that the composition effect is responsible for the simple averages that show relatively healthy children in slum areas.

In other words, it appears that moving a child from a rural setting to a slum setting while keeping parental characteristics the same would lead to worse health outcomes for the child. Another way of looking at it is that people in slums do not get as high returns to their wealth status in terms of child health as they would get in rural areas.

Furthermore, the standard policy recommendation of increasing mother's education to achieve better child health outcomes appears to work less well in slums than in rural areas. In slums, there is little apparent difference in child health outcomes between a mother with no education and one with up to 11 years of education, holding wealth status and area characteristics constant. We explore whether the lower efficiency of mother's education in creating child health is the result of lower-quality schools for mothers in slums. Although there do appear to be slightly lower levels of literacy for given years of schooling in slums, the effect is not large, and there is not much difference in terms of the wealth status achieved.

We conclude that something about the health environment that we are unable to adequately capture in the data is responsible for both the lower levels of health in slums when controlling for parental and area characteristics and for making maternal education less efficient at impacting child health. To some extent, this might not be too surprising. It might not matter much for health that a mother knows to wash her hands, to boil water before use, and to take a sick child to the doctor if the local playground is an open sewer, or if diseases are allowed to spread quickly and easily because of too-high population density. On the other hand, the greater density of slum population means that policies and interventions can reach a much larger number of people at a lower cost compared to less dense areas.

Hence, in addition to the variables which have been included in this paper, future research should consider other factors that can better capture residential crowding and health service facilities. In addition, dealing with the potential endogeneity issue caused by selective migration might shed more light on the potential mechanisms at work among the urban poor, but exploring that issue also requires better data than what is currently available. Creating a better understanding of what it is, exactly, about slums that make them unhealthy and why there is less effect of maternal education on child health in slums are important areas for future research.

Our results do, however, provide some guidance for policies that aim to improve child health. If our current results hold true, we should expect to see a greater impact on child health from "soft" investments such as education and female empowerment in rural areas, whereas in urban, especially slum areas, priority should be given to "hard" investments, which deal with housing and environment. To ensure the health and overall well-being of the growing urban population, policymakers and researchers should focus more attention on interventions that improve city environments and what the impact of those improvements may be. This supports a need for public health and public infrastructure projects that directly target health conditions in slums. The upside is that given the density of population in urban areas in general, and in slums in particular, there is the potential for appropriate policies to generate substantial effects and to become effective at lower costs.

Tables and Figures

Table 1.1: Descriptive Statistics

Variable	Rural	Slum	Urban	Total
Dependent Variables				
Height-for-age Z-score	−1.986	−1.587	−1.483	−1.766
	(1.670)	(1.627)	(1.691)	(1.684)
Weight-for-height Z-score	−1.036	−0.827	−0.784	−0.924
	(1.293)	(1.341)	(1.386)	(1.334)
Individual and Household Variables				
Girl	0.485	0.464	0.474	0.478
Age of child (months)	30.004	30.398	30.606	30.252
	(17.014)	(16.795)	(16.726)	(16.891)
Mother's height (cm)	151.217	152.074	152.451	151.735
	(5.603)	(5.755)	(5.858)	(5.733)
Mother's education (years)	3.324	6.736	7.519	5.178
	(4.269)	(5.018)	(5.600)	(5.211)
Father's education (years)	5.981	7.989	8.779	7.167
	(4.982)	(4.747)	(5.319)	(5.195)
Mother born in PSU	0.143	0.280	0.223	0.192
Hindu	0.853	0.691	0.717	0.783
Muslim	0.127	0.258	0.229	0.181
Christian	0.008	0.022	0.018	0.014
Other religion	0.012	0.028	0.036	0.022
Scheduled caste	0.243	0.219	0.183	0.221
Scheduled tribe	0.096	0.033	0.022	0.063
Other backward classes	0.434	0.333	0.392	0.403
Not a scheduled/backward caste/tribe	0.227	0.414	0.404	0.314
Wealth category 1 (poorest)	0.327	0.010	0.035	0.183
Wealth category 2	0.273	0.043	0.068	0.170
Wealth category 3	0.222	0.166	0.152	0.191
Wealth category 4	0.137	0.403	0.272	0.226
Wealth category 5 (richest)	0.042	0.378	0.473	0.230
Area Variables				
Average time to get water, and return (minutes)	11.615	6.742	6.169	9.123
Percentage with improved cooking fuel	0.072	0.787	0.695	0.387
Percentage with improved source of drink water	0.869	0.960	0.964	0.914
Percentage sharing toilet with 10 plus households	0.002	0.191	0.056	0.054
Percentage that has improved toilet	0.171	0.741	0.759	0.448
Average number of people per room	3.653	3.674	3.310	3.559
Percentage that has improved floor material	0.227	0.779	0.768	0.487
Percentage that has improved wall material	0.526	0.929	0.902	0.711
Percentage that has improved roof material	0.698	0.943	0.922	0.809
Percentage that has radio	0.269	0.368	0.400	0.325
Percentage that has television	0.264	0.743	0.733	0.490
Percentage that has refrigerator	0.036	0.281	0.349	0.173
Percentage that has bicycle	0.588	0.455	0.540	0.549
Percentage that has motorcycle/scooter	0.095	0.247	0.328	0.191
Percentage that has car	0.006	0.034	0.060	0.027
Percentage that has telephone (non-mobile)	0.046	0.171	0.250	0.128
Percentage that has a mobile telephone	0.054	0.336	0.380	0.202
Percentage that has a watch	0.705	0.907	0.918	0.805
Percentage that has an animal-drawn cart	0.081	0.007	0.013	0.047
Percentage that has computer	0.004	0.048	0.081	0.034
Percentage in wealth category 1 (poorest)	0.342	0.010	0.030	0.189
Percentage in wealth category 2	0.285	0.045	0.070	0.178
Percentage in wealth category 3	0.210	0.169	0.143	0.183
Percentage in wealth category 4	0.120	0.398	0.281	0.219
Percentage in wealth category 5 (richest)	0.041	0.378	0.476	0.230
Observations	8,159	2,971	4,487	15,617

Notes. Standard deviations in parentheses (not shown for categorical variables). All area variables are calculated as the mean for the household's PSU, excluding the household itself.

Table 1.2: Determinants of Child Health: Height-for-Age

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Child age dummies[a]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Parental education and mother's height[b]	No	Yes	Yes	Yes	Yes	Yes	Yes
Household religion and caste[c]	No	Yes	Yes	Yes	Yes	Yes	Yes
Household wealth status[d]	No	No	Yes	No	No	No	Yes
Area environment[e]	No	No	No	Yes	No	No	Yes
Area asset[f]	No	No	No	No	Yes	No	Yes
Area wealth distribution[g]	No	No	No	No	No	Yes	Yes
State and survey month fixed effects	No	Yes	Yes	Yes	Yes	Yes	Yes
All children (n=15,617)							
Slum	0.386***	0.079	−0.103*	−0.185*	−0.116	−0.135*	−0.176*
	(0.057)	(0.058)	(0.059)	(0.105)	(0.079)	(0.081)	(0.106)
Urban	0.435***	0.132***	−0.033	−0.081	−0.051	−0.082	−0.089
	(0.054)	(0.042)	(0.048)	(0.067)	(0.064)	(0.070)	(0.071)
Girl	0.013	0.013	0.013	0.015	0.017	0.016	0.015
	(0.029)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
Boys (n=8,155)							
Slum	0.390***	0.124	−0.087	−0.160	−0.063	−0.099	−0.129
	(0.077)	(0.080)	(0.082)	(0.124)	(0.103)	(0.105)	(0.125)
Urban	0.413***	0.123 * *	−0.058	−0.107	−0.078	−0.105	−0.114
	(0.061)	(0.052)	(0.058)	(0.086)	(0.078)	(0.084)	(0.090)
Girls (n=7,462)							
Slum	0.382***	0.037	−0.119	−0.205	−0.178*	−0.166	−0.225
	(0.077)	(0.080)	(0.085)	(0.140)	(0.107)	(0.109)	(0.144)
Urban	0.461***	0.154***	0.004	−0.037	−0.014	−0.046	−0.051
	(0.067)	(0.057)	(0.064)	(0.087)	(0.080)	(0.088)	(0.090)

Notes. * sign. at 10%; ** sign. at 5%; *** sign. at 1%. Weighted OLS with robust standard errors clustered at PSU level in parentheses.
[a] Age dummies for 4-7, 8-11, 12-17, 18-23, 24-35, 36-47, and 48-59 months old, with 0-3 as the excluded category.
[b] Education dummies for mother and father. The dummies are for 1-4 years, 5-7, 8-9, 10-11, and 12 plus years of education.
[c] Religion dummies for each of Muslim, Christian, and other, with Hindu the excluded category. Caste dummies for each of scheduled caste, scheduled tribe, and other backward class, with none of the above the excluded category.
[d] Wealth dummies for the household being in wealth category 2, 3, 4, and 5, respectively
[e] Area environment variables include water access, captured by the average time to fetch water and whether an improved source of drinking water is available, access to improved cooking fuel, sharing toilet with ten or more households, access to improved toilet, and the average number of people per room. Each calculated as the average of households in PSU excluding the household itself.
[f] Area assets include improved building materials (floor, wall, and roof), radio, television, refrigerator, bicycle, motorcycle/scooter, car, telephone (land-line and mobile), watch, cart, and computer. Each calculated as the average of households in PSU excluding the household itself.
[g] Area wealth is the percentage of households in wealth categories 2 through 5. Each calculated as the average of households in PSU excluding the household itself.

Table 1.3: Determinants of Child Health: Weight-for-Height

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Child age dummies[a]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Parental education and mother's height[b]	No	Yes	Yes	Yes	Yes	Yes	Yes
Household religion and caste[c]	No	Yes	Yes	Yes	Yes	Yes	Yes
Household wealth status[d]	No	No	Yes	No	No	No	Yes
Area environment[e]	No	No	No	Yes	No	No	Yes
Area asset[f]	No	No	No	No	Yes	No	Yes
Area wealth distribution[g]	No	No	No	No	No	Yes	Yes
State and survey month fixed effects	No	Yes	Yes	Yes	Yes	Yes	Yes
All children (n=15,617)							
Slum	0.189***	0.064	−0.019	−0.066	−0.075	−0.039	−0.105
	(0.048)	(0.051)	(0.056)	(0.089)	(0.069)	(0.071)	(0.092)
Urban	0.223***	0.138***	0.068*	0.015	0.054	0.045	−0.005
	(0.042)	(0.036)	(0.040)	(0.061)	(0.051)	(0.056)	(0.064)
Girl	0.021	0.027	0.027	0.029	0.028	0.029	0.026
	(0.024)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)
Boys (n=8,155)							
Slum	0.152 * *	0.074	−0.028	−0.048	−0.064	−0.023	−0.059
	(0.065)	(0.069)	(0.073)	(0.110)	(0.091)	(0.091)	(0.113)
Urban	0.229***	0.152***	0.061	0.029	0.051	0.058	0.022
	(0.052)	(0.047)	(0.051)	(0.076)	(0.066)	(0.069)	(0.078)
Girls (n=7,462)							
Slum	0.232***	0.063	0.005	−0.091	−0.081	−0.042	−0.149
	(0.057)	(0.066)	(0.073)	(0.120)	(0.092)	(0.093)	(0.119)
Urban	0.214***	0.126***	0.085	−0.009	0.059	0.037	−0.033
	(0.050)	(0.046)	(0.052)	(0.077)	(0.067)	(0.074)	(0.078)

Notes. * sign. at 10%; ** sign. at 5%; *** sign. at 1%. Weighted OLS with robust standard errors clustered at PSU level in parentheses.
[a] Age dummies for 4-7, 8-11, 12-17, 18-23, 24-35, 36-47, and 48-59 months old, with 0-3 as the excluded category.
[b] Education dummies for mother and father. The dummies are for 1-4 years, 5-7, 8-9, 10-11, and 12 plus years of education.
[c] Religion dummies for each of Muslim, Christian, and other, with Hindu the excluded category. Caste dummies for each of scheduled caste, scheduled tribe, and other backward class, with none of the above the excluded category.
[d] Wealth dummies for the household being in wealth category 2, 3, 4, and 5, respectively
[e] Area environment variables include water access, captured by the average time to fetch water and whether an improved source of drinking water is available, access to improved cooking fuel, sharing toilet with ten or more households, access to improved toilet, and the average number of people per room. Each calculated as the average of households in PSU excluding the household itself.
[f] Area assets include improved building materials (floor, wall, and roof), radio, television, refrigerator, bicycle, motorcycle/scooter, car, telephone (land-line and mobile), watch, cart, and computer. Each calculated as the average of households in PSU excluding the household itself.
[g] Area wealth is the percentage of households in wealth categories 2 through 5. Each calculated as the average of households in PSU excluding the household itself.

Table 1.4: Determinants of Child Health: Mortality

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Parental education and mother's height[a]	No	Yes	Yes	Yes	Yes	Yes	Yes
Household religion and caste[b]	No	Yes	Yes	Yes	Yes	Yes	Yes
Household wealth status[c]	No	No	Yes	No	No	No	Yes
Area environment[d]	No	No	No	Yes	No	No	Yes
Area asset[e]	No	No	No	No	Yes	No	Yes
Area wealth distribution[f]	No	No	No	No	No	Yes	Yes
State and survey month fixed effects	No	Yes	Yes	Yes	Yes	Yes	Yes
All children (n=16,760)							
Slum	0.550***	0.793	0.879	0.675	0.787	0.817	0.654
	(0.087)	(0.137)	(0.155)	(0.178)	(0.156)	(0.161)	(0.175)
Urban	0.590***	0.768***	0.827*	0.730 **	0.805*	0.802*	0.722 **
	(0.055)	(0.076)	(0.088)	(0.103)	(0.103)	(0.106)	(0.102)
Girl	1.108	1.098	1.098	1.101	1.096	1.098	1.097
	(0.075)	(0.075)	(0.075)	(0.075)	(0.075)	(0.075)	(0.075)
Boys (n=8,735)							
Slum	0.688 **	0.936	1.075	1.321	0.842	0.969	1.190
	(0.122)	(0.187)	(0.226)	(0.360)	(0.218)	(0.235)	(0.337)
Urban	0.654***	0.818	0.908	0.881	0.849	0.862	0.841
	(0.079)	(0.107)	(0.128)	(0.158)	(0.149)	(0.148)	(0.154)
Girls (n=8,025)							
Slum	0.413***	0.620*	0.660	0.289***	0.662	0.638	0.295***
	(0.100)	(0.163)	(0.179)	(0.122)	(0.197)	(0.190)	(0.123)
Urban	0.527***	0.715 **	0.742 **	0.562 **	0.759	0.737	0.568 **
	(0.069)	(0.099)	(0.112)	(0.127)	(0.140)	(0.148)	(0.126)

Notes. * sign. at 10%; ** sign. at 5%; *** sign. at 1%. Cox regresions with robust standard errors clustered at PSU level in parentheses. Coefficients presented are hazards ratios.

[a] Education dummies for mother and father. The dummies are for 1-4 years, 5-7, 8-9, 10-11, and 12 plus years of education.

[b] Religion dummies for each of Muslim, Christian, and other, with Hindu the excluded category. Caste dummies for each of scheduled caste, scheduled tribe, and other backward class, with none of the above the excluded category.

[c] Wealth dummies for the household being in wealth category 2, 3, 4, and 5, respectively

[d] Area environment variables include water access, captured by the average time to fetch water and whether an improved source of drinking water is available, access to improved cooking fuel, sharing toilet with ten or more households, access to improved toilet, and the average number of people per room. Each calculated as the average of households in PSU excluding the household itself.

[e] Area assets include improved building materials (floor, wall, and roof), radio, television, refrigerator, bicycle, motorcycle/scooter, car, telephone (land-line and mobile), watch, cart, and computer. Each calculated as the average of households in PSU excluding the household itself.

[f] Area wealth is the percentage of households in wealth categories 2 through 5. Each calculated as the average of households in PSU excluding the household itself.

Table 1.5: Mother's Education and Child Health

	All	Girls	Boys
Rural × 1-4 years of education	−0.012	−0.068	0.023
	(0.070)	(0.107)	(0.089)
Rural × 5-7 years of education	0.030	−0.023	0.088
	(0.051)	(0.071)	(0.069)
Rural × 8-9 years of education	0.132 **	0.088	0.176 **
	(0.059)	(0.086)	(0.083)
Rural × 10-11 years of education	0.202 **	0.161	0.228 **
	(0.086)	(0.122)	(0.109)
Rural × 12+ years of education	0.232***	0.281 **	0.187*
	(0.084)	(0.119)	(0.113)
Slum	−0.065	−0.198	0.046
	(0.140)	(0.188)	(0.177)
Slum × 1-4 years of education	0.112	0.523	−0.145
	(0.169)	(0.512)	(0.229)
Slum × 5-7 years of education	−0.091	0.042	−0.193
	(0.158)	(0.232)	(0.200)
Slum × 8-9 years of education	−0.228	−0.208	−0.257
	(0.147)	(0.218)	(0.190)
Slum × 10-11 years of education	0.069	0.284	−0.111
	(0.159)	(0.190)	(0.226)
Slum × 12+ years of education	0.242	0.288	0.211
	(0.176)	(0.261)	(0.196)
Urban	−0.107	−0.133	−0.063
	(0.088)	(0.111)	(0.114)
Urban × 1-4 years of education	−0.101	−0.202	−0.007
	(0.141)	(0.219)	(0.160)
Urban × 5-7 years of education	0.163	0.208*	0.123
	(0.101)	(0.124)	(0.143)
Urban × 8-9 years of education	0.103	0.300 **	−0.117
	(0.108)	(0.149)	(0.131)
Urban × 10-11 years of education	0.101	0.208	−0.036
	(0.122)	(0.174)	(0.169)
Urban × 12+ years of education	0.321***	0.398***	0.220
	(0.107)	(0.136)	(0.143)
female	0.015		
	(0.027)		
Child age dummies[a]	Yes	Yes	Yes
Father's education and mother's height[b]	Yes	Yes	Yes
Household religion and caste[c]	Yes	Yes	Yes
Household wealth status[d]	Yes	Yes	Yes
Area environment[e]	Yes	Yes	Yes
Area asset[f]	Yes	Yes	Yes
Area wealth distribution[g]	Yes	Yes	Yes
State and survey month fixed effects	Yes	Yes	Yes
Observations	15,617	7,462	8,155

Notes. * sign. at 10%; ** sign. at 5%; *** sign. at 1%. Weighted OLS with robust standard errors clustered at PSU level in parentheses.

[a] Age dummies for 4-7, 8-11, 12-17, 18-23, 24-35, 36-47, and 48-59 months old, with 0-3 as the excluded category.

[b] Education dummies for father. The dummies are for 1-4 years, 5-7, 8-9, 10-11, and 12 plus years of education.

[c] Religion dummies for each of Muslim, Christian, and other, with Hindu the excluded category. Caste dummies for each of scheduled caste, scheduled tribe, and other backward class, with none of the above the excluded category.

[d] Wealth dummies for the household being in wealth category 2, 3, 4, and 5, respectively

[e] Area environment variables include water access, captured by the average time to fetch water and whether an improved source of drinking water is available, access to improved cooking fuel, sharing toilet with ten or more households, access to improved toilet, and the average number of people per room. Each calculated as the average of households in PSU excluding the household itself.

[f] Area assets include improved building materials (floor, wall, and roof), radio, television, refrigerator, bicycle, motorcycle/scooter, car, telephone (land-line and mobile), watch, cart, and computer. Each calculated as the average of households in PSU excluding the household itself.

[g] Area wealth is the percentage of households in wealth categories 2 through 5. Each calculated as the average of households in PSU excluding the household itself.

Table 1.6: Relationship between Mother's Education and Wealth and Literacy

	Wealth[a]		Literacy[b]	
	OLS	Ordered Logit	LPM	Logit
Rural × 1-4 years of education	0.377***	0.762***	0.495***	4.419***
	(0.054)	(0.102)	(0.026)	(0.198)
Rural × 5-7 years of education	0.707***	1.342***	0.790***	5.887***
	(0.044)	(0.082)	(0.020)	(0.202)
Rural × 8-9 years of education	1.048***	1.909***		
	(0.051)	(0.096)		
Rural × 10-11 years of education	1.446***	2.652***		
	(0.076)	(0.146)		
Rural × 12+ years of education	1.979***	3.643***		
	(0.059)	(0.126)		
Slum	1.455***	2.431***	0.031 * *	1.083***
	(0.088)	(0.182)	(0.015)	(0.405)
Slum × 1-4 years of education	0.375***	0.808***	0.509***	3.664***
	(0.118)	(0.240)	(0.075)	(0.479)
Slum × 5-7 years of education	0.543***	1.141***	0.685***	4.431***
	(0.084)	(0.180)	(0.061)	(0.460)
Slum × 8-9 years of education	0.789***	1.772***		
	(0.087)	(0.197)		
Slum × 10-11 years of education	0.888***	2.075***		
	(0.099)	(0.258)		
Slum × 12+ years of education	1.164***	3.210***		
	(0.093)	(0.276)		
Urban	1.115***	2.042***	0.010	0.390
	(0.078)	(0.151)	(0.007)	(0.322)
Urban × 1-4 years of education	0.232 * *	0.437 * *	0.477***	4.084***
	(0.108)	(0.193)	(0.049)	(0.335)
Urban × 5-7 years of education	0.623***	1.097***	0.786***	5.521***
	(0.077)	(0.141)	(0.034)	(0.339)
Urban × 8-9 years of education	1.021***	1.949***		
	(0.079)	(0.160)		
Urban × 10-11 years of education	1.363***	2.866***		
	(0.085)	(0.193)		
Urban × 12+ years of education	1.666***	4.262***		
	(0.074)	(0.190)		
Observations	11,318		5,969	

Notes. * sign. at 10%; ** sign. at 5%; *** sign. at 1%. All regressions weighted and with robust standard errors clustered at PSU level in parentheses. Explanatory variables not shown are mother's age and age squared, religion dummies for each of Muslim, Christian, and other, with Hindu the excluded category. Caste dummies for each of scheduled caste, scheduled tribe, and other backward class, with none of the above the excluded category, and state dummies.

[a] Outcome is household being in wealth category 1, 2, 3, 4, or 5.

[b] Literacy is coded 1 for being literate and 0 if not being literate. Women with 6 or more years of education were assumed to be literate and where therefore not given the literacy test during the survey. The sample consists of 3,982 rural, 828 slum, and 1,159 urban residents.

Table 1.7: Area of Residence and Child Health by Migration Status

	All		Girls		Boys	
	Non-migrants	Migrants	Non-migrants	Migrants	Non-migrants	Migrants
Height-for-age Z-score						
Slum	0.052	−0.244 * *	0.214	−0.325*	−0.084	−0.172
	(0.194)	(0.121)	(0.281)	(0.170)	(0.264)	(0.139)
Urban	−0.053	−0.088	0.030	−0.052	−0.155	−0.110
	(0.137)	(0.081)	(0.193)	(0.098)	(0.196)	(0.102)
Girl	0.151*	−0.011				
	(0.079)	(0.029)				
Observations	2,999	12,618	1,432	6,030	1,567	6,588
Weight-for-height Z-score						
Slum	−0.363*	−0.048	−0.148	−0.147	−0.559 * *	0.037
	(0.205)	(0.098)	(0.296)	(0.135)	(0.256)	(0.122)
Urban	−0.093	0.012	0.111	−0.061	−0.344*	0.084
	(0.147)	(0.064)	(0.181)	(0.085)	(0.207)	(0.077)
Girl	0.065	0.019				
	(0.067)	(0.024)				
Observations	2,999	12,618	1,432	6,030	1,567	6,588
Cox regression on survival						
Slum	0.892	0.556*	0.162*	0.311 * *	2.598*	0.860
	(0.436)	(0.169)	(0.156)	(0.152)	(1.361)	(0.295)
Urban	1.077	0.649***	0.470	0.605 * *	1.959*	0.665*
	(0.359)	(0.102)	(0.305)	(0.149)	(0.782)	(0.139)
Girl	0.811	1.156 * *				
	(0.144)	(0.085)				
Observations	3,203	13,557	1,523	6,502	1,680	7,055
Child age dummies[a]	Yes	Yes	Yes	Yes	Yes	Yes
Parental education and mother's height[b]	Yes	Yes	Yes	Yes	Yes	Yes
Household religion and caste[c]	Yes	Yes	Yes	Yes	Yes	Yes
Household wealth status[d]	Yes	Yes	Yes	Yes	Yes	Yes
Area environment[e]	Yes	Yes	Yes	Yes	Yes	Yes
Area asset[f]	Yes	Yes	Yes	Yes	Yes	Yes
Area wealth distribution[g]	Yes	Yes	Yes	Yes	Yes	Yes
State and survey month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Notes. * sign. at 10%; ** sign. at 5%; *** sign. at 1%. Top two panels show weighted OLS and bottom panel shows Cox regression on length of life. All have robust standard errors clustered at PSU level in parentheses.
[a] Age dummies for 4-7, 8-11, 12-17, 18-23, 24-35, 36-47, and 48-59 months old, with 0-3 as the excluded category.
[b] Education dummies for mother and father. The dummies are for 1-4 years, 5-7, 8-9, 10-11, and 12 plus years of education.
[c] Religion dummies for each of Muslim, Christian, and other, with Hindu the excluded category. Caste dummies for each of scheduled caste, scheduled tribe, and other backward class, with none of the above the excluded category.
[d] Wealth dummies for the household being in wealth category 2, 3, 4, and 5, respectively
[e] Area environment variables include water access, captured by the average time to fetch water and whether an improved source of drinking water is available, access to improved cooking fuel, sharing toilet with ten or more households, access to improved toilet, and the average number of people per room. Each calculated as the average of households in PSU excluding the household itself.
[f] Area assets include improved building materials (floor, wall, and roof), radio, television, refrigerator, bicycle, motorcycle/scooter, car, telephone (land-line and mobile), watch, cart, and computer. Each calculated as the average of households in PSU excluding the household itself.
[g] Area wealth is the percentage of households in wealth categories 2 through 5. Each calculated as the average of households in PSU excluding the household itself.

Table 1.8: Mother's Education and Child Health by Migration Status

	All		Girls		Boys	
	Non-migrants	Migrants	Non-migrants	Migrants	Non-migrants	Migrants
Rural × 1-4 years of education	−0.048	−0.018	−0.288	−0.022	0.300	−0.035
	(0.195)	(0.073)	(0.259)	(0.115)	(0.284)	(0.094)
Rural × 5-7 years of education	−0.017	0.020	−0.095	−0.031	0.053	0.071
	(0.141)	(0.055)	(0.184)	(0.078)	(0.190)	(0.074)
Rural × 8-9 years of education	0.048	0.132 ∗ ∗	0.080	0.087	0.008	0.175 ∗ ∗
	(0.164)	(0.064)	(0.218)	(0.093)	(0.226)	(0.089)
Rural × 10-11 years of education	0.242	0.165∗	−0.149	0.195	0.630 ∗ ∗	0.130
	(0.204)	(0.093)	(0.240)	(0.140)	(0.294)	(0.115)
Rural × 12+ years of education	0.093	0.250∗∗∗	0.007	0.328 ∗ ∗	0.172	0.173
	(0.227)	(0.094)	(0.271)	(0.131)	(0.309)	(0.126)
Slum	−0.074	−0.060	−0.079	−0.173	−0.063	0.031
	(0.278)	(0.161)	(0.391)	(0.217)	(0.375)	(0.204)
Slum × 1-4 years of education	−0.029	0.191	0.138	0.561	−0.164	−0.080
	(0.370)	(0.302)	(0.363)	(0.673)	(0.524)	(0.244)
Slum × 5-7 years of education	0.132	−0.188	0.385	−0.119	0.006	−0.244
	(0.241)	(0.211)	(0.351)	(0.301)	(0.322)	(0.260)
Slum × 8-9 years of education	0.040	−0.363 ∗ ∗	0.059	−0.369	0.041	−0.383∗
	(0.272)	(0.182)	(0.408)	(0.246)	(0.417)	(0.228)
Slum × 10-11 years of education	0.269	0.008	0.908∗	0.033	−0.132	−0.011
	(0.353)	(0.173)	(0.466)	(0.212)	(0.470)	(0.238)
Slum × 12+ years of education	0.545∗	0.098	0.318	0.177	0.658∗	0.045
	(0.294)	(0.217)	(0.420)	(0.313)	(0.379)	(0.232)
Urban	0.011	−0.118	−0.068	−0.134	−0.067	−0.083
	(0.197)	(0.096)	(0.273)	(0.118)	(0.262)	(0.125)
Urban × 1-4 years of education	−0.204	−0.128	−0.091	−0.246	0.035	−0.043
	(0.283)	(0.160)	(0.495)	(0.234)	(0.343)	(0.177)
Urban × 5-7 years of education	−0.102	0.198∗	−0.097	0.286 ∗ ∗	0.076	0.120
	(0.265)	(0.102)	(0.346)	(0.125)	(0.376)	(0.143)
Urban × 8-9 years of education	0.016	0.117	0.799 ∗ ∗	0.227	−0.327	−0.024
	(0.277)	(0.118)	(0.401)	(0.160)	(0.306)	(0.144)
Urban × 10-11 years of education	0.019	0.099	−0.084	0.211	0.173	−0.068
	(0.254)	(0.132)	(0.405)	(0.180)	(0.334)	(0.186)
Urban × 12+ years of education	0.073	0.359∗∗∗	−0.155	0.510∗∗∗	0.365	0.194
	(0.246)	(0.115)	(0.354)	(0.143)	(0.323)	(0.157)
female	0.151∗	−0.010				
	(0.080)	(0.029)				
Child age dummies[a]	Yes	Yes	Yes	Yes	Yes	Yes
Parental education and mother's height[b]	Yes	Yes	Yes	Yes	Yes	Yes
Household religion and caste[c]	Yes	Yes	Yes	Yes	Yes	Yes
Household wealth status[d]	Yes	Yes	Yes	Yes	Yes	Yes
Area environment[e]	Yes	Yes	Yes	Yes	Yes	Yes
Area asset[f]	Yes	Yes	Yes	Yes	Yes	Yes
Area wealth distribution[g]	Yes	Yes	Yes	Yes	Yes	Yes
State and survey month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,999	12,618	1,432	6,030	1,567	6,588

Notes. * sign. at 10%; ** sign. at 5%; *** sign. at 1%. Top two panels show weighted OLS and bottom panel shows Cox regression on length of life. All have robust standard errors clustered at PSU level in parentheses.

[a] Age dummies for 4-7, 8-11, 12-17, 18-23, 24-35, 36-47, and 48-59 months old, with 0-3 as the excluded category.

[b] Education dummies for mother and father. The dummies are for 1-4 years, 5-7, 8-9, 10-11, and 12 plus years of education.

[c] Religion dummies for each of Muslim, Christian, and other, with Hindu the excluded category. Caste dummies for each of scheduled caste, scheduled tribe, and other backward class, with none of the above the excluded category.

[d] Wealth dummies for the household being in wealth category 2, 3, 4, and 5, respectively

[e] Area environment variables include water access, captured by the average time to fetch water and whether an improved source of drinking water is available, access to improved cooking fuel, sharing toilet with ten or more households, access to improved toilet, and the average number of people per room. Each calculated as the average of households in PSU excluding the household itself.

[f] Area sssets include improved building materials (floor, wall, and roof), radio, television, refrigerator, bicycle, motorcycle/scooter, car, telephone (land-line and mobile), watch, cart, and computer. Each calculated as the average of households in PSU excluding the household itself.

[g] Area wealth is the percentage of households in wealth categories 2 through 5. Each calculated as the average of households in PSU excluding the household itself.

Table 1.9: Relationship between Mother's Education and Wealth and Literacy by Migration Status

	Wealth[a]		Literacy[b]	
	Non-migrants	Migrants	Non-migrants	migrants
Rural × 1-4 years of education	0.408***	0.364***	0.485***	0.495***
	(0.126)	(0.058)	(0.060)	(0.029)
Rural × 5-7 years of education	0.635***	0.708***	0.678***	0.808***
	(0.095)	(0.047)	(0.056)	(0.021)
Rural × 8-9 years of education	1.041***	1.038***		
	(0.114)	(0.057)		
Rural × 10-11 years of education	1.282***	1.476***		
	(0.143)	(0.084)		
Rural × 12+ years of education	2.069***	1.948***		
	(0.129)	(0.062)		
Slum	1.352***	1.467***	0.075	0.022*
	(0.208)	(0.086)	(0.053)	(0.012)
Slum × 1-4 years of education	0.593***	0.304 * *	0.512***	0.501***
	(0.222)	(0.145)	(0.140)	(0.079)
Slum × 5-7 years of education	0.646***	0.521***	0.556***	0.749***
	(0.196)	(0.090)	(0.111)	(0.079)
Slum × 8-9 years of education	0.911***	0.732***		
	(0.221)	(0.087)		
Slum × 10-11 years of education	0.900***	0.905***		
	(0.212)	(0.102)		
Slum × 12+ years of education	1.363***	1.068***		
	(0.200)	(0.096)		
Urban	0.817***	1.148***	0.003	0.010
	(0.195)	(0.078)	(0.015)	(0.008)
Urban × 1-4 years of education	0.331	0.227*	0.558***	0.453***
	(0.258)	(0.126)	(0.112)	(0.049)
Urban × 5-7 years of education	0.747***	0.615***	0.654***	0.811***
	(0.198)	(0.081)	(0.088)	(0.034)
Urban × 8-9 years of education	1.139***	1.020***		
	(0.230)	(0.080)		
Urban × 10-11 years of education	1.514***	1.364***		
	(0.212)	(0.088)		
Urban × 12+ years of education	1.830***	1.655***		
	(0.201)	(0.075)		
Observations	2,223	9,095	919	5,050

Notes. * sign. at 10%; ** sign. at 5%; *** sign. at 1%. All regressions OLS weighted and with robust standard errors clustered at PSU level in parentheses. Explanatory variables not shown are mother's age and age squared, religion dummies for each of Muslim, Christian, and other, with Hindu the excluded category. Caste dummies for each of scheduled caste, scheduled tribe, and other backward class, with none of the above the excluded category, and state dummies.

[a] Outcome is household being in wealth category 1, 2, 3, 4, or 5.

[b] Literacy is coded 1 for being literate and 0 if not being literate. Women with 6 or more years of education were assumed to be literate and where therefore not given the literacy test during the survey. The sample consists of 3,982 rural, 828 slum, and 1,159 urban residents.

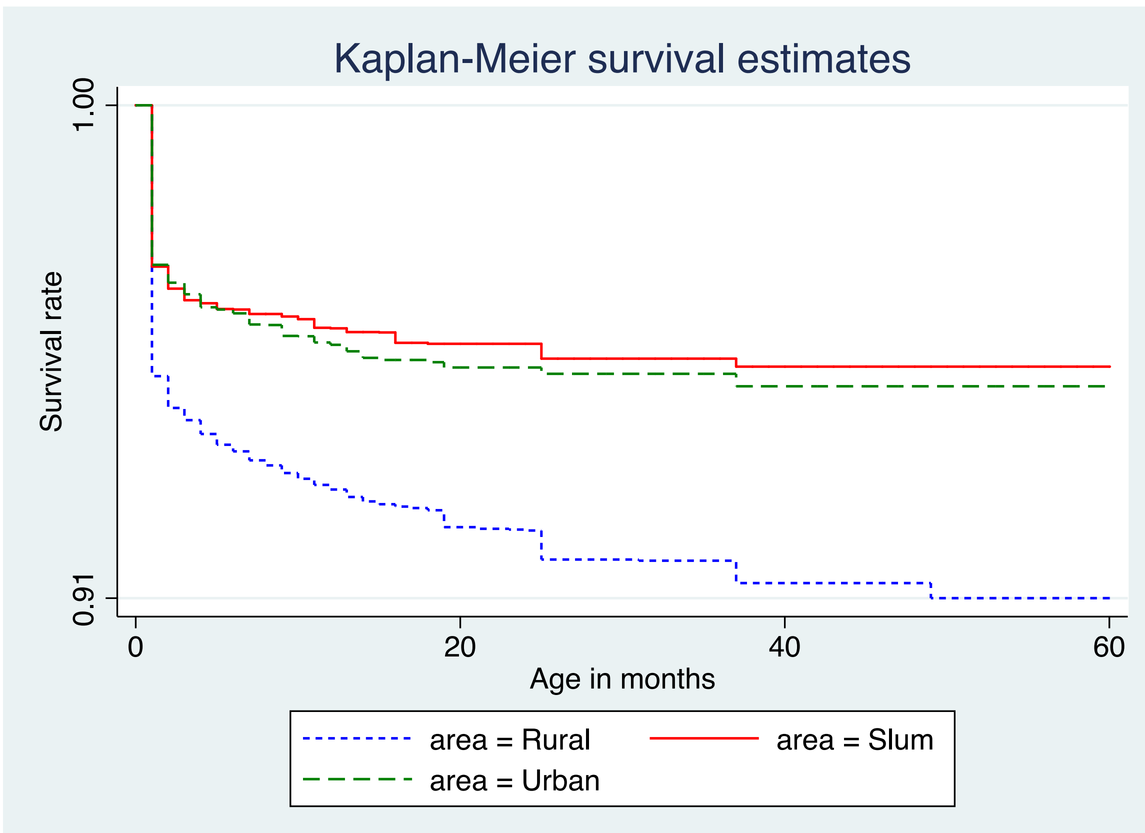

Figure 1.1: Mortality in Rural, Slum, and Urban Areas Until Age 5

Chapter 2

FROM THE GROUND UP: AN IMPACT EVALUATION OF THE COMMUNITY INFRASTRUCTURE UPGRADING PROGRAM IN DAR ES SALAAM

2.1 Introduction

The rapid and largely uncontrolled population growth concentrated in informal settlements and slum areas has been recognized as one of the most important challenges in the twenty-first century (UN-HABITAT 2011). According to the recent estimates by UN-HABITAT, 32.7 per cent of the world's population live in slums. Although the member countries of the United Nations had found it necessary to commit themselves to the objective of "promoting, where appropriate, the upgrading of informal settlements and urban slums as an expedient measure and pragmatic solution to the urban shelter deficit" (UNCHS Habitat), this population is still growing. Between 2000 and 2010, the number of slum dwellers in developing countries increased from 767 million to 828 million, and the figure might reach 889 million by 2020 (UN-HABITAT 2010). Given the trends in urbanization and slum populations in developing countries, and the pressures this places on both the urban centers and livelihoods of those living in slum conditions, finding sustainable approaches to effectively support the transformation of these areas into holistic human settlements conducive to human and economic development is critical.

Demolition, relocation and *in situ* upgrading are the most common approaches to addressing the challenge of informal settlements. Demolition is considered a short-sighted approach, addressing the symptoms rather than the causes of informal settlement creation. Without offering a sustainable housing alternative, people simply rebuild their huts in the same location or shift to another unoccupied piece of land nearby (Burra 2005). Even if people do not move back to the same or another slum, demolition and relocation disrupt the social networks, job opportunities and schooling of residents (Huchzermeyer 2009). Relocating slum dwellers in distant areas might cause unemployment or increase considerable transportation costs (Cadavid 2010; UN-HABITAT 2003). As such, it is increasingly being accepted that informal settlements are not a problem that should be removed, but rather a necessary equilibrium that should be integrated, through an incremental approach, into the city's development plans (Santosa et al. 2005).

The general trend is to support *in situ* upgrading or redevelopment with the active participation of communities and NGOs where this is possible, and with minimal relocation of residents. Despite critics and discussions on the advantages and disadvantages of various policies (Mukhija 2001; Okpala 1999; Werlin 1999), UN-HABITAT has already claimed that "experience accumulated over the last few decades suggests that *in situ* slum upgrading is more effective than resettlement of slum dwellers and should be the norm in most slum-upgrading projects and programs (UN-HABITAT 2003)."

The steady growth of Dar es Salaam has been mirrored by a growing informal settlement population. The total number of houses in the unplanned areas of Dar es Salaam was about 50,000 housing units in 1974, and the figure was estimated to be more than 200,000 units in 2000 (URT 2000). 2008 figures indicated that approximately 2.15 million people, or 65 percent of the Dar es Salaam population should be considered living in slums (UN-HABITAT 2008). The number of informal settlements in the city increased from 40 in 1985 to over 150 in 2003 (Kombe 2005). The historical development of these settlements, with the Government of Tanzania (GoT) becoming more tolerant since the 1970's, in contrast to their "demolition" approach characterizing earlier interventions, together with the National Land Policy (1995) acknowledging the tenure status of "long-standing occupation" has meant that residents enjoy *de facto* rather than *de jure* property rights.

With a very low threat of eviction, unplanned settlements in Dar es Salaam are characterized by durable dwelling constructions through a continual process of private upgrading. The 2007 Household Budget Survey for instance shows that, at the time, the typical dwelling had a cement floor (90%), cement walls (88%) and galvanized metal sheets for roofing (94%), highlighting the permanence of these structures. However, these settlements are also characterized by a basic lack of access to basic community infrastructure – roads, drainage systems, and waste removal containers for instance (UN-HABITAT 2008).

On this backdrop, the World Bank agreed to finance the Community Infrastructure Upgrading Programme (CIUP) to be implemented through the Dar es Salaam City Council and Local Government partners across the 3 districts of the city from 2006 to 2012. The program focuses on community infrastructure investments that provide public goods to settlements with the aim of unlocking the economic potential of these settlements, focusing on incremental *in situ* upgrading, while minimizing the disruptive effects of relocation wherever possible.

While there is clear intrinsic value for improving the livelihoods of slum dwellers through community infrastructure investments, this process is hypothesized to affect households across a broad range of potential outcomes, from health and happiness, to migration, increased private investment and strengthened social cohesion. Understanding the causal mechanisms underlying the link between the upgrading process and these outcomes of interest can provide tremendous value to the design of upgrading programs in the future by helping to shed light on some of the unintended consequences of the process as well as identifying how the potential positive impacts may be maximized. However, rigorously measuring the causal impact of these types of projects is challenging for a variety of reasons.

This paper explores the reasons for why "impact" results in the literature should be handled with care, and presents the design and results of an impact evaluation conducted on the CIUP. We find that the CIUP interventions increased household sizes and decreased out-migration, halved diarrhea rates for children under 5, and increased female school enrollment rates, but did not have significant impacts on employment, business operations, income and expenditure, private investment or social cohesion.

The data and design limitations of the study are also reflected on to ensure that these results are interpreted within the correct context. While the impact evaluation literature has recently begun to grow, this is the first World Bank informal settlement upgrading program that has been evaluated using counterfactual analysis to go beyond the identification of correlation between intervention and outcomes of interest, to being able to estimate the causal impact of the program, controlling for external factors. In this light, the results presented here should be seen as a positive step in the right direction to improving the evidence base from which World Bank support and Government policy decisions are made. We begin with a review of the impacts of informal settlement upgrading interventions in

Section 2. We then describe the CIUP in more detail in Section 3. Section 4 describes the methodological framework to measure impact through "difference-in-difference matching" technique along with the sampling details. Section 5 presents the results of the impact evaluation, measuring the effect of the CIUP on health, education, migration, economic and social cohesion outcomes. Finally, we reflect on these results with recommendations and conclude in section 6.

2.2 Literature Review

Identifying a strong correlation between an intervention and an outcome of interest does not necessarily imply that the program caused the observed change in outcomes. The reason for this is clear in the case of informal settlement upgrading projects. By doing a simple "before and after" analysis, measuring the beneficiary outcomes at baseline and then during a follow up after the intervention has been implemented, any change observed in the outcome can be the result of anything that may have influenced these individuals during the period between baseline and follow up. This could include natural trends, or external shocks that would have caused these changes even in the absence of the program.

To measure the true impact of the CIUP, we need to understand what would have happened to those living in the upgraded settlements had upgrading never taken place. Theoretically, this would require observing the same households at the same point in time both with and without having been exposed to the upgrading program. This is clearly impossible, in which case we try to identify a counterfactual or "control" group of households having not received the program, that proxies for what the upgraded, or "treated" households would have been like in the absence of the program. The more plausible the control group is for comparison, the more plausible any impacts measured using this control group as a basis are. Comparing, for instance, households in the upgraded areas to a random selection of households that were not upgraded begs the question: why were the others not upgraded and what does this mean about their comparability with the treatment group?

In many cases the choice of upgrading sites has both practical and political components. If, for instance, the upgraded sites were chosen because they were better connected politically, this may apply to other Government interventions too, leading to a potential overestimate of the project impacts. Conversely, if the upgrading settlements were targeting poor and marginalized communities specifically, comparing to households not receiving the upgrade could lead to an underestimate of program impact when treatment households were worse off than control households before the intervention took place. Treated households are likely to differ from untreated households for a range of reasons intrinsically linked to the fact that they are part of the treatment group in the first place. This selection bias needs to be overcome in order to generate plausible impact results.

The gold standard would be to conduct a randomized controlled trial (RCT) which randomly assigns individuals to treatment or control status, much in the same way as clinical trials are conducted. By definition, these two groups are balanced on both observable (eg. age) and unobservable (eg. motivation) variables and any change in outcomes observed can be directly attributed to the intervention. Random allocation of upgrading locations is neither feasible nor desirable in many cases, and alternative "quasi-experimental" methods are used to replicate the conditions of a laboratory trial as closely as possible.

The range of potential impacts from an upgrading program (or any of its sub-components) is large. There is a wealth of literature showing strong correlations between housing, service provision and child health (Alderman and Lavy 1996; Lavy et al. 1996; Mwabu et al. 1993; Newman et al. 2002). Few studies, however, have been able to account for the potential bias (households with solid dwellings, water and electricity are also likely to be richer with better access to health services) and those that have, either through RCTs or quasi-experimental approaches have found mixed results. RCTs looking at a large government informal settlement upgrading program in Mexico (Alegria et al. 2012) and an NGO-implemented housing intervention providing prefabricated structures to households in El Salvador and Uruguay (Cooper et al. 2011) found no health effects, but identified improvements in satisfaction and social cohesion. Similarly, a study looking at the provision of household taps found improvements in happiness without any impact on health (Devoto et al. 2012). However, Cattaneo et al. (2009) found strong evidence that concrete floors improve health and cognitive development indicators in children under five years old effectively cutting the transmission mechanism through which fecal matter is ingested by children, increasing the presence of intestinal parasites, increasing the likelihood of anemia and diarrhea and stunting the mental and physical development of children in these conditions. A recent Cochrane review (Turley et al. 2013) identified 5 rigorous slum upgrading evaluations globally with no clear consensus on the results, highlighting the importance of research such as this to help fill an important knowledge gap as well as feeding into improved project design.

Rigorous evidence linking improved tenure security to increased labor supply (Field 2007) and incentivizing private investment by increasing the long-term returns to investment and improving access to capital by using the land as collateral for loans is also well-founded in the literature (eg. Field (2010)), giving credence to de Soto (2000) hypothesis that there are large potential gains to formalization, unlocking the capital potential of informal land assets. The provision of public infrastructure, by increasing the potential returns, also theoretically will have an effect of increasing private investment. While very little evidence exists on the empirical foundation of this hypothesis, an experimental study in Mexico constructing pavements in slums was found to increase household credit, vehicle ownership and home improvements (Gonzalez-Navarro and Quintana-Domeque 2010).

Finally, Katz et al. (2001); Kling et al. (2004) use a random lottery for relocating households to better neighborhoods in Boston and find that "moving to opportunity" improves safety, behavioral problems among boys and health outcomes with no sustained behavioral change improvements for boys in the long run.

Beyond this handful of rigorous evaluations on upgrading-related interventions, and despite the clear value broader evidence could provide both to the theory and implementation of upgrading program, evidence is limited (Field and Kremer 2006; Legovini 2010). For instance, there is sparse evidence on the effects of upgrading on schooling achievement. Electrification has been shown to be correlated with increased time spent on homework by being able to work at night (The World Bank 2008) and improvements in safety through informal settlement upgrading seems to have an effect on school enrollment rates (Archambault et al. 2012).

Migration is also a critical component to any upgrading activity. Understanding how pull factors influence household decisions to migrate is critical to developing effective upgrading strategies to account for potential shifts in population size and demographics endogenous to the upgrading process. The migration theory explaining how households choose between living in rural areas and moving to urban settlements is well established (Brettell and Hollifield 2000). The empirical evidence supporting this claim is, however, lacking. Archambault et al. (2012), using extensive longitudinal datasets of informal settlements and combining this with census information in Nairobi find 25% fewer children in an average informal settlement compared to other areas. Quasi-experimental evidence in South Africa also suggests a strong shift in household demographics as a result of their Upgrading of Informal Settlements Programme. Evidence from the Limpopo Province of South Africa showed that informal settlements were characterized by migrant laborers sending remittances to family members in rural areas. After the upgrading intervention, household sizes increased, remittances decreased and the ratio of children in the settlement increased highlighting the household choice to protect children from the poor conditions faced in informal settlements (The World Bank 2011).

A review of the literature highlights the fact that more rigorous evaluation is needed, looking at a broad spectrum of potential impacts resulting from the upgrading process to fully understand all of the various dynamics that it creates. Through a careful evaluation of the CIUP, and implicitly, its full package of interventions, this study explores some of these issues further, adding to the literature, while offering concrete suggestions on moving forward with upgrading support in the future.

2.3 CIUP and Data

The Community Infrastructure Upgrading Programme (CIUP), financed by the World Bank, is a community-driven infrastructure upgrading program that targeted unplanned areas in Dar es Salaam. Dar es Salaam consists of 3 districts: Ilala, Kinondoni and Tameke. These districts are made up of 73 wards which in turn are broken into 276 sub-wards or "mitaa". CIUP targeted 31 mitaa for upgrading in two phases, covering approximately 327,980 people based on the 2002 census data (Torero). The project was phased in order to test and learn from the initial experience and incorporate these lessons into the design and implementation of Phase 2. Upgrading of Phase 1 took place between 2007 and 2009, while Phase 2 was implemented afterwards and fully completed in 2011.

The CIUP was designed as an inclusive, holistic and participatory approach to the upgrading process in Dar es Salaam, with the objective of providing important public infrastructure to unplanned settlements lacking these facilities. Working through the local government with a budget of 18.8 million USD with an estimated cost of 18,000 USD per hectare (or 50 USD per capita) of upgrading, the project focused on public infrastructure investments that had the most potential to impact the lives of the approximately 300,000 people living in the affected areas (Mehta and Dastur 2008). While the broad set of interventions available through the program was agreed upon *ex ante*, by working with local leaders, a tailored plan was developed for each of the selected mitaa's that could meet their specific needs. A total of 31 mitaa's were supported through the program providing (i) paving of trunk roads, (ii) footpaths; (iii) public toilets; (iv) drainage systems; (v) streetlights; (vi) pedestrian crossings; (vii) upgraded water kiosks and (viii) solid waste containers. This "hard" infrastructure was complemented by marketing campaigns to promote sanitation improvements in the community, similar to the Water and Sanitation Program (WSP) sanitation campaigns in rural Tanzania, encouraging households to look after and upgrade their toilet facilities for health and social status reasons. The project completed 40.3km of two-way roads, 57.8km of one-way roads, 26.3km of footpaths, 132.5km of road side drains, 548 culverts, 8.6km of trunk drains, 3153 pedestrian crossings, 83 solid waste containers, 2780 street lights, and 24 public toilets (see Table 2.1).

A core component of the project was an impact evaluation to test measures beyond the standard outputs described in the results framework of the project. In this case, the impact evaluation began in 2006 with a baseline survey of all 31 intervention mitaa together with 12 unaffected mitaa for use as a control group. The treatment and control groups were selected through the following process. The Government of Tanzania initially considered all 310 unplanned settlements across the 3 districts in Dar es Salaam. Scores between 23 and 33 were provided to each area, and mitaa were then deemed eligible for upgrading if they reached a score of 30 or more. This reduced the number of eligible mitaa to 63. A restriction was placed on the selection of eligible mitaa to ensure that 300Ha were to be upgraded in each of the three districts, with a total of 900Ha, and any mitaa falling below 10Ha in size would be combined with a neighboring mitaa to be considered for upgrading to benefit from economies of scale. The selection process generated 31 mitaa that were chosen for participation in the CIUP. These clear selection criteria ensured that the process was transparent and void of potential political interference. The process also helped to identify candidate mitaa to be considered as control group comparisons for the purposes of the evaluation. Since a rigorous ranking system was conducted, all mitaa meeting the same ranking criteria were likely to be similar across a range of measures, and households within these mitaa were likely to be following the same growth trajectory. Baseline results, however, showed some important differences between the two groups before any intervention took place that should be kept in mind when interpreting the results.

A sample of 1860 households across treatment and control groups was identified at baseline after conducting power calculations. Of these, 1080 were included in the treatment group while 780 were included in the control. A larger sample of treatment households was selected in order to have the opportunity to compare Phase 1 with Phase 2 results independently of the control group comparison. The analysis of this paper focuses primarily on the difference between control and treatment households, but future research may further compare the Phase 1 and Phase 2 communities to assess the longer term impacts of the CIUP.

A total of 31 treatment mitaa (ie all mitaa selected for program participation) and 12 control mitaa were selected. Using 2002 census data, the sample was stratified by mitaa (in control and treatment groups independently). Proportional samples at the mitaa level were then rounded to the nearest 15, determining the number of EAs chosen from each mitaa. EAs were then selected within the mitaa with probability proportional to size (PPS), a full listing of all existing residential dwellings was taken and a random sample of 15 households drawn from each EA. So, for example when calculating the sample size for Kilimani mitaa, we multiple the total sample size (1080) by the percentage share Kilimani population has in relation to all mitaa in the treatment group. Using census data this produces:

$$\frac{(1080 \times 13464)}{327980} = 44.3$$

This is rounded to 45, resulting in 3 EAs to be selected with PPS and 15 households randomly sampled from each of these EAs. The sampling frame ensures that mitaa sample is representative for the mitaa and does not require reweighting for analysis. This assumes, however, that the population growth trajectory was the same in all EAs between 2002 and 2006 when the sample was taken.

Although originally planned as a panel survey, tracking original households at baseline through to endline, the survey company did not keep identifiable records that could be used to accurately identify and follow up with original baseline households. While not ideal, and limiting the possibilities for analysis, a few options were still available, as described in the following sections.

Given the features of the CIUP project described above, a number of important issues need to be considered in order to measure the impact of the program. Firstly, in the absence of the possibility of randomization, the specific selection of the mitaa included in the CIUP means that any potential control group needs to meet the same selection criteria in order to avoid a selection bias influencing the results. Secondly, the interventions provided through CIUP were at the community rather than household level. Thus, even though we wish to measure household-level impacts, the unit of intervention is the mitaa, and this has implications on the sampling frame and potential power of the study. A small sample size runs the risk of not being able to identify a statistically significant impact even if a true impact (for the population exists). Accounting for the independence of sampling units when preparing the sample size calculation is thus critical to ensuring that the sample has enough power to detect any hypothesized effects. Lastly, the regression model specifications used here to measure the size of the treatment effect need to adequately control for potentially confounding variables. The design presented has its limitations and, as such, any inferences coming from the study should be treated with care bearing in mind the important caveats.

2.4 Empirical Strategy

As a first step, we are interested in measuring the change in outcomes of interest in each upgraded mitaa as a result of the program. Since matching directly on individual households was not feasible given the data constraints, using the baseline to difference out individual fixed effects (through a dif-in-dif model) is not possible. A second best option is conducting a dif-in-dif regression at the EA level since EAs have not changed between baseline and endline − this measures the change in the average household characteristics within a treatment

EA over time over and above any change coming from other external factors that would influence control EAs, such as time trends, or city/country-level shocks. Since the baseline and endline surveys differed somewhat, this dif-in-dif approach was possible for a subset of questions and is described using the following equation:

$$\bar{Y}_{ij} = \beta_1 T_{ij} + \beta_2 t + \beta_3 t \times T_{ij} \tag{2.1}$$

where $\bar{Y}_{ij}$ corresponds to the average outcomes of interest for households in EA i at time j where $i = 1$ to 124 and $j = 1$ (baseline) or 2 (endline). We define $T_{ij} = 1$ if the EA is in the treatment group, and 0 otherwise; $t = 1$ if EA observation is at endline, and 0 otherwise. β_1 reflects the average difference between treatment and control group EAs at baseline, β_2 is the time trend associated with both groups and β_3 is the difference-in-difference estimator providing the measure of impact for the program, controlling for control/treatment group differences at baseline and any shared trend over time across the two groups.

In cases where we have outcomes of interest only at endline, we run a cross-sectional regression controlling for baseline characteristics collected through retrospective endline questions. The model is less robust than Equation (1) since it cannot difference out fixed effects and make strong assumptions about the nature of the two groups − namely, that, controlling for observable characteristics, the two groups were the same at baseline and would have had similar trends over time in the absence of the CIUP intervention. The model is specified as

$$Y_k = \mu + \beta_1 T_k + \beta_2 X_k \tag{2.2}$$

where Y_k corresponds to the outcome of interest for household k. We define $T_k = 1$ if the household is in the treatment group, and 0 otherwise; X_k is a vector of exogenous control variables collected through a retrospective module in the endline survey; and μ is the mean of Y in the control group when all $X_k = 0$. In this case β_1 reflects the average treatment effect of the program controlling for possible confounding variables.

While Equation (1) gives us a reasonably robust measure of impact at the EA level − ie, identifying the change in average household characteristics over time − Equation (2) is less robust, requiring strong assumptions to justify a credible causal interpretation. Beyond this, the average treatment effect may not be the most important measure we are looking for.

There are two ways in which we may think about the measure of program impact:

(1) Changes in the average household characteristics living in the upgraded settlement;

(2) Changes in the lives of the original residents

We often tend to assume we are after (1) but there are important reasons why (2) should be measured as well. By looking at changes at the community level, we may see improvements for two reasons:

A. Improvements in the environment can improve attractiveness, drive up prices and push poorer residents out; or

B. Improvements can increase access to opportunities, leveraging on this to improve the lives of original residents.

Being able to differentiate between these two scenarios is difficult. While the data do not allow for us to completely differentiate the two cases, we run the following regression to disentangle these effects and try to understand how impacts for in-migrants differ from non-migrants:

$$Y_k = \beta_1 T_k + \beta_2 D_k + \beta_3 D_k \times T_k + \beta_4 X_k \tag{2.3}$$

where Y_k, k, X_k and T_k are defined as before. $D_k = 1$ if the household is a non-migrant (defined as having stayed in the settlement for 6 years or more), and 0 otherwise. In this case β_3 measures the impact on original migrants over and above the impact for in-migrants. In the case where β_3 is negative, this indicates that most of the observed differences in outcomes is due to changes resulting from in-migrants rather than original residents.

These three equations each have their own flaws; however, interpreted holistically, they provide an opportunity to explore further into the underlying mechanisms through which changes in household outcomes are being created – through a real change in household outcomes, or through a migration effect. The next section explores these issues in more detail, and presents the key findings from the analysis.

2.5 Results

Given the multidimensional nature of slum upgrading, the results presented here reflect a wide range of indicators that could potentially be influenced by public infrastructure interventions. Of course, it is impossible to cover the entire range of possible outcomes, and any review will only reflect on a subset. In this case we restrict the study to present results that have clear underlying causal mechanisms, grounded in economic theory and identified in the urban upgrading and infrastructure literature.

Since this is not a randomized evaluation, assigning causality to the results needs to be done with care. Before presenting results on the outcomes of interest, we consider three important threats to the validity of the impact measurements, in order to ensure that results are interpreted with the requisite assumptions and caveats. We review: (i) baseline balance; (ii) potential contamination of CIUP in control areas and confounding external interventions; and (iii) selective migration.

Threats to validity

We start by presenting "baseline balance" statistics. This offers two things. Firstly, it provides an overview of the state of residents in the selected unplanned settlements before the CIUP was implemented to paint a picture of the living conditions and socioeconomic state of households at the time. Secondly, it plays an important role in determining the effectiveness of our identification strategy by highlighting whether the assumption that residents in control and treatment areas were indeed similar at baseline is true, which is a necessary condition for the analysis to provide a rigorous measure of the causal impact of the program. In the case that control and treatment groups differ at baseline, understanding where and how they differ is also important in later analysis as it can provide guidance on the level of robustness checks and controls required when measuring the impact of our outcomes of interest.

We then provide details of the types of interventions received in the study sub-wards to (i) verify that there has indeed been a differential impact between treatment and control communities in terms of the level of community infrastructure upgrading taking place and (ii) whether there have been any other interventions directed to control or treatment areas outside of the program that may confound the results. The underlying causal chain leading from intervention to outcome relies on there being a greater increase in infrastructure upgrading in the treatment areas than in control areas and, if similar upgrading had taken place in control areas, it would undermine any subsequent analysis. If the CIUP has not made significant changes to the infrastructure in treatment areas, we cannot claim any observed outcomes resulting from the analysis could be attributed to the program. Furthermore, if other interventions (eg. from NGOs or other Government ministries) selectively targeted either control or treatment areas with other programs (such as a health or education campaign), disentangling these interventions from the CIUP would not be possible. As long as external interventions are equally distributed across treatment and control areas, their effect can be controlled for, allowing us to isolate the impact of CIUP interventions. Finally, we review, to the extent possible given data availability, the migration patterns of control and treatment households, how this influences household demographics, and what implication this has for interpreting results.

Outcomes

With a good understanding of the caveats and assumptions made in the analysis, results are then presented on four areas of interest:

1. Economic activity: employment; income and expenditure; asset accumulation; business ownership and investment; housing tenure; credit; housing investments and renovation

2. Health: diarrhea, acute respiratory illness and overall morbidity across age groups

3. Education and time use: school enrollment across age groups and gender, time spent on daily activities

4. Social cohesion: awareness of and participation in community activities, reliance on and support for neighbors in daily activities, community outreach.

Baseline comparability

Table 2.2 provides an overview of a range of baseline indicators on demographics, employment, education, health, tenure status, services and dwelling characteristics, time use, assets and crime collected in 2006 before the CIUP had been implemented. Of the 73 indicators reported on, we find 26 significantly different indicators for the treatment and control groups, which implies that these groups likely had differing characteristics before the intervention took place.

We find that household demographics across the groups were fairly similar in 2006. The typical household had 3.8 household members, with a 39 year old household head having 8 years of education and a 75% chance of being a male. On average, 0.9 children per household were enrolled in school. Employment is slightly lower in the treatment area, with 87% of household heads employed compared to 91% in the treatment area (most of whom are "self-employed"). Household monthly income hovered between 140,000 and 150,000 TZS (approximately 100 USD) which is not significantly different across groups.

Treatment households had stayed in their dwellings for slightly more than two years longer than control households and were more likely to have paying tenants on their property, although the proportion of households owning their dwelling was indistinguishably different across groups, at around 38%. Ownership of individual assets differed across groups but not systematically, providing no strong indication that one group had a broader asset base than the other. Health outcomes measured at baseline suffered from poor data quality, which makes it difficult to use this information, however, the available data indicate that diarrhea rates were lower for treatment households, while the incidence of acute respiratory illness was the same across groups at baseline.

Services and infrastructure across groups in 2006 was relatively similar, with 45% to 48% of households having electricity connections and walking 5 to 6 minutes to access their primary water source. Housing structures did not resemble the corrugated iron shacks usually synonymous with unplanned settlements, and 94% of households had a cement floor and 97% of dwellings had walls made of brick or cement. Dwellings in the control area were slightly bigger, with an average of 2.7 rooms, compared to 2.4 rooms in the treatment area.

The results highlight some important differences between groups that need to be accounted for in the subsequent analysis. Differential employment rates, length of residence, living conditions and health outcomes at baseline imply that the assumption that treatment and control groups are the same does not strictly hold. In this case, where possible, a difference-in-difference estimate will be calculated at the EA level (as from Equation (1)), that can control for EA-level fixed effects, and still provides a valid estimator as long as there are no differential trends in outcomes across time, or time-varying shocks specific to the control or treatment group. Where a difference-in-difference estimator is not possible (ie. when the baseline did not collect this measure), a cross-sectional analysis of the difference in means between treatment and control areas needs to make sure it adequately controls for these underlying differences between groups to increase the accuracy of the estimate. A table listing the control variables used for the endline cross-sectional analysis at the household level is provided in Table 2.3, and the change in household size is used for the difference-in-difference analysis at the EA level. Even after including these controls, the results from the cross-sectional analysis should be interpreted with care, especially with attempting to draw a causal link between intervention and outcome.

Self-reported upgrading interventions

The CIUP was responsible for the following upgrading activities in the treatment subwards: street lights, drainage systems, toilet marketing (and some public toilets), water kiosks, trunk roads, foot paths, and waste management. Understanding how much activity in these areas has been ongoing since the baseline was conducted in 2006 in both treatment and control areas is helpful in determining whether and what type of impacts should be expected.

Administrative data provides us with information about the physical construction that has taken place in the treatment areas but it does not give us an idea of (i) what types of similar upgrading has taken place in the control areas and (ii) how aware households are of the upgrading process. In this case, the survey asks whether households know of any community upgrading interventions that have taken place to improve the: (i) water supply; (ii) toilets; (iii) sewerage; (iv) garbage collection; (iv) electricity; (v) internal roads; (vi) water drainage; (vii) street lights; (viii) land regularization; (ix) schools; and (x) health services. The results, presented in Table 2.4 are broadly consistent with the CIUP stated interventions in the treatment areas, and the absence of other external interventions that may have been implemented differentially in treatment or control areas. We find no difference between control and treatment areas in health, schooling, sewerage, electricity, or land regularization programs. Since none of these were part of the CIUP package of intervention, this serves only to confirm that other interventions are unlikely to confound our results. We do, however, see strong, positive impacts in self-reported knowledge of community interventions taking place for toilets, garbage collection, internal roads, water drainage and street lights. Responses on "water supply" provide no differential between control and treatment areas; however, we explore this further by breaking water supply into: (i) piped water; (ii) yard tap; and (iii) water kiosks. As expected with the CIUP interventions, a significant increase in upgrading support to water kiosks is observed. Interestingly, however, control households report having received upgrading to their piped water supply. This is important to note, as it implies that a piped water program may have been implemented in some of the control sub-wards during the study duration, while not being provided in the treatment sub-wards.

Access to services

The next logical change to be expected in the causal chain is better access to the services that households reported having been upgraded. We use "time taken to get to X" and "whether household has X" as proxies for access to services, and find that the results are aligned with self-reported interventions (see Table 2.5 and Table 2.6). No differences are reported on access to electricity, schools or health clinics. However, distance to a water supply decreases significantly from 3 minutes to 1.5 minutes, and toilets from 13 to just under 4 minutes. Households report streetlights being available on their roads up from 2% in the control area to 46% in the treatment area, reducing time to reach a street light from 15.5 minutes to 3 minutes. Access to water drainage directly outside dwellings increased from 14% to 37% and time to point decreased from 7.5 minutes to 1 minute. Finally, households indicating that the access road to their dwelling was "somewhat improved" jumped from 7% to 48%. Garbage collection systems were already relatively high in the control area at 71%, however household access to a collection system increased further to 91% through CIUP. It is clear that the CIUP interventions have had measurable impact in improving access to infrastructure and services in treatment areas aligned with the program's targets, however, whether this translates into measurable outcomes in the well-being of participating households is still an empirical question.

Although large infrastructure investment resulted in increased access for households, the sustainability of this infrastructure poses a challenge. Of the households that reported having streetlights on their street outside their home, 48% of these people reported that the lights were not working. Similarly, 29% of households reported their drainage systems as not in working order. However, garbage collection activities (94%) and community roads (98%) were mostly seen as functioning in the way they were expected to. This raises important questions about the sustainability of community infrastructure and the need for ongoing support from local government moving forward. Sustainability of these interventions must be borne in mind when interpreting reported impacts.

Demographics and Migration

Possibly one of the most important and interesting questions to answer regarding urban upgrading projects is whether the gentrification improves the lives of current residents, or just improves the settlement characteristics by inducing out-migration by the most marginalized, opening opportunities for in-migration from relatively better-off households. Understanding this link is important from a poverty reduction and equity point of view. While more traditional targeted interventions to alleviate poverty such as conditional cash transfers can be directed to individuals, minimizing the potential for capture from third parties, the dynamics of public infrastructure investments are more ambiguous. Understanding the migration issues present in slums is also important for identification purposes − observed differences between control and treatment households may be a direct effect on recipient households, or it could just reflect differential migration patterns across the groups. Interpretation of the results then clearly relies heavily on at least a basic understanding of these migration patterns. The following need to be considered explicitly:

(i) Differences in rate of migration between treatment and control areas: upgrading can increase the attractiveness of a settlement, reducing the likelihood of out-migration; however it could also increase living costs, speeding up out-migration of poorer residents. The direction of impact is therefore ambiguous.

(ii) Differences between original residents and in-migrants post intervention: it is expected that in-migrants are likely to be younger, and earlier in their life cycle than original residents.

(iii) Differences between the in-migrant characteristics across treatment and control: the community upgrading may influence the attractiveness of treatment areas compared to control areas, incentivizing relatively more well-off households to move into upgraded communities.

(iv) Differences of original residents' selection to remain in the settlement: Aside from the differential rate of out-migration described in (i), those that decide to remain may differ systematically in control and treatment areas. For instance, wealthier households able to afford to stay in the upgraded location may choose to remain in higher proportions than would otherwise be the case in the control areas

(v) Within-household migration decisions: Improved infrastructure may also influence household decisions on whether to bring other members to stay with them. For instance, Archambault et al. (2012) finds that household will bring children from rural areas to stay with them in the newly upgraded urban areas as they provide a more conducive environment for child development.

These factors all add layers of complexity to the analysis and we need to get a sense of how important each of these is to our sample. Addressing (i): By the nature of our sampling procedure, the rate of migration, (i), can be estimated by the proportion of sampled households moving in (out) after the baseline survey was conducted in 2006. A large difference exists, more than doubling migration rates: in treatment areas, 24% of households moved in after baseline, compared to 53% in the control group (see Table 2.7).

Addressing (ii) and (iii): Here, we explore the differences between original dwellers and in-migrants post intervention (ii), and differences in the characteristics between in-migrants across treatment and control group (iii) using Equation (3) from the model described in Section 4. From a set of retrospective questions asked to all survey participants in the endline, as well as time-invariant indicators such as gender (described in Table 2.8), we compare the household characteristics of in-migrants with original residents in 2006 (since no original baseline data are available for in-migrants, this method offers the most consistent framework for comparing groups).

As expected, there are a range of indicators on which in-migrants differ from original residents that are consistent with the "life cycle" hypothesis. Original residents had a household head that is 13 years older and 28 percentage points more likely to be married on average, a larger family, more assets, more children enrolled in school, more likely to own a house and own a business 6 years ago.

The characteristics of in-migrants across treatment and control are more similar than the comparison with original residents, but there are still a few differences. Treatment in-migrants household heads are 4 years older, 12 percentage points more likely to run a business and 14 percentage points more likely to own their dwelling 6 years ago than their counterpart control in-migrants, supporting the hypothesis that in-migrants to treatment areas are relatively better off, although the results here are weak.

Addressing (iv): We then reproduce Table 2.8 by restricting our sample to original dwellers only. We find that treatment original households are more likely to have an income-generating business and have more household members. The treatment original household heads are slightly older and less likely to have a savings account. The original households in treatment group also had lived there for longer before the CIUP. Other things like access to services and assets are similar between control and treatment groups (see Table 2.9).

The review of migration rates and its implication on comparability offers the following insights:

1. Differential in-migration (both rates of migration and demographics) implies that any analysis comparing the full sample of control and treatment households will not be able to differentiate between the effect of the program on resident well-being vs. the effect of the program on changing the population demographic through migration

changes. Results of this nature should thus be interpreted as the overall impact of the program on the community through welfare improvements and induced migration.

2. Since it is not apparent that original dwellers have differentially selected to move out in control or treatment areas, restricting the regression to original residents of the community in the sample can provide a plausible measure of direct impact of the program on residents (ie independent of the effect of migration on community demographics). Self-selection issues are still not overcome in this type of analysis, so, even though the results can provide some indication of resident impact, they should be interpreted with care. In light of this, we present results for all outcomes as the four equations described in Section III. to provide a more holistic view of impacts at both the individual and community level.

While we have explored the influence of migration as a way to improve our identification of other outcomes, migration itself can be seen as an outcome of interest. We have already noted that control households are significantly more likely to move than treatment households, but another important area of consideration is within-household migration decisions and their influence on demographics and other household outcomes. We find the household size is also significantly larger in treatment areas, increasing from 3.97 to 4.23 people per household, but when restricting the analysis to non-migrants, the impact of 0.36 people per household is even larger, indicating that this is not just a result of larger in-migrant households, but a choice of original residents in the treatment area to expand their households (see Table 2.10). This expansion may occur from in-migration of household members from other locations, but could also be caused by other mechanisms, such as increased fertility in the treatment area. We examine the ratio of children to adults to follow Archambault et al. (2012) who show that the ratio of children to adults in Nairobi slums implies that many households choose to leave their children in rural areas when the infrastructure available in slums is not conducive to child development. However, the child/adult ratio is similar across treatment and control households at both baseline (Table 2.2) and endline (Table 2.10). Unfortunately the data cannot clearly identify the exact transmission mechanism through which our impact is being directed; however, acknowledging that upgrading has an effect on household sizes, regardless of the mechanism, offers important insights into urban planning in the future.

2.5.1 Economic Activity

There are various mechanisms through which unplanned settlement upgrading could affect economic activity. Firstly, investment in public infrastructure offers potentially higher returns to private investment, inducing (local) business investments and private dwelling upgrades. Through increased business investment, an expanding economy could offer more job prospects, increasing employment, income and expenditure. Second, an improved environment may reduce morbidity, increasing productivity and labor participation. Improvements in services may also lead to increased acquisition of assets and in-migration of household members, reducing the time required, to collect firewood for instance, redistributing time allocation to more productive activities such as paid work. The arguments for efficiency and productivity gains, although plausible, are weakly, if at all, linked to actual increased labor force participation, and the strongest potential link is through increased private investment. However, it is argued that a strong property rights are a prerequisite for increased private investments with large potential gains to formalization, unlocking the capital potential of informal land assets (de Soto 2000). Increased tenure security through formalization has been shown to incentivize private investment and upgrading of slum properties by increasing the long-term returns to investment and improving access to capital by using the land as collateral for loans (eg. Field (2010)). However, with no specific land titling scheme included in the CIUP, the level of private investment to be expected through the public infrastructure investment is unclear.

Employment

Employment of household heads is high in both groups at close to 90%, with treatment employment rates slightly (but not significantly) lower (see Table 2.11). The majority of people are self-employed with their own business. For all individuals between age 15 and 65, the endline treatment employment is significantly lower than the control by almost 8 percentage points (see Figure 2.1). The youth employment is much higher in the control group, especially for girls (see Figure 2.2), consistent with the findings about the school enrollment which will be discussed later. Average yearly household income of 3,660,000 TZS (about 2,500 USD) and expenditure (both actual and per capita) also remain indistinguishable across groups; however, these data are very noisy, making it difficult to obtain reasonable and reliable estimates. Households in the treatment group tend to have more micro-enterprises as shown in Figure 2.3, and the likelihood of opening a business at first appears stronger in the treatment group. However, when running robustness tests and a difference-in-difference regression to control for baseline business ownership, the effect falls away, indicating the observed impact is most likely due to differences between groups at baseline (Table 2.12).

Upgrading

The survey collected a range of renovation and upgrading indicators to assess the total private expenditure on upgrading as well as the specific areas in which upgrading took place, if at all (Table 2.13).

Although there is a slight increase in the total amount of investment for upgrading the household's dwelling over the past 6 years (up from 290,000 to 360,000 TZS − a difference of approximately 50 USD), this is not statistically significant, the overall investment amount is low, and the measurement is noisy, making it difficult to obtain more precise estimates. There is very little difference across groups on the probability of conducting any particular upgrading activity (eg. plastering, extensions, upgrading building material, etc.); however there is a significant increase in the likelihood that a household has upgraded their toilet in the last 6 years (from 10% in the control group to 18% in the treatment group), which is driven almost entirely by original residents rather than in-migrants. This, however, does not translate into significantly different toilet facilities in the treatment area. The upgrading results are modest in comparison to titling programs that have been evaluated in the past, but point to some interesting conclusions. With unclear property rights, inducing private investment through public infrastructure investments cannot be taken as given; however when combined with a particular promotion campaign (such as the sanitation marketing conducted as part of the CIUP package of interventions), it has the potential to influence investment decisions, if only modestly.

2.5.2 Health

The link between the environment and health is well established, and most of the urban upgrading literature focuses on this. Waterborne diseases and ARI are the health challenges most commonly linked to urban upgrading programs. Decreased density, better housing structures with improved ventilation coming from private upgrading investments, and cleaner cooking methods (eg. when electricity is provided) have been shown to directly impact the incidence of ARI for children and females living in the affected households (Turley et al. 2013), while water source and sanitation improvements, drainage and garbage disposal mechanisms held to reduce the incidence of diarrhea, especially for children under 5 (Wolff et al. 2001). Despite the clear causal pathway for upgrading projects to improve health, results from rigorous evaluations do not all lead to the same conclusions. In fact, many rigorous evaluations (Cooper et al. 2011; Devoto et al. 2012) have seen no effect on child health, while, on the other extreme, Cattaneo et al. (2009) find that increased presence of fecal matter in densely populated areas with poor sanitation is also a major contributor to child anemia, which, in turn, causes physical and cognitive stunting during early child development. The authors show that an investment in concrete floors removes this transmission mechanism, ultimately improving cognitive development for children.

Focusing on the two main sicknesses associated with slums, we find an overall decrease in diarrhea and ARI incidence in the treatment area (Table 2.14). This result, however, masks the distributional impact of the CIUP on health. Breaking the results down by age, we observe that, consistent with the literature, there is a much stronger impact on children under 5. Diarrhea almost halves, from 22% to 12%, and ARI incidence drops from 27% to 18% in the past 12 months. These illnesses are also more severe and last longer in control areas. When restricting only to non-migrant households (implying that the child would have spent their entire life in the settlement if they stayed with the family from birth), the impacts increase even further. When restricting the analysis to children under 18, the positive impact on health remains but reduces somewhat. Finally, when restricting the sample to household members older than 18, all of the impacts on diarrhea and ARI fall away, with treatment household members in fact being 3 percentage points more likely to be sick on the day of the visit. We should be noted that baseline diarrheal rates did differ, however it is not possible to do a dif-in-dif analysis, as the way in which sickness episodes were captured at baseline differed from endline. As such, the results should be treated with care, but do support the clear link, already identified in the literature, between urban upgrading and child health, while having no impact on adult household members.

2.5.3 Education

Education enrollment can be affected by urban upgrading projects in myriad ways. First, schooling programs may be included explicitly as part of the upgrading activities. Second, through a decrease in crime associated with the urban upgrading (eg. with the provision of street lights), going to school can become safer and more accessible. Third, improved road infrastructure may make transport options more viable, improving the time and effort required to get to school. Fourth, through improved access to electricity and lighting, studying opportunities increase and an environment more conducive to learning may help students study more and stay in school. Fifth, time reallocation through household demographic shifts and improved access to services may reduce home and work duties for children, decreasing the opportunity costs to staying in school.

We find that the CIUP interventions are associated with an overall increase in student (age 6 to 18) school enrollment from 85% to 89% (Table 2.15). Including gender and an interaction between gender and the treatment, the results show that all of the impact is driven by increased enrollment in the treatment group for girls, while there is no impact on boys' enrollment. We further break the analysis down by age and find no impact on children aged 6 to 12. The cohort driving the observed impact is girls aged 13 to 16. 13 to 16 year old girls in the control group have a 79% enrollment rate compared to 93% for the same-aged girls in our treatment group. No such difference is seen for boys, where both control and treatment boys have a 93% enrollment rate. An impact is still observed for older children (aged 17 to 19), but this is lower and borderline significant. Control group girls have a 62% enrollment rate compared to a 74% enrollment rate for girls in the treatment group. Figure 2.4 highlights the stark contrast between control group females and the rest of the cohort.

The large improvement in school enrollment was discussed in detail in the January 2013 stakeholder focus group. Although striking, a number of plausible reasons for this improvement were discussed:

1. Improved security, as a result of streetlights, footpaths, etc. makes it safer for children to go to school. This would affect female adolescents more than their male counterparts especially when considering crimes related to sexual harassment, especially prevalent in slum areas.

2. Improved health has been shown to improve female school participation rates where health and schooling are complements, while increasing labor force participation for males, for whom improved health increases strength, and thus attractiveness in the (manual) labor market (Pitt et al. 2012).

3. Increased female decision-making power has been shown in the literature to increase household resources directed to children. Improved female empowerment, resulting from the continuous community engagement events focusing particularly on involving females in the decision making process may translate into increased decision power in the household by females and more emphasis on schooling (especially for girls).

4. An increase in the household size resulting in changing household member roles reduces the burden and opportunity costs for females (who are often the ones required to tend to household chores), making schooling relatively more attractive.

We then ran tests to confirm or reject these hypotheses. For improved security, we find no correlation between the household's perception of safety in the settlement and the likelihood that a child is enrolled in school. Similarly, we find no differential correlation between health and schooling across gender. It is not possible to directly test a relationship between the community meetings and female empowerment; however, a commonly identified result in the literature shows that increased female decision making in the household leads to a reduction in expenditure on cigarettes and tobacco and an increase in expenditure on schooling. We find consistency in the data − treatment households are 3 percentage points less likely to spend money on cigarettes and tobacco and 11 percentage points more likely to spend money on monthly schooling costs. While far from identifying a rigorous causal relationship, the results support a message that improved female empowerment induced through the community engagement may play a part in reducing high school drop out for girls.

The "household size – enrollment" relationship, however, provides the strongest evidence of a potential causal pathway. We see a strong relationship between the number of children in the household and whether girls are enrolled in school. Accounting for the treatment group status, and overall household size, each extra child in the household is associated with a 2.5 percentage point increase in the likelihood that a girl child attends school; however, the number of children in the household has no relationship with boys' enrollment. Taking this further, we find that over 50% of children that are not enrolled in school cite work as the reason for leaving school. This is even more common for females (55%) than males. Restricting our analysis only to females that have dropped out of school, we find a borderline significant increase in the control group by 18 percentage points in selecting "work" as the reason for leaving school. This substantiates an argument that an increase in household size (induced by the upgrading) influences female school enrollment rather than male enrollment, ostensibly because of the change in opportunity costs, releasing time for females (who are the most likely to be required to help with housework, etc.) to attend school.

2.5.4 Social Cohesion

Finally, we consider what potential impact the CIUP could have on more nuanced "social cohesion" indictors. Since *in situ* community upgrading is often supported because of its potential to enhance the social fabric of a community, it is useful to try to quantify this more intangible outcome. We focus on revealed rather than stated preferences by asking questions that relate to direct actions within the community. At the first level, we would like to see if people are aware of community activities such as volunteer programs, neighborhood security groups and organized sports clubs, for instance. We then assess whether any change in awareness of community activities is accompanied with actual participation. We also explore neighbor dynamics by finding out how much people rely on (and help) their neighbors on a range of day-to-day activities such as child care, transport and job search. We find that, while there is weak evidence of an increase in awareness regarding a handful of community activities, this does not translate into increased participation, and reliance on neighbors is indistinguishably different across treatment and control groups (Table 2.16 and Table 2.17).

2.6 Conclusion

This paper presents a unique opportunity to fill an important knowledge gap on slum upgrading interventions. With only a handful of rigorous evaluations done on slum upgrading activities (none of these on World Bank projects that we are aware of), and the importance of finding ways to improve slum conditions in a rapidly urbanizing world, this evaluation offers insights into a broad range of impacts that similar community infrastructure upgrading projects may expect.

Despite a focus on rigor and quality, a number of caveats to the study need to be carefully included in any interpretation of the findings. With some important differences between treatment and control group at baseline, and an inability to track households migrating out of the study wards, the control group as an effective comparison for analysis can be called into question. The bias of any results is unknown, but various robustness checks, and a focus on the theory of change, combined with an ex-post qualitative review to contextualize any seemingly anomalous results helps to provide justification (and skepticism) when it is due.

Strong results in access to infrastructure, household sizes, and health show that, even with community infrastructure interventions that do not include the full range of standard upgrading activities can still have an important impact on communities. Although it included a comprehensive community engagement component, the project was void of any specific social/health/education/titling programs that are commonly included in similar programs. We see no change in social cohesion in these communities, and perhaps this is to be expected given the context; but important impacts, such as reduced diarrhea and increased household sizes are substantial.

While some intuitive results have been verified through this study, a number of unexpected results that should feed into further policy discussion have been identified. In particular, the potential pull factors drawing new household members to the upgraded communities has a number of knock-on effects that are critical for the policy debate. On the one hand, upgrading planning needs to account for the potential in-migration that results from the intervention and the implication this has on the ability for the community infrastructure to provide effectively to these populations. On the other hand, policymakers need to understand more carefully what a change in household size might mean for the ways in which households, and household members make decisions. For instance, the link between household size and school attendance, while tenuous, provides new insight into ways in which slum upgrading programs may serve the development objectives of a wider range of stakeholders.

Ex ante impact expectations need to take into consideration baseline levels, and what room for improvement there is when setting targets. We see no increase in employment rates, (most) upgrading indicators and households running businesses. This may not be surprising given the high levels from which the outcomes of interest started at baseline. Employment rates for household heads were 90% at baseline, while almost all households were made with concrete walls and floors. This leaves very little room for improvement, with marginal increases becoming harder to achieve at these high baseline levels. As such, finding no impact in these indicators can be expected.

There is still room for improvement: poor maintenance, low private investment and unclear economic benefits provide space for reflection on what can be done to achieve these objectives in future projects. We see that drainage systems and streetlights in particular suffer from sustainability challenges. Identifying supporting community incentive schemes, for instance, to overcome collective action problems associated with common goods could be considered to maximize potential development impacts. The project did not include any tenure security component. While it cannot be identified here, there is strong evidence that improved tenure security substantially increases private investment. The results from the study show limited private investment taking place, calling into question whether the added effort of including such a component would be justified. Other, incremental tenure options such as the provision of street addresses for instance, could be included and tested in future programs, identifying ways to stimulate private investment through improved perception of tenure security while limiting the complexity of the intervention.

Future research can focus on areas that this study has not been able to address adequately: namely, spillover effects and migration. It is expected that investments in community infrastructure in one area are likely to provide potential benefits to neighboring communities, through improved hygiene, security and economic opportunities that are not necessarily confined to the treatment area. If neighboring control communities are improved through such spillovers, the comparison between treatment and comparison groups would underestimate the program impact. Differential in- and out-migration also changes the households in a treatment community such that, by tracking only people that remain in the community, we do not get a clear picture of the overall program impact. Lower-income households could be forced to move out due to increase living costs, making way for higher-income groups − resulting in a false interpretation about benefits accruing to households (in this case the community may improve, but at the expense, not for the benefit of, the household). Alternatively the upgrading scheme may catalyze growth, lifting households out of poverty traps and opening opportunities to move out of the slum. These two contrasting conclusions would lead to two very different policy recommendations. This study does not include analysis of out-migrants and results should thus be interpreted as improvements to the community rather than to households.

Tables

Table 2.1: Completed CIUP activities based on project monitoring data

		Total	Phase 2	Phase 1
Two way roads	Km	40.3	14.9	25.5
One way roads	Km	57.8	33.9	23.9
Footpaths	Km	26.3	10.7	15.6
Road side drains	Km	132.5	63.6	69
Culverts	Lines	548	319	229
Pedestrian crossing	Number	3153	1020	2133
Solid waste containers	Number	83	35	48
Street lights	Number	2780	1630	1150
Public toilets	Number	24	17	7
Trunk drains	Km	8.6	3	5.6

Table 2.2: Baseline comparability

Variable	treatment	control	p-value	5% sig
Demographics				
Male	0.49	0.53	0	YES
Age in years	24.22	23.53	0.08	
Enrolled in school	0.9	0.92	0.24	
Male (HHH)	0.75	0.77	0.26	
Age (HHH)	39.49	38.29	0.06	
Household size	3.8	3.83	0.82	
HH child ratio (child: age 0-19)	0.32	0.32	0.78	
HH child ratio (child: age 5-19)	0.2	0.2	0.95	
Employment				
employed=1	0.38	0.41	0.03	YES
employed=1 HHH	0.87	0.91	0.01	YES
Total household income (TZS)	149739.06	142772.27	0.52	
Total household income (TZS, drop $> 650,000 = top1\%$)	131388.42	128432.13	0.51	
Education				
Years of education completed	6.86	6.8	0.72	
Years of education completed (HHH)	8	8.05	0.81	
Age 6 - 12 school enrollment	0.9	0.92	0.24	
Age 6 - 12 female school enrollment	0.9	0.94	0.14	
Health				
Experienced diarrhea in last month	0.02	0.05	0.01	YES
Experienced acute respiratory illness in last month	0.05	0.07	0.21	
Tenure				
Length of time occupying the same dwelling (years)	8.7	6.47	0	YES
Number of paying tenants	2.46	1.38	0	YES
Rental per room per month for tenants (TZS)	5860.68	2855.56	0.09	
Increase in rent from last year for tenants (TZS)	216.82	144.45	0.25	
Expected sale price of dwelling (TZS)	28565960	19140820	0.04	YES
Total rent (if HH does not own)	10633.08	10564.85	0.97	
Increase in HH rent since last year (TZS)	551.5	632.2	0.36	
A HH member owns the dwelling	0.38	0.4	0.34	
Services and structure				
HH has an electricity connection	0.45	0.48	0.32	
Monthly electricity charge (TZS)	8686.31	9031.47	0.68	
Number of hours per day of electricity provision	15.6	14.33	0.01	YES
Number of blackouts per week	3.02	3.03	0.87	
Monthly expenditure on water (TZS)	7585.65	6182.92	0.08	
Length of time to walk to primary drinking source	5.56	5.11	0.15	
HH boils water before drinking	0.67	0.68	0.57	
HH filters water before drinking	0.51	0.53	0.57	
Monthly expenditure on waste collection	712.3	504.23	0	YES
HH has a telephone	0.57	0.54	0.2	
Monthly telephone charge	10086.94	9814.81	0.77	
Dwelling has a brick/cement floor	0.94	0.94	0.9	
Dwelling has brick/cement walls	0.97	0.98	0.02	YES
Brick/cement roof=1	0.08	0.11	0.02	YES
C I. Sheet/wood rood=1	0.91	0.89	0.06	
Number of rooms in HH (excluding bathroom, garage)	2.43	2.74	0.01	YES
HH premises have been flooded in past year	0.25	0.34	0	YES
Time use				
Time spent on activity yesterday (minutes)				
Work outside home	608.18	608.8	0.95	
School classes or homework	253.29	300.05	0.59	
Grinding grains, cooking and food shopping	147.89	126.02	0	YES
Doing dishes, laundry, ironing, or cleaning your house	146.13	114.2	0	YES
Collecting water	61.48	67.33	0.28	

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Variable	treatment	control	p-value	5% sig
Collecting firewood	48.17	75.71	0	YES
Doing other household chores (child caring, sick caring)	156.16	174.14	0.2	
Feeding yourself (breakfast, lunch, dinner), sleeping	669.73	634.17	0	YES
Activities not mentioned before?	212.15	216.81	0.78	
Assets				
A HH member owns at least one of the following assets				
Radio	0.77	0.81	0.02	YES
TV	0.33	0.35	0.28	
Iron (electric or coal)	0.46	0.57	0	YES
Stove	0.9	0.94	0.01	YES
Fan	0.34	0.39	0.05	
Sofa	0.22	0.23	0.88	
Table	0.86	0.84	0.49	
Chairs	0.73	0.78	0.02	YES
Beds	0.98	0.95	0.01	YES
Bicycle	0.1	0.07	0.17	
Motorcycle/scooter	0	0.01	0.26	
Car or truck	0.02	0.03	0.18	
Cart	0.04	0.04	0.64	
Pack animals	0	0	0.39	
Sewing machine	0.1	0.06	0.01	YES
Loom	0.01	0.01	0.12	
Tools	0.12	0.05	0	YES
Urban land (Hectares)	0.08	0.12	0.01	YES
Rural land (Hectares)	0.16	0.08	0	YES
Crime				
HH burglary in last 6 months	0.07	0.07	0.66	
At least one HH member was a victim of theft in last 6 months	0.17	0.19	0.13	

Table 2.3: Description of control variables for endline cross-sectional analysis

Variable
number of months living in the settlement before 2006
gender of the household head (male=1)
age of the household head
In 2006, the dwelling had electricity=1
In 2006, the dwelling had running water=1
In 2006, the dwelling had toilet with running water=1
In 2006, the dwelling had concrete/cement floor=1
In 2006, the dwelling had brick/cement walls=1
In 2006, the dwelling had separate kitchen=1
In 2006, the household head ran any form of income-generating business=1
In 2006, number of household members living in this dwelling
In 2006, any household member owned (rather than rented) the structure or land=1
the head of household was also the head of the household 6 years ago=1
In 2006, the household head was employed=1
In 2006, the household head was married=1
Six years ago, the household head had a savings account or participated in any savings institution=1
Six years ago, number of household members were enrolled
number of radios owned in 2006
number of televisions owned in 2006
number of irons (electric or coal) owned in 2006
number of stoves owned in 2006
number of fridges owned in 2006
number of microwaves owned in 2006
number of cell phones owned in 2006
number of computers owned in 2006
number of fans owned in 2006
number of sofas owned in 2006
number of tables owned in 2006
number of chairs owned in 2006
number of beds owned in 2006
number of other home durables owned in 2006
number of bicycles owned in 2006
number of motorcycles/scooters owned in 2006
number of cars or trucks owned in 2006
number of carts owned in 2006
number of pack animals (donkeys, horses) owned in 2006
number of other transport goods owned in 2006
number of sewing machines owned in 2006
number of looms owned in 2006
number of tools owned in 2006
number of other business assets owned in 2006
number of urban land (hectares) owned in 2006
number of rural land (hectares) owned in 2006

Table 2.4: Community upgrading interventions in past 6 years

Interventions in the past 6 years	Water Supply	Toilets	Sewerage	Garbage receptacles	Electricity connections	Internal community roads	Water drainage	Street lights	Land tenure and regu-larization	Schools	Health services	Private connection to piped water	Yard tap (shared connection)	Water kiosk
Observations	1,810	1,810	1,810	1,810	1,810	1,810	1,810	1,810	1,810	1,810	1,810	1,810	1,810	1,810
Endline Control:	0.24	0.12	0.05	0.32	0.51	0.25	0.23	0.09	0.22	0.66	0.58	0.18	0.1	0.36
Endline Control N:	778	778	778	778	778	778	778	778	778	778	778	778	778	778
Endline Treatment:	0.36	0.19	0.12	0.65	0.54	0.76	0.66	0.54	0.23	0.69	0.58	0.11	0.18	0.56
Endline Treatment N:	1077	1077	1077	1077	1077	1077	1077	1077	1077	1077	1077	1077	1077	1077
Control Mean:	0.241	0.0996	0.0546	0.336	0.523	0.262	0.228	0.0955	0.224	0.673	0.583	0.186	0.111	0.367
with controls														
treatment	0.09	0.09**	0.03	0.29***	0.01	0.48***	0.41***	0.44***	-0.01	0	-0.03	-0.09**	0.06	0.20**
	(0.064)	(0.036)	(0.032)	(0.093)	(0.076)	(0.058)	(0.063)	(0.063)	(0.042)	(0.070)	(0.086)	(0.038)	(0.042)	(0.086)
Observations	1,806	1,806	1,806	1,806	1,806	1,806	1,806	1,806	1,806	1,806	1,806	1,806	1,806	1,806
no-move interaction														
treatment	0.12*	0.08*	0.02	0.26**	0.01	0.48***	0.41***	0.46***	-0.03	0	-0.03	-0.12***	0.04	0.24**
	(0.065)	(0.047)	(0.034)	(0.099)	(0.085)	(0.058)	(0.064)	(0.065)	(0.043)	(0.068)	(0.084)	(0.040)	(0.047)	(0.092)
lived here for 6yrs+	0.07*	-0.02	0.01	-0.04	-0.05	0.04*	0	0	0.03	0.02	0.01	-0.02	-0.02	-0.02
	(0.035)	(0.031)	(0.020)	(0.031)	(0.049)	(0.024)	(0.026)	(0.029)	(0.032)	(0.030)	(0.034)	(0.035)	(0.023)	(0.045)
treatment*6yrs+	-0.07	0.01	0.02	0.05	0.01	-0.01	-0.01	-0.03	0.02	0	0	0.05	0.03	-0.05
	(0.055)	(0.036)	(0.025)	(0.039)	(0.056)	(0.034)	(0.043)	(0.052)	(0.044)	(0.045)	(0.052)	(0.034)	(0.040)	(0.064)
Observations	1,806	1,806	1,806	1,806	1,806	1,806	1,806	1,806	1,806	1,806	1,806	1,806	1,806	1,806

Notes: Robust standard errors in parentheses. $***p < 0.01, **p < 0.05, *p < 0.1$

Table 2.5: Time taken to access services

Time taken to get to ... in minutes	Water supply	Toilets sewerage	Garbage disposal	Electricity	Community roads	Water drainage	Street lights	Primary schools	High Schools	Health clinics	Police station
Observations	1,810	1,810	1,810	1,810	1,810	1,810	1,810	1,810	1,810	1,810	1,810
Endline Control:	3.17	13.3	2.66	0.59	1.24	7.87	15.91	7.43	11.91	10.42	9.75
Endline Control N:	778	778	778	778	778	778	778	778	778	778	778
Endline Treatment:	1.1	3.06	0.54	0.55	0.78	0.77	2.39	5.55	9.65	9.61	6.66
Endline Treatment N:	1077	1077	1077	1077	1077	1077	1077	1077	1077	1077	1077
Control Mean:	2.96	13.3	2.634	0.613	1.31	7.947	15.56	7.663	12.01	10.8	10.15
with controls											
treatment	-1.78***	-9.76***	-2.09***	-0.04	-0.62	-6.92***	-12.85***	-2.07	-2.55	-1.11	-3.33**
	(0.619)	(2.119)	(0.627)	(0.226)	(0.495)	(1.164)	(1.725)	(1.622)	(1.618)	(1.490)	(1.587)
Observations	1,806	1,806	1,806	1,806	1,806	1,806	1,806	1,806	1,806	1,806	1,806
no-move interaction											
treatment	-1.70**	-10.53***	-2.45**	-0.27	-0.94	-8.35***	-14.21***	-3.70*	-3.28*	-1.38	-3.56*
	(0.687)	(2.567)	(0.943)	(0.315)	(0.687)	(1.316)	(1.848)	(1.966)	(1.828)	(1.908)	(1.851)
lived here for 6yrs+	-0.06	-1.25	-1.06	0.01	-0.32	-2.09**	-1.82*	-1.57	-0.08	-0.79	-0.23
	(0.553)	(1.247)	(1.069)	(0.365)	(0.400)	(0.880)	(1.036)	(1.099)	(1.180)	(1.317)	(0.953)
treatment*6yrs+	-0.11	1.39	0.74	0.35	0.53	2.53**	2.39**	2.74**	1.1	0.55	0.39
	(0.651)	(1.330)	(0.978)	(0.351)	(0.489)	(0.969)	(1.052)	(1.176)	(1.347)	(1.443)	(1.151)
Observations	1,806	1,806	1,806	1,806	1,806	1,806	1,806	1,806	1,806	1,806	1,806

Notes: Robust standard errors in parentheses. $***p < 0.01, **p < 0.05, *p < 0.1$

Table 2.6: Access to services

VARIABLES	HH uses flush toilet	HH uses public latrine	HH has access to garbage collection system	Dwelling is connected to electricity	access road to your dweeling is somewhat improved	There is a drain outside the dwelling	Streetlights on household's street
Observations	1,805	1,805	1,811	1,812	1,812	1,812	1,812
Endline Control:	0.12	0.09	0.72	0.62	0.06	0.13	0.02
Endline Control N:	772	772	777	778	778	778	778
Endline Treatment:	0.11	0.09	0.91	0.62	0.47	0.4	0.43
Endline Treatment N:	1076	1076	1079	1079	1079	1079	1079
Control Mean:	0.121	0.0864	0.714	0.617	0.0668	0.143	0.0232
with controls							
treatment	-0.01	0.01	0.20**	-0.01	0.41***	0.23***	0.42***
	(0.026)	(0.023)	(0.080)	(0.022)	(0.043)	(0.050)	(0.054)
Observations	1,799	1,799	1,805	1,806	1,806	1,806	1,806
no-move interaction							
treatment	0.02	0.02	0.19**	-0.01	0.44***	0.27***	0.47***
	(0.032)	(0.027)	(0.079)	(0.025)	(0.049)	(0.052)	(0.054)
lived here for 6yrs+	0.01	0.01	-0.03	0	0.04	0.07*	-0.02
	(0.024)	(0.017)	(0.036)	(0.023)	(0.023)	(0.035)	(0.023)
treatment*6yrs+	-0.05	-0.02	0.02	0	-0.05*	-0.07	-0.07**
	(0.031)	(0.024)	(0.042)	(0.029)	(0.027)	(0.045)	(0.032)
Observations	1,799	1,799	1,805	1,806	1,806	1,806	1,806

Notes: Robust standard errors in parentheses. $***p < 0.01, **p < 0.05, *p < 0.1$

Table 2.7: Migration rates by treatment status

Migrant status	Control	Phase 1	Phase 2
Original resident	47%	75.61%	75.60%
Arrived post-2006	53%	24.39%	24.40%

Table 2.8: Baseline comparison between migrants and non-migrants

VARIABLES	Obs	Control mean	treatment	sd	lived here for 6yrs+	sd	treat *6yrs+	sd
Dwelling 6 years ago had...								
Electricity	1,809	0.577	-0.01	(0.056)	-0.05	(0.058)	0.02	(0.068)
Running water	1,809	0.182	-0.03	(0.043)	-0.04	(0.028)	0.05	(0.037)
Toilet with running water	1,809	0.311	0.05	(0.060)	0	(0.037)	0.01	(0.053)
Concrete/cement floor	1,809	0.937	-0.05*	(0.026)	-0.04	(0.023)	0.03	(0.029)
Brick/cement walls	1,809	0.966	-0.05*	(0.025)	-0.02	(0.015)	0.04	(0.026)
Separate kitchen	1,809	0.257	0.05	(0.036)	0.12***	(0.034)	-0.06	(0.049)
Status 6 years ago								
HH had a income-generating business	1,809	0.446	0.12***	(0.037)	0.07**	(0.033)	0.02	(0.047)
HH size	1,808	3.453	0.55	(0.335)	1.72***	(0.248)	0.47	(0.382)
HH owned dwelling	1,809	0.335	0.14***	(0.027)	0.51***	(0.035)	-0.17***	(0.049)
HHH employed	1,809	0.888	-0.01	(0.034)	0	(0.026)	-0.02	(0.039)
HHH married	1,809	0.587	0.11*	(0.053)	0.28***	(0.043)	-0.08	(0.056)
HHH had a savings account	1,809	0.363	0.04	(0.036)	0.18***	(0.028)	-0.10***	(0.038)
Number of HH members enrolled in school	1,809	0.978	0.21*	(0.122)	0.73***	(0.092)	-0.11	(0.132)
months living here before 2006	1,809	66.29	0	0.000	141.3***	(10.792)	45.04***	(12.077)
Number of assets owned 6 years ago								
Radio	1,807	0.724	-0.03	(0.052)	0.08***	(0.021)	0.09*	(0.051)
TV	1,807	0.572	0.06	(0.059)	0.09**	(0.037)	-0.05	(0.052)
Iron (electric or coal)	1,807	0.518	0.08	(0.048)	0.17***	(0.053)	-0.05	(0.064)
Stove	1,807	0.755	0.05	(0.065)	0	(0.039)	-0.01	(0.056)
Fridge	1,807	0.268	0.05	(0.036)	0.14***	(0.033)	-0.05	(0.045)
Microwave	1,807	0.0848	-0.02	(0.031)	0.04*	(0.026)	0	(0.031)
Cell phone	1,807	1.65	-0.02	(0.160)	0.30**	(0.143)	-0.17	(0.167)
Computer	1,807	0.0876	-0.01	(0.024)	0.04*	(0.025)	-0.04	(0.031)
Fan	1,807	0.565	0.06	(0.072)	0.13***	(0.040)	-0.03	(0.068)
Sofa	1,807	1.321	0.09	(0.111)	0.48***	(0.059)	-0.15	(0.106)
Table	1,807	0.878	0.05	(0.065)	0.37***	(0.055)	-0.1	(0.080)
Chairs	1,807	1.018	0.17	(0.162)	0.68***	(0.181)	-0.41*	(0.234)
Beds	1,807	1.684	0.12**	(0.061)	1.06***	(0.113)	-0.24*	(0.137)
Another home	1,807	0.149	-0.04	(0.049)	0.06	(0.046)	0.08	(0.074)
Bicycle	1,807	0.104	0.01	(0.028)	0.07*	(0.036)	-0.01	(0.042)
Motorcycle/scooter	1,807	0.0383	0	(0.017)	-0.01	(0.018)	-0.01	(0.021)
Car or truck	1,807	0.0492	0.02	(0.020)	0.04*	(0.020)	-0.05*	(0.029)
Cart	1,807	0.0164	0	(0.009)	0.01**	(0.006)	0.01	(0.011)
Pack animals	1,807	0	0	0.000	-0.00***	0.000	0	(0.002)
Sewing machine	1,807	0.235	-0.18	(0.215)	-0.11	(0.208)	0.14	(0.212)
Loom	1,807	0.0082	0	(0.006)	0	(0.005)	0.01	(0.010)
Tools	1,807	0.0698	0.11	(0.105)	-0.01	(0.055)	0.13	(0.183)
Urban land (Hectares)	1,807	0.198	0.15	(0.108)	0.27*	(0.149)	-0.26	(0.183)
Rural land (Hectares)	1,807	0.233	-0.08	(0.121)	0.03	(0.113)	0.41***	(0.135)
Demographics								
HHH male	1,809	0.777	0	(0.033)	-0.05	(0.039)	0.01	(0.050)
HHH age (years)	1,809	40.07	4.26***	(1.033)	13.02***	(0.901)	-1.65	(1.305)

Table 2.9: Retrospective comparison between treatment and control, non-migrants only

VARIABLES	Obs	Control Mean:	treatment	sd
Dwelling 6 years ago had the following				
Electricity	1,158	0.551	0.01	(0.057)
Running water	1,158	0.163	0.02	(0.052)
Toilet with running water	1,158	0.312	0.06	(0.069)
Concrete/cement floor	1,158	0.918	-0.02	(0.028)
Brick/cement walls	1,158	0.953	-0.01	(0.017)
Separate kitchen	1,158	0.321	-0.01	(0.033)
Status 6 years ago				
HH had a income-generating business	1,158	0.484	0.15***	(0.041)
HH size	1,158	4.367	1.01***	(0.320)
HH owned dwelling	1,158	0.603	-0.03	(0.056)
HHH employed	1,158	0.886	-0.02	(0.025)
HHH married	1,158	0.738	0.02	(0.026)
HHH had a savings account	1,158	0.461	-0.07**	(0.031)
Number of HH members enrolled in school	1,158	1.367	0.11	(0.117)
months living here before 2006	1,158	141.3	45.04***	(12.072)
Number of assets owned 6 years ago				
Radio	1,157	0.767	0.06	(0.037)
TV	1,157	0.621	0.01	(0.057)
Iron (electric or coal)	1,157	0.606	0.03	(0.050)
Stove	1,157	0.755	0.04	(0.042)
Fridge	1,157	0.341	0	(0.042)
Microwave	1,157	0.108	-0.02	(0.036)
Cell phone	1,157	1.81	-0.18	(0.150)
Computer	1,157	0.111	-0.05*	(0.028)
Fan	1,157	0.633	0.03	(0.082)
Sofa	1,157	1.574	-0.06	(0.117)
Table	1,157	1.076	-0.06	(0.074)
Chairs	1,157	1.379	-0.24	(0.229)
Beds	1,157	2.245	-0.12	(0.153)
Another home	1,157	0.181	0.04	(0.085)
Bicycle	1,157	0.14	0	(0.033)
Motorcycle/scooter	1,157	0.035	-0.01	(0.012)
Car or truck	1,157	0.07	-0.03	(0.022)
Cart	1,157	0.0233	0	(0.011)
Pack animals	1,157	0	0	(0.002)
Sewing machine	1,157	0.178	-0.03	(0.023)
Loom	1,157	0.00875	0.01	(0.007)
Tools	1,157	0.0671	0.24	(0.148)
Urban land (Hectares)	1,157	0.344	-0.12	(0.147)
Rural land (Hectares)	1,157	0.251	0.33***	(0.088)
Demographics				
HHH male	1,158	0.752	0.02	(0.036)
HHH age (years)	1,158	46.98	2.60**	(0.977)

Table 2.10: Demographics

VARIABLES	hh size	hhh married=1	hh child ratio (child: age 0-19)	hh child ratio (child: age 5-19)
Observations	1812	1812	1,812	1,812
Endline Control:	3.95	0.69	0.3	0.19
Endline Control N:	778	778	778	778
Endline Treatment:	5.13	0.72	0.32	0.21
Endline Treatment N:	1079	1079	1079	1079
Control Mean:	3.97	0.7	0.3	0.18
treatment	0.26***	0.01	0.02	0.02
	(0.110)	(0.018)	(0.011)	(0.010)
Observations	1,806	1,806	1,806	1,806
no-move interaction				
treatment	0.11	0.03	0.02	0.02
	(0.108)	(0.029)	(0.016)	(0.012)
lived here for 6yrs+	-0.19	-0.08***	0.03	0.05***
	(0.158)	(0.024)	(0.020)	(0.015)
treatment*6yrs+	0.27	-0.02	-0.01	-0.01
	(0.203)	(0.031)	(0.022)	(0.017)
Observations	1,806	1,806	1,806	1,806
exclude in-migrants				
treatment	0.36*	0.02	0.01	0.01
	(0.183)	(0.021)	(0.015)	(0.013)
Observations	1,157	1,157	1,157	1,157
EA Dif-in-Dif				
Baseline Control:	3.84	0.66	0.33	0.2
Baseline Control N:	44	44	44	44
Baseline Treatment:	3.8	0.69	0.32	0.2
Baseline Treatment N:	71	71	71	71
Endline Control:	3.97	0.69	0.3	0.18
Endline Control N:	44	44	44	44
Endline Treatment:	5.13	0.72	0.32	0.21
Endline Treatment N:	71	71	71	71
control for household size change				
treatment	1.20***	-0.02	-0.04*	-0.01
	(0.225)	(0.031)	(0.020)	(0.015)
Control Mean:	0.137	0.0317	-0.0276	-0.0195
Observations	115	115	115	115

Notes: Robust standard errors in parentheses. $***p < 0.01, **p < 0.05, *p < 0.1$

Table 2.11: Income, employment and expenditure

VARIABLES	HH head employed	Yearly total HH income	months living in this settlements	rent or own (own=1)	monthly expenditure	per capita monthly expenditure	total value of assets
Observations	1812	1812	1815	1815	1810	1810	1810
Endline Control:	0.9	3606101.37	113.74	0.31	511938.47	154788.61	11229553.15
Endline Control N:	778	778	781	781	778	778	778
Endline Treatment:	0.82	4162997.29	199.09	0.48	587136.98	140225.04	14691193.98
Endline Treatment N:	1079	1079	1079	1079	1077	1077	1077
Control Mean:	0.9	3661000	112.4	0.31	520823	157139	9111000
with controls							
treatment	-0.03	254,737.44	43.41***	0.02	6,244.95	-5,165.31	1,384,744.29
	(0.018)	(673163.715)	(10.004)	(0.019)	(56608.148)	(15036.591)	(2303407.105)
Observations	1,809	1,809	1,809	1,809	1,809	1,809	1,809
no-move interaction							
treatment	-0.03	1,560,586.09	-14.68**	-0.01	-8,754.91	-13,754.25	-3025052.15
	(0.022)	(1819960.763)	(5.492)	(0.029)	(55223.003)	(25029.625)	(2263459.346)
lived here for 6yrs+	0.03	141,561.68	134.86***	0.08***	30,828.50	-11,866.34	-4844335.07*
	(0.021)	(819577.514)	(9.906)	(0.022)	(66110.858)	(27215.337)	(2471156.089)
treatment*6yrs	0	-1838433.73	50.89***	0.03	53,565.48	26,531.96	7,554,878.57**
	(0.027)	(1617996.947)	(11.806)	(0.031)	(88363.226)	(33457.416)	(3117791.186)
Observations	1,809	1,809	1,809	1,809	1,809	1,809	1,809
EA Dif-in-Dif							
Baseline Control:	0.92	1723928.33	84.24	0.41	131770.08	42120.36	2346807.94
Baseline Control N:	44	44	44	44	44	44	44
Baseline Treatment:	0.87	1595084.94	125.9	0.38	131855.78	41563.55	2036738.35
Baseline Treatment N:	71	70	71	71	71	71	71
Endline Control:	0.9	3708773.88	113.46	0.31	520778.38	158243.34	9736363.47
Endline Control N:	44	44	44	44	44	44	44
Endline Treatment:	0.82	4135070.68	199.4	0.48	590207.12	140639.77	14788143
Endline Treatment N:	71	71	71	71	71	71	71
control for household size change							
treatment	0.01	-294,477.59	13.54	0.10**	16,518.29	-7,844.84	4,155,025.61
	(0.032)	(468944.536)	(10.892)	(0.047)	(68471.441)	(21933.297)	(3826039.715)
Control Mean:	-0.0215	1984845	29.22	-0.0958	389008	116123	7389556
Observations	115	114	115	115	115	115	115

Notes: Robust standard errors in parentheses. $***p < 0.01, **p < 0.05, *p < 0.1$

Table 2.12: Micro-enterprise activity

Run a microenterprise in last 12 months	Endline only	Dif-in-dif
Observations	1815	1815
Endline Control:	0.44	-0.02
Endline Control N:	781	781
Endline Treatment:	0.57	-0.04
Endline Treatment N:	1079	1079
Control Mean:	0.42	-0.02
with controls		
treatment	0.07**	-0.02
	(0.036)	(0.033)
Observations	1,809	1,809

Notes: Robust standard errors in parentheses. $***p < 0.01, **p < 0.05, *p < 0.1$

Table 2.13: Renovations

VARIABLES	Expenditure on Repair and maintenance of household during the last year	Per capita expenditure on Repair and maintenance of household during the last year	Upgraded the wall materials since 2006	Upgraded the roofing materials since 2006	Upgraded the floor materials since 2006	Added or upgraded your hh perimeter /fencing since 2006	Upgraded your toilet since 2006	Upgraded your kitchen since 2006	How much did you spend in total on upgrading your dwelling over the past 6 yrs
Observations	1810	1815	1815	1815	1815	1815	1815	1815	1,812
Endline Control:	103843.19	30705.98	0.09	0.09	0.12	0.05	0.1	0.04	288751.08
Endline Control N:	778	781	781	781	781	781	781	781	778
Endline Treatment:	124164.81	21895.1	0.14	0.16	0.17	0.05	0.23	0.06	477702.14
Endline Treatment N:	1077	1079	1079	1079	1079	1079	1079	1079	1079
Control Mean:	109877	32498	0.09	0.09	0.13	0.05	0.1	0.04	288183
with controls									
treatment	-11,262.40	-6,232.99	0.01	0.02	-0.01	-0.02	0.08***	0	70,702.12
	(53307.937)	(10490.553)	(0.020)	(0.024)	(0.028)	(0.017)	(0.024)	(0.016)	(61076.608)
Observations	1,809	1,809	1,809	1,809	1,809	1,809	1,809	1,809	1,809
no-move interaction									
treatment	-5,778.11	7,946.20	0.01	0.02	0.02	0	0.01	0	98,576.97
	(41965.327)	(11865.743)	(0.023)	(0.023)	(0.027)	(0.018)	(0.020)	(0.016)	(82929.029)
lived here for 6yrs+	141,655.31	56,862.53	0.03	0.04	0.09***	0.01	0.05	0	80,211.21
	(112928.361)	(38589.493)	(0.021)	(0.026)	(0.031)	(0.020)	(0.030)	(0.019)	(73524.041)
treatment*6yrs	-60,306.28	-38,988.85	-0.01	0	-0.05	-0.03	0.09**	0	-46,520.34
	(101447.682)	(30492.629)	(0.026)	(0.030)	(0.037)	(0.025)	(0.038)	(0.026)	(98280.837)
Observations	1,809	1,809	1,809	1,809	1,809	1,809	1,809	1,809	1,809
EA Dif-in-Dif	household	per capita							
Baseline Control:	8815.15	2147.89							
Baseline Control N:	44	44							
Baseline Treatment:	7833.28	2610.13							
Baseline Treatment N:	71	71							
Endline Control:	115370.77	34649.05							
Endline Control N:	44	44							
Endline Treatment:	122613.47	21722.72							
Endline Treatment N:	71	71							
control for household size change									
treatment	-46,502.68	-21,358.54							
	(87002.475)	(27914.199)							
Control Mean:	106556	32501							
Observations	115	115							

Notes: Robust standard errors in parentheses. $***p < 0.01, **p < 0.05, *p < 0.1$

Table 2.14: Health impacts by age

VARIABLES	How many days has this person been unable to perform his/her main activity during the last 6 months	Is this person still currently sick (Yes=1)	diarrhea in last 12 months=1	For how many days was this person sick with diarrhea	ARI in last 12 months=1	For how many days was this person sick w/ an ARI	cough =1	breathing with sound=1	another type of sickness=1	For how many days was this person sick with this illness
age ≤ 5										
treatment	-0.49	0	-0.10**	-0.33*	-0.09**	-0.77*	-0.10**	-0.07**	-0.12***	-0.63*
	(0.414)	(0.022)	(0.041)	(0.189)	(0.038)	(0.404)	(0.039)	(0.030)	(0.038)	(0.329)
Observations	946	946	946	946	946	946	946	946	946	946
Control Mean:	2.417	0.0588	0.219	0.885	0.267	2.241	0.265	0.155	0.396	2.497
≤ 5, hh lived here 6 yrs+										
treatment=1	-0.12	-0.01	-0.16**	-0.60**	-0.11**	-0.64	-0.11*	-0.10**	-0.19***	-1.05***
	(0.460)	(0.025)	(0.065)	(0.295)	(0.055)	(0.515)	(0.057)	(0.044)	(0.039)	(0.363)
Observations	580	580	580	580	580	580	580	580	580	580
Control Mean:	1.75	0.0549	0.28	1.098	0.274	2.037	0.268	0.171	0.439	2.549
≤ 18										
treatment	0.13	0.02	-0.06**	-0.20*	-0.07***	-0.83***	-0.08***	-0.05***	-0.12***	-0.77***
	(0.240)	(0.015)	(0.021)	(0.116)	(0.016)	(0.228)	(0.015)	(0.014)	(0.026)	(0.183)
Observations	2,939	2,939	2,939	2,939	2,939	2,939	2,939	2,939	2,939	2,939
Control Mean:	1.621	0.0416	0.141	0.562	0.181	1.608	0.175	0.0978	0.337	2.06
> 18										
treatment	1.02*	0.03**	-0.01	0	-0.02	0.01	-0.01	-0.01	-0.11***	-0.86***
	(0.607)	(0.011)	(0.013)	(0.042)	(0.014)	(0.248)	(0.012)	(0.009)	(0.024)	(0.253)
Observations	4,938	4,938	4,938	4,938	4,938	4,938	4,938	4,938	4,938	4,938
Control Mean:	3.034	0.0569	0.0659	0.22	0.08	0.908	0.0715	0.0366	0.328	2.918

Notes: Robust standard errors in parentheses. $***p < 0.01, **p < 0.05, *p < 0.1$

Table 2.15: School enrollment and time use by age group

VARIABLES	currently enrolled in school	not enrolled in school to help with housework =1	not enrolled because of work	(mins) working outside the home	(mins) school classes or homework	(mins) grinding grains cooking and food shopping	(mins) doing dishes laundry ironing or cleaning your house	(mins) collecting water	(mins) collecting firewood	(mins) doing other household chores (child caring sick caring)	(mins) feeding yourself, sleeping, dress	(mins) relaxing/ entertainment
Observations	2,003	266	266	2,003	2,003	2,003	2,003	2,003	2,003	2,003	2,003	2,003
Endline Control:	0.85	0.27	0.58	251.98	131.17	54.7	63.72	23.39	12.76	37.25	612.32	206.02
Endline Control N:	714	107	107	2978	2978	2978	2978	2978	2978	2978	2978	2978
Endline Treatment:	0.88	0.3	0.49	250.34	138.7	54.38	66.3	29.44	13.82	41.58	596.53	195.97
Endline Treatment N:	1343	165	165	5078	5078	5078	5078	5078	5078	5078	5078	5078
Control Mean:	0.847	0.287	0.604	66.36	413.1	32.02	54.88	24.25	10.01	15.18	598	176.7
with controls												
treatment	0.04**	-0.03	-0.15*	23.43	-0.9	-2.71	-1.52	6.18**	1.32	4.96	-20.17	-7.2
	(0.016)	(0.081)	(0.085)	(13.970)	(20.307)	(4.012)	(4.376)	(3.028)	(1.583)	(3.250)	(20.093)	(18.002)
Observations	1,996	264	264	1,996	1,996	1,996	1,996	1,996	1,996	1,996	1,996	1,996
Control Mean:	0.848	0.29	0.61	66.57	413.3	32.11	54.86	24.28	9.992	14.86	597.9	177.2
gender interaction												
treatment	0.08***	-0.06	-0.12	14.05	6.12	-2.56	0.76	5.16**	1.99	1.66	-17.04	-10.63
	(0.023)	(0.093)	(0.093)	(13.383)	(7.504)	(5.836)	(4.208)	(2.445)	(1.473)	(4.072)	(19.147)	(15.595)
male	0.09***	-0.15	-0.01	203.48***	26.95***	-84.18***	-59.02***	-21.72***	-8.21***	-54.45***	-6.64	3.16
	(0.026)	(0.119)	(0.107)	(9.526)	(8.929)	(4.338)	(3.746)	(1.470)	(1.503)	(2.520)	(8.720)	(7.358)
treatment*male	-0.07**	0.08	-0.08	-27.85**	-0.31	3.54	1.44	-0.48	-0.58	7.59**	3.96	6.54
	(0.030)	(0.141)	(0.133)	(12.953)	(10.737)	(4.972)	(4.373)	(1.957)	(1.997)	(3.263)	(9.458)	(8.664)
Observations	1,996	264	264	7,856	7,856	7,856	7,856	7,856	7,856	7,856	7,856	7,856
Control Mean:	0.848	0.29	0.61	253.6	132.2	53.82	62.79	23.12	12.69	37.24	614.1	202.6
age 6-12												
treatment	0.03			-2.97	-1.31	10.16*	5.22	3.73	3.09	3.9	-11.48	-16.55
	(0.017)			(20.304)	(21.874)	(5.476)	(5.977)	(3.765)	(2.586)	(3.179)	(18.848)	(22.850)
individual's age	0.01**	0	0	2.12	28.80***	1.74**	5.51***	2.30***	0.45	1.08*	-15.88***	-16.10***
	(0.003)	(.)	(.)	(2.283)	(3.358)	(0.834)	(0.836)	(0.618)	(0.331)	(0.590)	(2.182)	(3.125)
treatment*male	-0.01			35.57**	-19.54	-14.09**	-1.24	6.68	-2.96	1.79	0.17	14.11
	(0.020)			(13.211)	(22.031)	(6.950)	(7.031)	(4.211)	(3.104)	(4.917)	(12.820)	(18.131)
male	0.02	-0.22	-0.14	-29.29***	35.39**	-1.55	-7.23	-5.77*	1.56	-0.17	-0.4	-11.89
	(0.016)	(.)	(.)	(8.727)	(16.102)	(4.851)	(4.523)	(2.941)	(2.219)	(3.904)	(7.937)	(14.486)
Observations	1,058	25	25	1,062	1,062	1,062	1,062	1,062	1,062	1,062	1,062	1,062
Control Mean:	0.963	0.462	0.462	46.54	463.8	9.543	30.26	14.17	6.343	4.714	611.7	189.1
age 13-16												
treatment	0.15***	-0.03	-0.03	45.74*	27.52	-26.30**	-3.67	4.94	-0.47	-9.42	-32.44	-7.44
	(0.055)	(0.138)	(0.117)	(24.097)	(37.952)	(11.542)	(10.215)	(6.339)	(3.960)	(8.791)	(23.031)	(23.697)
individual's age	-0.09***	-0.06	-0.03	19.53**	-46.77***	6.25**	6.66**	1.19	1.61	4.51*	4.84	0.83
	(0.012)	(0.059)	(0.052)	(8.273)	(10.094)	(2.399)	(2.989)	(1.659)	(1.395)	(2.532)	(6.087)	(4.344)
treatment*male	-0.15**	0.35	0.02	-23.5	-37.74	37.71***	2.71	0.42	3.73	19.94	16.12	-13.67
	(0.069)	(0.235)	(0.240)	(37.977)	(51.825)	(10.449)	(9.591)	(7.845)	(4.800)	(13.153)	(21.546)	(21.041)
male	0.15***	-0.39*	-0.1	61.96*	46.88	-72.57***	-39.12***	-16.25**	-4.88	-30.29***	-6	47.68***
	(0.047)	(0.210)	(0.181)	(32.009)	(37.969)	(7.467)	(6.477)	(6.870)	(4.244)	(11.129)	(13.205)	(14.669)
Observations	568	108	108	568	568	568	568	568	568	568	568	568
Control Mean:	0.788	0.289	0.5	66.03	406.8	49.94	72.12	31.2	12.65	20.45	581.2	170.4

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VARIABLES	currently enrolled in school	not enrolled in school to help with housework =1	not enrolled because of work	(mins) working outside the home	(mins) school classes or homework	(mins) grinding grains cooking and food shopping	(mins) doing dishes laundry ironing or cleaning your house	(mins) collecting water	(mins) collecting firewood	(mins) doing other household chores (child caring sick caring)	(mins) feeding yourself, sleeping, dress	(mins) relaxing/ entertainment
age 17-19												
treatment	0.12*	-0.06	-0.25	5.19	-40.07	-18.78	-22.37	11.36	1.51	32.74*	-1.6	20.3
	(0.068)	(0.145)	(0.157)	(22.275)	(42.989)	(12.405)	(15.295)	(7.551)	(4.312)	(16.670)	(28.869)	(20.779)
individual's age	0.04	-0.07	-0.01	14.7	-27.1	-3.42	-0.26	-3.45	-3.15	-3.3	5.07	15.32**
	(0.046)	(0.077)	(0.105)	(14.184)	(17.072)	(5.174)	(4.194)	(2.953)	(1.879)	(6.200)	(6.840)	(5.880)
treatment*male	-0.13	-0.02	-0.14	-13.08	59.22	11.87	4.49	-10.53	-6.73	-21.3	3.92	-4.47
	(0.084)	(0.203)	(0.219)	(47.356)	(48.321)	(11.007)	(20.125)	(7.896)	(5.997)	(18.316)	(29.245)	(29.461)
male	0.19***	-0.19	0	104.10***	42	-83.23***	-44.67**	-10.66**	-1.15	-39.03***	-8.31	9.45
	(0.070)	(0.159)	(0.173)	(33.096)	(42.257)	(5.182)	(17.444)	(5.202)	(4.356)	(10.753)	(23.292)	(22.321)
Observations	370	131	131	531	531	531	531	531	531	531	531	531
Control Mean:	0.623	0.245	0.735	127.5	283.5	67.38	100.5	37.73	15.19	32.73	576.4	158
EA Dif-in-Dif												
enrollment rate age 6-12												
Baseline Control:	0.94	N=44										
Baseline Treatment:	0.91	N=71										
Endline Control:	0.96	N=44										
Endline Treatment:	0.98	N=71										
control for												
household size change												
treatment	0.07*	(0.037)										
Control Mean:	0.0276											
Observations	115											

Notes: Robust standard errors in parentheses. $***p < 0.01, **p < 0.05, *p < 0.1$

Table 2.16: Social cohesion: awareness and participation in community activities

Do you have...active in your settlement?	A neighborhood improvement group	Volunteers	A sports club	A neighborhood security watch organization	Local politics	Religious groups	Women or youth groups	community savings group	Parent-teacher associations
Observations	1815	1815	1815	1815	1815	1815	1815	1815	1815
Control:	0.06	0.04	0.19	0.27	0.28	0.29	0.23	0.27	0.11
Control N:	781	781	781	781	781	781	781	781	781
Treatment:	0.11	0.08	0.11	0.39	0.22	0.28	0.19	0.24	0.1
Treatment N:	1079	1079	1079	1079	1079	1079	1079	1079	1079
Control Mean:	0.05	0.04	0.19	0.28	0.26	0.29	0.24	0.26	0.11
with controls									
treatment	0.06**	0.03*	-0.08**	0.11*	-0.07	-0.03	-0.06	-0.05	-0.02
	(0.025)	(0.018)	(0.030)	(0.061)	(0.057)	(0.053)	(0.043)	(0.048)	(0.037)
Observations	1,809	1,809	1,809	1,809	1,809	1,809	1,809	1,809	1,809
no-move interaction									
treatment	0.06*	0.05**	-0.09**	0.12*	-0.11	-0.09	-0.07	-0.04	0
	(0.033)	(0.020)	(0.035)	(0.066)	(0.070)	(0.065)	(0.048)	(0.057)	(0.041)
lived here for 6yrs+	-0.03	0.02	0.02	-0.01	-0.05	-0.01	0.03	-0.02	0.04*
	(0.018)	(0.020)	(0.030)	(0.035)	(0.032)	(0.029)	(0.034)	(0.027)	(0.018)
treatment*6yrs+	0	-0.02	0.02	0.01	0.09*	0.10**	0.02	0	-0.04
	(0.031)	(0.027)	(0.035)	(0.046)	(0.047)	(0.039)	(0.040)	(0.041)	(0.026)
Observations	1,809	1,809	1,809	1,809	1,809	1,809	1,809	1,809	1,809

Does anybody from this hh participate in...?	A neighborhood improvement group	Volunteers	A sports club	A neighborhood security watch organization	Local politics	Religious groups	Women or youth groups	community savings group	Parent-teacher associations
Observations	1815	1815	1815	1815	1815	1815	1815	1815	1815
Control:	0.02	0.04	0.05	0.13	0.11	0.17	0.1	0.08	0.07
Control N:	781	781	781	781	781	781	781	781	781
Treatment:	0.03	0.05	0.05	0.15	0.09	0.15	0.09	0.09	0.06
Treatment N:	1079	1079	1079	1079	1079	1079	1079	1079	1079
Control Mean:	0.01	0.03	0.05	0.14	0.1	0.17	0.1	0.08	0.07
with controls									
treatment	0.02**	0.01	0	0	-0.02	-0.04	-0.02	-0.01	-0.02
	(0.009)	(0.016)	(0.014)	(0.040)	(0.035)	(0.045)	(0.029)	(0.024)	(0.026)
Observations	1,809	1,809	1,809	1,809	1,809	1,809	1,809	1,809	1,809
no-move interaction									
treatment	0.02	0.02	0	0.03	-0.05	-0.06	0.01	-0.01	-0.01
	(0.014)	(0.015)	(0.018)	(0.043)	(0.044)	(0.057)	(0.030)	(0.031)	(0.028)
lived here for 6yrs+	0.01	0.02	0.02**	0.04	-0.01	0.02	0.06**	0.01	0.03*
	(0.009)	(0.020)	(0.011)	(0.030)	(0.026)	(0.033)	(0.023)	(0.025)	(0.016)
treatment*6yrs+	-0.01	-0.02	0	-0.04	0.04	0.03	-0.04	0.01	-0.02
	(0.016)	(0.023)	(0.019)	(0.033)	(0.035)	(0.038)	(0.029)	(0.031)	(0.021)
Observations	1,809	1,809	1,809	1,809	1,809	1,809	1,809	1,809	1,809

Notes: Robust standard errors in parentheses. $***p < 0.01, **p < 0.05, *p < 0.1$

Table 2.17: Social cohesion: dependence and support for neighbors

Does your hh rely your neighbors for any of the following?	Child care	Transport	Sharing of food	Medical care or emergency	Job search	Household services (water electricity etc.)	Security (eg. watching home while away)	Other
Observations	1815	1815	1815	1815	1815	1815	1815	1815
Control:	0.23	0.15	0.23	0.42	0.14	0.49	0.74	0.04
Control N:	781	781	781	781	781	781	781	781
Treatment:	0.25	0.16	0.23	0.37	0.15	0.38	0.65	0.01
Treatment N:	1079	1079	1079	1079	1079	1079	1079	1079
Control Mean:	0.23	0.14	0.22	0.41	0.14	0.48	0.74	0.05
with controls								
treatment	0.01	-0.01	-0.02	-0.08	-0.01	-0.12**	-0.11	-0.03*
	(0.035)	(0.039)	(0.034)	(0.067)	(0.028)	(0.050)	(0.080)	(0.017)
Observations	1,809	1,809	1,809	1,809	1,809	1,809	1,809	1,809
no-move interaction								
treatment	-0.03	-0.04	0.01	-0.08	0	-0.14**	-0.16**	-0.03
	(0.037)	(0.045)	(0.046)	(0.078)	(0.037)	(0.053)	(0.069)	(0.022)
lived here for 6yrs+	-0.01	-0.01	0.02	0.03	0.03	0.04	0	0.01
	(0.024)	(0.027)	(0.030)	(0.048)	(0.021)	(0.043)	(0.052)	(0.023)
treatment*6yrs+	0.07**	0.06	-0.03	0	-0.01	0.02	0.08	-0.01
	(0.033)	(0.039)	(0.039)	(0.056)	(0.032)	(0.055)	(0.062)	(0.023)
Observations	1,809	1,809	1,809	1,809	1,809	1,809	1,809	1,809

Does your hh help neighbors for any of the following?	Child care	Transport	Sharing of food	Medical care or emergency	Job search	Household services	Security	Other
Observations	1815	1815	1815	1815	1815	1815	1815	1815
Control:	0.24	0.15	0.22	0.4	0.12	0.37	0.73	0.04
Control N:	781	781	781	781	781	781	781	781
Treatment:	0.26	0.14	0.22	0.34	0.11	0.3	0.62	0.01
Treatment N:	1079	1079	1079	1079	1079	1079	1079	1079
Control Mean:	0.23	0.14	0.21	0.39	0.12	0.38	0.73	0.05
with controls								
treatment	0.01	-0.03	-0.01	-0.08	-0.03	-0.09	-0.13	-0.03**
	(0.037)	(0.038)	(0.035)	(0.068)	(0.028)	(0.056)	(0.080)	(0.016)
Observations	1,809	1,809	1,809	1,809	1,809	1,809	1,809	1,809
no-move interaction								
treatment	-0.01	-0.04	0.03	-0.08	-0.01	-0.12**	-0.19**	-0.03
	(0.035)	(0.041)	(0.044)	(0.078)	(0.038)	(0.052)	(0.071)	(0.021)
lived here for 6yrs+	-0.02	0	0.06*	0.04	0.01	0.03	0	0
	(0.027)	(0.022)	(0.032)	(0.047)	(0.025)	(0.036)	(0.052)	(0.023)
treatment*6yrs+	0.06*	0.02	-0.06	0	-0.02	0.04	0.1	0
	(0.030)	(0.032)	(0.037)	(0.054)	(0.032)	(0.045)	(0.063)	(0.023)
Observations	1,809	1,809	1,809	1,809	1,809	1,809	1,809	1,809

Notes: Robust standard errors in parentheses. $***p < 0.01, **p < 0.05, *p < 0.1$

Figures

Figure 2.1: Employment status of individuals age 15-65

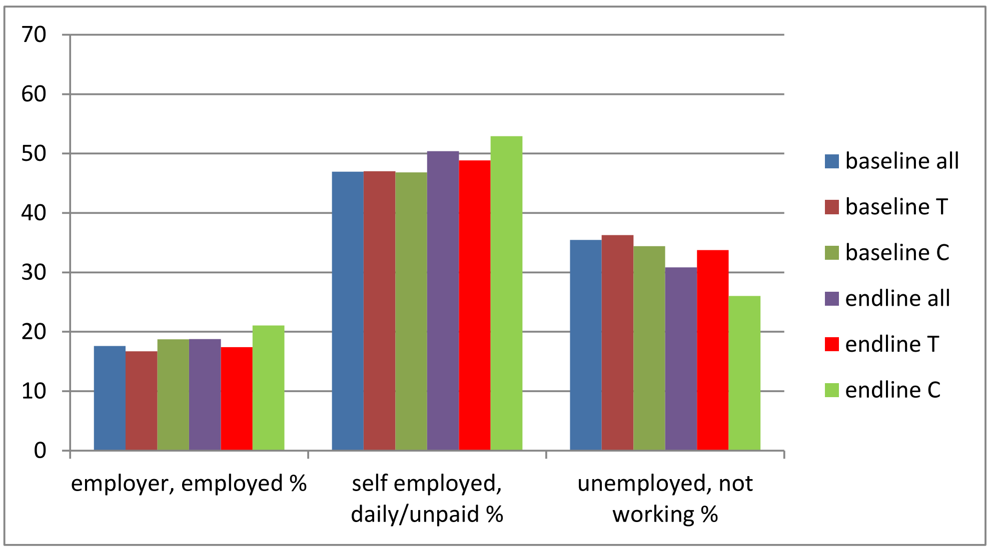


Figure 2.2: Employment rate of individuals 14-18 by gender

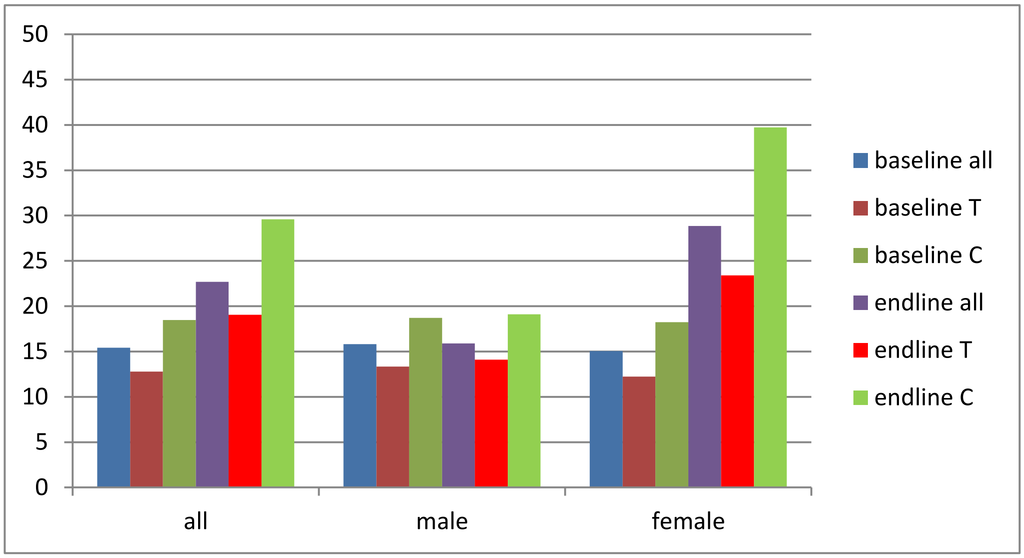


Figure 2.3: Distribution of number of micro-enterprises in the endline

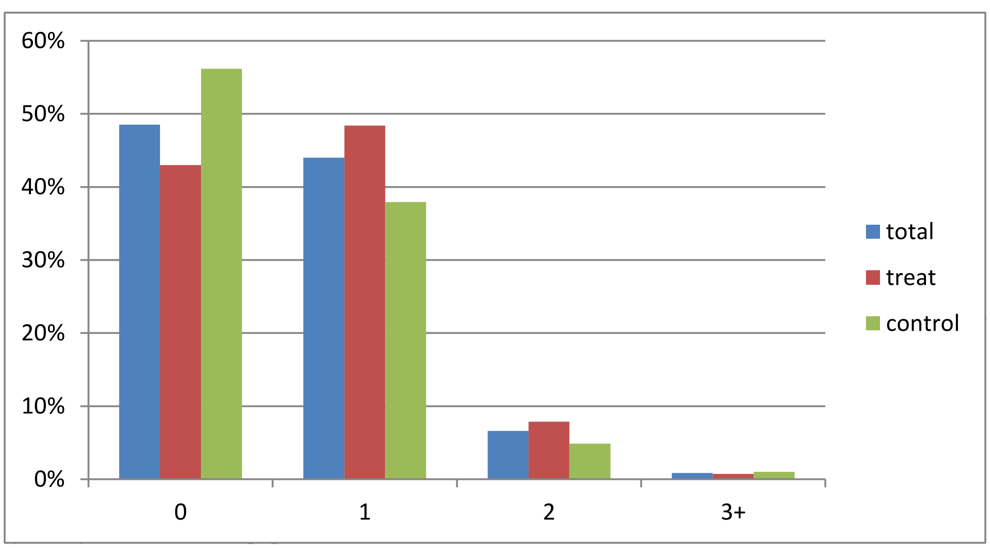
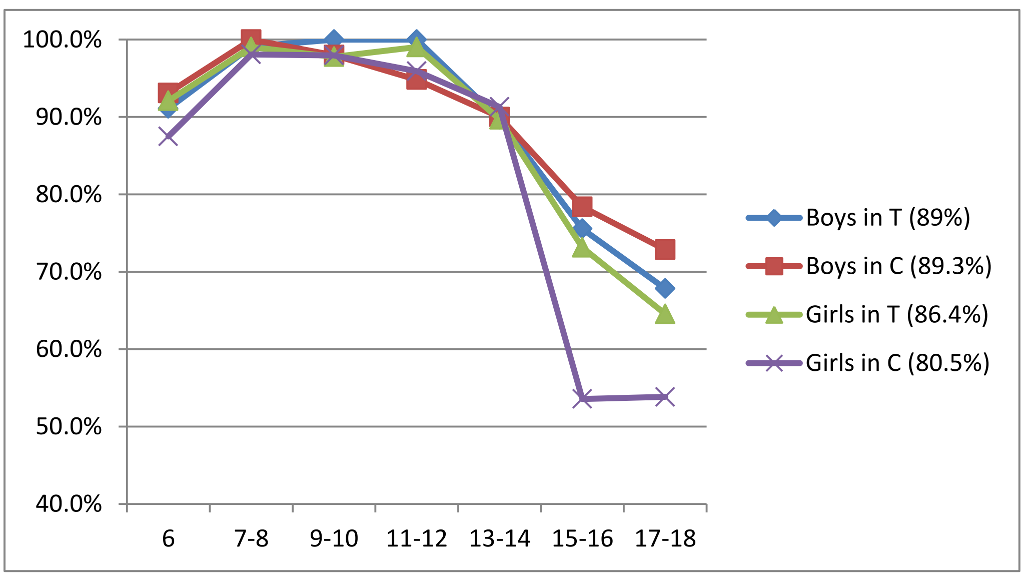


Figure 2.4: School enrollment rate by age and gender



Chapter 3

INTRA-HOUSEHOLD BARGAINING AND CHILD LABOR: EVIDENCE FROM INDIA

3.1 Introduction

Child labor is an age-old phenomenon and of enormous importance in the contemporary world. The latest estimates indicate that 11–15% of the world's children are child laborers (ILO-IPEC 2013; UNICEF 2014b). According to the International Labour Office (2013), the largest absolute number of child laborers is found in the Asia and the Pacific region but Sub-Saharan Africa continues to be the region with the highest incidence of child labor with more than one in five children in child labor. Child labor may deprive children of their childhood and time for education. Moreover, children who are engaged in hazardous work or working under unhygienic conditions are exposed to high risks of health, safety and moral development.

With an estimated 12.6 million children engaged in hazardous occupations, India has the largest number of child laborers under the age of 14 in the world (UNICEF 2014a). Recently, the Government of India passed new legislations and established new administration unit to deal with issues related to child labor. However, basic legal protections for children remain weak. Legislation to prohibit work for children under the age of 14 and to proscribe hazardous work for children under 18 has been introduced in Parliament but has yet to be passed. The worst forms of child labor continue to exist in many sectors, particularly in dangerous activities in agriculture and the manufacturing of goods in the informal economy, according to the US Department of Labor's Bureau of International Labor Affairs (2013).

While the existence of child labor is frequently condemned as odious and immoral[1],

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[1] Some studies examine the relation between education and child labor and find that the two activities are not always mutually exclusive, and there may be important complementarities between them. In some cases, working actually makes it possible for the children to go to school. Hence, a restricted amount of child labor and schooling can actually be complementary. See Basu (1999) for a comprehensive review.

the real issue is to better understand the determinants of child labor so as to evaluate its welfare implications (Baland and Robinson 2000). Intra-household bargaining models have been widely used to examine parental investment in children. In this paper, I utilize the Hindu Succession Act Amendment (HSAA) in India as a source of exogenous variation in woman's unearned income to study how a mother's bargaining power can affect child labor. An instrumental variable strategy is used to deal with the endogenous timing of marriage.

This paper contributes to the literature by understanding the causes of child labor and the consequences of the reform to women's inheritance rights. I find that the increase in mothers' bargaining power is associated with a lower probability of child labor, and this negative impact is especially strong for teenage daughters. A daughter of 12 to 14 years old is less likely to be counted as working by 30 percentage points and is less likely to do family work by 20.6 percentage points if her mother is exposed to the HSAA. The HSAA also has differential impact for different families and seems to generate more child labor reduction for the more disadvantaged– poorer and larger families.

The rest of the paper proceeds as follows. Section 2 summarizes the related literature. Section 3 presents the theoretical framework. Section 4 describes the data and empirical strategy that I use to test the collective model's predictions. Section 5 presents the results. Section 6 concludes.

3.2 Literature Review

This paper examines the impact on child labor from the change in intra-household bargaining power due to the Hindu Succession Act Amendment (HSAA). Therefore, the related literature can be put into three categories. First, the consequences of the reforms to women's inheritance rights. Second, the impact of intra-household bargaining power on outcomes related to children. Third, the causes of child labor.

Previous literature has examined the Hindu Succession Act Amendment (HSAA) and other reforms to women's inheritance rights. Roy (2008) finds that the HSAA increases women's autonomy within their marital families. Deininger et al. (2013) and Roy (2013) both find positive impact on education for girls. Heath and Tan (2013) find that the HSAA increases women's autonomy and labor supply, particularly into high-paying jobs. On the other hand, Anderson and Genicot (2014) finds that the HSAA increases the incidence of wife beating, and Rosenblum (2014) finds that the HSAA caused an increase in female child mortality because giving daughters inheritance rights increases the cost of daughters. In other countries, studies find that inheritance law reforms decreased the use of son-biased fertility stopping rules (Carranza 2012) and increased women's education and bargaining power (Harari 2013).

The distribution of intra-household bargaining power has been used to study various resource allocation within a household. Traditionally, each household is treated as a single agent maximizing a single utility function for the household as a whole. This unitary approach ignores the different preferences of individual household members and violates the individualism, which is the foundation of microeconomic theory. Both theoretical and empirical research have challenged the unitary models. A lot of research finds that the bargaining power between parents affects how parents allocate resources on their children. The seminal paper of Lundberg et al. (1997) shows that when the household allowance for children to be handed over to the women, instead of men, there was a rise in the expenditure on children's clothing. Other studies examine the impact of bargaining power on children's welfare, including child health (Allendorf 2007; Atkin 2011; Duflo 2003; Ghuman 2003; Maitra 2004; Pitt et al. 2003; Thomas et al. 2002), use of prenatal and delivery care (Beegle et al. 2001), and children's education (Rangel 2006; Afridi et al. 2012).

Research on child labor is enormous and scattered across disciplines. Rosenzweig and Evenson (1977) make one of the first attempts to construct a formal model to study child labor. Their one-period model illustrates joint family decisions concerning fertility and the allocation of male and female child time to schooling and work activities. Their empirical findings from rural India indicate that when variables positively associated with the economic contribution of children have high values, namely when size of landholdings, farm productivity and child wage rates are higher, child labor and fertility increase while education decreases. Basu and Van (1998) present a model showing multiple equilibria by assuming that (i) child labor only occurs if adult wage is too low, and (ii) adult labor and child labor are perfect substitutes. They argue that the mass phenomenon of child labor does not reflect the selfishness of parents wanting to enjoy more leisure time while their children work, but rather that poverty compels them to send their children to work. Baland and Robinson (2000) build a model to show that child labor is inefficient, and a small ban on child labor may improve the efficiency. Ersado (2005) utilizes data from Nepal, Peru, and Zimbabwe and suggests that increasing adult educational level and wage will help curb the prevalence and intensity of child labor. More recently, Bharadwaj et al. (2013) find that after India's child labor ban, child labor actually increases, child wages decrease, and school enrollment decreases. Microfinance, one of the most popular interventions for poverty alleviation, has been proved to both mitigate and increase child labor (see reviews such as Doorn and Churchill (2004) and Blume and Breyer (2011)). Furthermore, Lakdawala (2011) finds that the expanded access to credit increases child labor in households at the middle of the wealth distribution. See Basu (1999) and Edmonds (2007) for more reviews of theoretical ideas, data challenges, empirical evidence, and policy debates.

A few studies have examined the relationship between intra-household bargaining and child labor. Basu and Ray (2002) and Basu (2006) use collective models to show that child labor can initially decline and then rise again as the mother's power rises. Galasso (1999) uses data from Indonesia and finds that as the share of household assets owned by the mother increases, child labor of girls falls but that of boys does not. However, when the sample is split further along ethnic lines, mother's assets at marriage have about an equal effect on the child labor of boys and girls. Reggio (2011) uses data from Mexico and finds that an increase in a mother's bargaining power is associated with fewer hours of work for her daughters but not for her sons. While the above papers estimate bargaining power from household survey information, I use an exogenous legislation change to capture the change in bargaining power.

3.3 Theoretical Framework

Becker and Lewis (1973) introduce a simple quantity-quality trade-off model to analyze parental investments in children. Fan (2004) modifies the Becker-Lewis model to include child labor into analysis. The household solves the following problem:

$$\max U = U(c, n, s) \tag{3.1}$$

s.t.

$$c + n(\pi + \alpha c) + sb = w + (n - s)w_c \tag{3.2}$$

where c is consumption of material goods, n is the total number of children, and s is the number of educated children. π denotes the constant cost of raising a child so $\pi + \alpha c$ represents each child's consumption, which is assumed to be equal across children and each child's consumption is related to the level of his or her parents' consumption by parents' altruism toward children (α). b is the cost of education. The wage rates of adults and children are denoted by w and w_c, respectively.

This type of models suggests that the productivity of child labor is crucial in determining whether parents will send some children to work. Higher productivity also increases fertility (Rosenzweig and Evenson 1977). In the case of the HSAA, changes in mother's autonomy should not influence child labor if the productivity of child labor does not change. However, this model of a unitary household obscures the potentially divergent goals of men and women regarding the number and treatment of children as women bear all the physical risks of childbirth and provide most of the effort required to raise children (Bardhan and Udry 1999). Therefore, I use a intra-household bargaining model instead.

Following Reggio (2011)'s collective model, I consider a general household's utility maximization problem, for a household that lives two periods and consists of two parents and one child. Children do not make decisions, and fertility and living arrangements issues are not considered at this stage. The household makes Pareto efficient decisions.

$$\max_{c_1,c_2,l_f,l_m,h,s} \sum_{t=1}^{2} \lambda U_{mt}(c_t, l_f, l_m, h, z) + (1-\lambda)U_{ft}(c_t, l_f, l_m, h, z) \tag{3.3}$$

s.t.

$$c_1 + \tau e + s = \sum_{p=m,f} A_p + \sum_{p=m,f} w_p(1 - l_p) + w_c h \tag{3.4}$$

$$c_2 = (w - w_c)e + w_c + Rs \tag{3.5}$$

and

$$h + e + l_c = 1 \tag{3.6}$$

where U_m and U_f denote mother's and father's utility respectively. λ corresponds to wife's weight in the household utility function. The term c_t denotes the aggregate consumption in period t. The leisure of parent p is denoted by l_p. Both parents care about the child's welfare, affected by the time allocation between education (e), work (h) and leisure of the child (l_c). Specifically, parents get disutility from sending the child to work. Finally, z is a vector containing the individual, household and community characteristics that affect parent's utilities.

In the first period, household's income comes from parents' nonlabor income (A_p), parents' labor income ($w_p(1-l_p)$) and from their child's labor ($w_c h$).[2] The price of the consumption goods is normalized to one. The term τ represents the cost of sending the child to school. In the second period the child works and her salary depends on the education received in the first period. The child's wage in the second period is $(w-w_c)e+w_c$. The wage increases with the amount of child's education. For example, if the child does not attend school in the first period, her salary remains constant at w_c. The household also gets income from first period savings: s denotes savings and R the gross return on the household wealth. The intertemporal household budget constraint is obtained by combining the budget constraints for both periods. It is given by:

$$c_1 + \frac{c_2}{R} + (\tau - \frac{w - w_c}{R})e = \sum_{p=m,f} A_p + \sum_{p=m,f} w_p(1-l_p) + w_c h + \frac{w_c}{R} \tag{3.7}$$

and the time constraint for the child is equation (3.6).

Solving this model generates two testable hypotheses. First, if the parent with larger marginal disutility for child labor has more power, the model predicts that child labor decreases with this parent's bargaining power. Second, if the parent with larger marginal utility for consumption also has more power, the model predicts that child labor increases with this parent's bargaining power.

[2] Households who work on agriculture production might not receive nominal wage as wage labor and might face a different budget constraint. Here we assume the returns in agricultural production can be treated as wages in this model. The data used in this paper do not provide wage information. Parental education is used as a proxy for potential wages of parents and discussed after the main results.

3.4 *Empirical Strategy*

3.4.1 Background on the Hindu Succession Act Amendment

Hindu Succession Act Amendment (HSAA) is the legal reform used for identification in this paper. Traditionally, Indian women were allowed to inherit ancestral property from fathers or late husbands only in the absence of male heirs. The Hindu Succession Act of 1956 unified different traditional schemes and clarified women's rights to inherit their father's "separate property" and his "notional" portion of joint family property, but continued to leave women out of the inheritance of "joint family property". Since land is the most common form of property in rural areas and is typically family-owned, such biased rights create significant gender discrimination.

Although the Hindu Succession Act of 1956 is a central law, the Indian constitution grants both the federal and state governments legislative authority over inheritance. In subsequent years, various states enacted amendments that explicitly granted daughters direct inheritance rights and the right to a share by survivorship in joint family property, equal with their brothers. Table 3.1 presents the timing in different states. For more details about the reform, see Agarwal (1994), Deininger et al. (2013), Heath and Tan (2013), Rosenblum (2014) or Roy (2013).

These reforms only applied to women who are Hindu, Buddhist, Sikh or Jain, and only to women who were not yet married at the time of the reform. Deininger et al. (2013) and Roy (2013) both find that women affected by the HSAA are more empowered through increasing education or dowries.[3] Heath and Tan (2013) show that the reform increased a woman's autonomy, and their results coincide with other programs estimating the effects of women's property rights or inheritance rights on her autonomy (Wang 2013; Roy 2008).

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[3] The direct impact on women's propensity to inherit actually remains controversial. Although Deininger et al. show that HSAA increased the likelihood of land inheritance by 15 percentage points, Roy finds no significant impact on women's propensity to inherit. Roy argues that the main reason for this difference is that Deininger et al. use the variation in the timing of death of the father of the woman to define treatment status. This definition might just reflect the fact that fathers who lived longer were more likely to acquire land during India's rapid economic growth and leave a share to their daughters.

3.4.2 Identification Strategy

I follow Heath and Tan (2013) to estimate the program effects using an instrumental variable approach. This is because the exposure to the program is determined by year of marriage, which is an endogenous choice. If the timing of marriage responded to the HSAA, an OLS estimate of treatment effects would capture this selection. This instrumental variable approach uses only variation in a woman's religion, year of birth, and state, which are predetermined at the time of the law change, to predict her exposure to the treatment.

In the first stage, that mother i's treatment status is instrumented by the fixed effects for each religion (r) - year of birth (τ) - state (j) cell:[4]

$$T_{ijr\tau} = \delta_{jr\tau} + \upsilon_{ijr\tau} \tag{3.8}$$

In the second stage, I assume that child k's outcome is a function of his or her mother's fitted probability of treatment, child and family characteristics ($X_{kijr\tau}$), as well as fixed effects for mother's year of birth, religion, and state and double interactions between year of birth and religion, year of birth and state, and state and religion:

$$y_{kijr\tau} = \beta \hat{T}_{ijr\tau} + X_{kijr\tau} + \theta_\tau + \upsilon_r + \varphi_j + \gamma_{r\tau} + \lambda_{j\tau} + \mu_{jr} + \epsilon_{kijr\tau} \tag{3.9}$$

$y_{kijr\tau}$ is the outcome variable of child k born to mother i. The outcome variables of interest include the status of working, the number of working hours for children who are working, and the status of school enrollment. For the binary variable of child labor, I use the definition of child labor according to the UNICEF. A child is considered to be involved in child labor under the following conditions: (i) children 5 to 11 years old who, during the reference week, did at least one hour of economic activity or at least 28 hours of household chores, or (ii) children 12 to 14 years old who, during the reference week, did at least 14 hours of economic activity or at least 28 hours of household chores. Binary variables of

[4]There are 1,914 dummies (29 states × 33 years of birth × 2 religions) in the child labor sample. Following Heath and Tan (2013), I use the criteria of weak instruments suggested by Stock et al. (2002): the first-stage F statistic must be exceeding 10 for TSLS inference to be reliable. The F statistic in my first stage is 79.75 so weak instruments should not be a major concern in this case.

whether a child is engaged in non-household work, household chores, and family work are also analyzed. For working hours, I use a Heckman selection model (Heckman 1976) to estimate the impact.

The coefficient of interest is β. If we assume mothers have larger marginal disutility for child labor, the sign of β should be negative when y indicates child labor, and the sign of β should be negative when y indicates school enrollment. $X_{kijr\tau}$ includes the child's gender and age, the residence being urban or rural, and a dummy variable for the month of survey. The coefficient for living in urban areas is expected to be negative since children tend to work more in rural than urban areas (Edmonds 2007). The month of survey is considered to avoid biased estimates due to seasonal differences.

3.4.3 Data

I use the latest Indian National Family Health Survey (NFHS-3, 2005-2006) to test the theoretical predictions. NFHS-3 is the third in a series of national surveys. Earlier NFHS surveys were carried out in 1992-93 (NFHS-1) and 1998-99 (NFHS-2). The NFHS is designed along the lines of the Demographic and Health Surveys (DHS) that have been conducted in many developing countries around the world. All three surveys were conducted under the stewardship of the Ministry of Health and Family Welfare, Government of India, with the International Institute for Population Sciences, Mumbai, serving as the nodal agency. The data is nationally representative with a large sample size: 45,073 children of 5 to 14 years old with parental information from 22,816 families. The survey includes year of marriage, state of residence,[5] and religion, which are used to determine a mother's treatment status.

Table 3.2 reports the summary statistics for children between 5 and 14 years old. Boys are 4 percentage points more than girls. 43% of the sample live in urban areas. Fathers have 2.2 more years of education than mothers on average. 13% of the mothers in the sample have the inheritance rights according to their state of residence and year of marriage. 9% of

[5] The exposure to the inheritance rights reform was jointly determined by a woman's state of birth and year of birth. Unfortunately, NFHS does not contain information on an individual's state of birth so the state of residence is used instead. Fortunately, Roy (2013) finds that inter-state migration of females is relatively low. Heath and Tan (2013) also show that their main results on female labor supply are driven by women who came to their current place "after marriage" instead of "before or at the time of marriage". These findings provide some reassurance that selective migration should not be a critical concern.

the children was considered working in the past week. 6% worked for someone who is not a member of this household. 52% helped with household chores, such as shopping, collecting firewood, cleaning, fetching water, or caring for children. 5% did other family work, such as work on the farm or in a business, or selling goods on the street. For children who reported working hours, the average hours of working in a week are about 12 hours for non-household members, 9 hours for household chores, and 13 hours for other family work. 76% of the children are currently attending school.

Table 3.3 presents the rates of child labor participation and school enrollment by age and gender. For both boys and girls, older children are more likely to work. A drop at age of 12 is probably due to the stricter definition of child labor from age of 12. The school enrollment increases by age at the beginning, peaks at 11 years old and then decreases.

3.5 Results

3.5.1 Main Results

A. Probability of working

The main results are estimated by equation (3.9) and reported in Table 3.4. The first column shows the OLS estimation for comparison. The remaining columns present the estimation using the instrumental variable approach. From the third column, the samples are restricted to older children given the assumption that the labor supply of older children can be more elastic. This assumption is partially supported by Table 3.3, where older children are consistently more likely to work. The third column examines children who are 10 years old or above. The age of 10 is selected due to the significant jump in percentage of child labor. This cut-off point also allows my results to be more comparable with Reggio (2011), who only examines children between 10 and 14 years old. The last three columns examine children who are 12 years old or above. This cut-off point is chosen because the UNICEF definition treats children of 12 to 14 years old with a stricter criteria of being working. As shown in Table 3.3, girls who are 12 to 13 years old are more likely to work than boys of the same age, the fifth and sixth columns report results for boys and girls, respectively, to capture potential gender differences.

In Table 3.4, across all specifications, children of mothers exposed to the HSAA are significantly less likely to work. All children are 5.1 percentage points less likely to work. Children who are 10 years old and above are 8.8 percentage points less likely to work. This impact is especially strong for children who are 12 to 14 years old. When both genders are pooled, children are 21.3 percentage points less likely to work.[6] The boys are 11.4 percentage points less likely to work, which is insignificant but still stronger than younger children. The girls are significantly less likely to be working by 30 percentage points. This stronger effect for girls is consistent with previous studies showing that mothers prefer to devote resources to improving the nutritional status of their daughters (Thomas 1990), and women's nonlabor income has a positive impact on the health of her daughter but not on her son's health (Thomas 1994).

B. Different work types

Table 3.5 breaks work into three categories: work for non-household members, household chores, and other family work. For children at all ages, children of mothers exposed to the HSAA are less likely to work,[7] but the impact is only significant for doing family work. A child is 5.4 percentage points less likely to do family work. The reduction is stronger for children who are 12 to 14 years old (by 17.1 percentage points), especially for daughters (by 20.6 percentage points).

Regarding other demographic characteristics, boys are more likely to work for non-household members and to do other family work. Girls are more likely to do household chores. Older children are more likely to work, and urban children are less likely to work, which is consistent with the literature (Edmonds 2007).

Table 3.6 reports the estimation for the hours of working, using the Heckman selection model. Consistent with Table 3.5, boys spend longer hours on non-household members and other family work, while girls work for more hours in household chores. Older children work longer, especially for non-household work. Compared with rural children, urban children

[6]Children are less likely to work by 21.3 (16.7) percentage points if the sample is restricted to children who are 13 (11) years old and above. Detailed estimations are available upon request.

[7] For children 12 years old or above, the coefficient of non-household work is small (0.013) and insignificant.

work for fewer hours in household chores and for about the same time in other work. The interpretation for mothers exposed to the inheritance law reform is challenging. Children of these mothers work almost 20 hours more for non-household members. This puzzling result might coincide with previous research showing that the child labor response to higher power of mother is U-shaped, where child labor will rise again beyond a point. Previous studies (Basu and Ray 2002; Basu 2006) argue that when one parent has most of the power, child labor is more attractive since the extra income can be allocated to the consumption of the powerful parent's favorite goods.

I also restrict the sample to children who are 10 years old and above to compare with the results of Reggio (2011). Surprisingly, a mother's exposure to the HSAA does not decrease the hours of child labor. Treated children work longer for non-household work and work shorter for household chores and family work, but none of the impact is significant. My findings here show that the HSAA decreases the child labor along the extensive margin but not the intensive margin. The results of non-household work coincide with Reggio (2011), who argues that when children work for significant number of hours, for pay, outside the home, the decision seems to be made by both parents or be determined by variables other than the distribution of power within the household.

C. School enrollment

Table 3.7 reports the estimation for school enrollment in the same order of Table 3.4. Boys and urban children are more likely to be in school than girls and rural children. For children of 10 to 14 years old, older children are less likely to be attending school. This is consistent with Table 3.3, where school enrollment increases by age, peaks at 11 years old and then decreases. Mother's exposure to the HSAA has a positive impact on school enrollment. The impact is small and insignificant for the whole sample but strong and significant for older children. Children of 10 to 14 years old are 9.9 percentage points more likely to be enrolled, and children of 12 to 14 years old are 13 percentage points more likely to be enrolled. The impact is the strongest for boys of 12 years old and above, who are 20 percentage points more likely to be attending school.

The fact that the HSAA does increase the school enrollment for girls who are 12 to 14 years old might contradict with Deininger et al. (2013) and Roy (2013), who both show that the HSAA increases girls' education. Since both studies examine women who were directly affected by the HSAA and have completed their education, it is possible that the the direct effect of the HSAA is stronger than the indirect effect through a more empowered mother.

If we consider more schooling and less child labor as household public goods, the findings here support Heath and Tan (2013)'s theoretical prediction that the HSAA will increase the supply of the household public good. Their empirical finding shows that the HSAA leads to decreases in anemia for children under 5 years old. Here we see that the public good effect extends to older children by reducing child labor and increasing schooling.

3.5.2 Discussion

A. Fertility and wealth

There are a few other potential channels which can affect child labor. The first factor to consider is the fertility decision. Heath and Tan (2013) find that the HSAA decreased the fertility, which coincides with other research showing that higher female bargaining power leads to fewer children in Brazil (Klawon and Tiefenthaler 2001), Malaysia (Rasul 2008), and Indonesia (Varanasi 2010). The number of children can lead the child labor to two opposite directions. A larger household may increase the manpower of the household, decrease each person's workload, and release some children from child labor. On the other hand, more children might incur more household tasks, such as child care, which are often undertaken by elder siblings, especially elder sisters. In two empirical studies (Patrinos and Psacharopoulos 1995, 1997), Patrinos and Psacharopoulos show that the number of siblings increases child labor.

Table 3.8 examines the differential impact of mother's exposure to the HSAA in smaller families and larger families.[8] Among smaller families, treated children are more likely to work: 5.2 percentage points for all children and 26 percentage points for boys who are 12 to 14 years old. In contrast, among larger families, treated children are less likely to work: 27.3 percentage points for all children, 70.8 percentage points for teenage boys and 65.6

[8] Families with no more than 4 children are considered smaller families. 74% of the children and 83% of the families in our sample belongs to smaller families.

percentage points for teenage girls. Understanding the resources allocation among siblings through birth order (Ejrnaes and Pörtner 2004; Emerson and Souza 2008) should shed more light on this differential impact. Unfortunately, the birth order information is missing for most of our sample: only 290 out of 45,073 children have birth order information. Future research may deal with the issues of endogeneity and see whether and how birth order may drive the results presented above.

The second factor is the family wealth status. In Basu and Van (1998), they argue that children will only work when the household is too poor so higher family wealth should decrease child labor. In the case of the HSAA, if the mother actually received more inheritance from her father, there will be an increase in family wealth. However, for part of the sample, we might only be able to capture the effect of an "expected" increase in wealth because this increase would only occur if the mother's father has already died. Besides, the family wealth might be negatively affected by the father's sisters who are eligible for the HSAA, but the NFHS-3 does not have information about the father's sisters. Furthermore, since both the wealth and mother's autonomy would decrease child labor, it is hard to disentangle these two effects.

Given the available information, I examine the differential impact of mother's exposure to the HSAA by family wealth status. The sample are divided into 5 categories: the poorest, poorer, middle, richer, and the richest families according to the NFHS-3 wealth index, which was constructed by taking the sum of household assets and using weights generated by principal components analysis. Table 3.9 shows that children in the poorest families experience the largest reduction of child labor by 20.6 percentage points, while children in richer families are more likely to work when their mothers are exposed to the HSAA.

When we look at Tables 3.8 and 3.9 together, it seems that the HSAA generates greater benefits for the more disadvantaged– children in larger and poorer families. Table 3.10 confirms that mothers in poorer families tend to give more births than richer families so the child labor reduction in Tables 3.8 and 3.9 might be driven by the same group of people. However, since the sample I use here only includes children who are 5 to 14 years old, the numbers of observation by wealth status indicate that there are fewer children of this age in the poorest families and more children outside of this age range than wealthier families. Future research might examine the age structure within families in more detail to see how that might affect child labor.

There are some potential reasons for the stronger impact in poorer and larger families. First, it is possible that mothers in poorer and larger have lower bargaining power initially. If we assume that the marginal benefit decreases when the level of bargaining power increases, we should see greater benefits for mothers with lower initial bargaining power. Second, it is possible that the poorer children and richer children participate in different types of work. Children from poorer families are more likely to work to sustain the family while children from richer families might do “work” which has more social and educational benefits. Given the different nature of work, when mothers in richer families get more power, they might encourage children to do more work, but more empowered mothers in poorer families might pull children out of work. It will be ideal to test this hypothesis with data which contain more detail information about the content of work.

B. Robustness checks

Similar to the wealth hypothesis, parental wage rates might have to be considered. In Basu and Van (1998), they argue that children will only work when parents' wages are too low. Since the NFHS-3 data do not provide wage information, I use parental education as a proxy for potential wages of parents.

Whether the mother works away from home can also drive the child labor into two opposite directions. On the one hand, if the mother works away from home, child labor, especially household chores, may increase because children who stay home have to take care of household chores. On the other hand, if mothers who work away from home earn more income, children may work less because the family gets wealthier.

The above concerns – number of living children, parental education, wealth, and whether the mother works away from home – are added as controls into the original estimation as a robustness check. The results are reported in Table 3.11 and are similar to the results before adding controls. As expected, more educated fathers and higher wealth are associated with lower child labor. Having more children seems to generate more needs than manpower so child labor rises. The higher income earned by mothers who work away from home is not enough to reduce child labor.

Another robustness check is performed by excluding the state of Jammu and Kashmir. Agarwal (1994) points out that the Hindu Succession Act of 1956 does not apply to state of Jammu and Kashmir. Because the Jammu and Kashmir HSA 1956 contains most of the provisions of the HSA 1956, I keep this state in the main analysis but exclude it for robustness check. The results in Table 3.12 are almost identical to Table 3.4 so the inclusion of Jammu and Kashmir should not be a concern.

C. Questions for future research

In addition to the factors discussed above, several issues await further examination. The first issue is how to incorporate the landowning status of households into the analytical framework. Whether the household owns land or not should be considered for at least two reasons. First, children in households with land are probably more likely to participate in family work, which includes work on the farm. Second, in the context of HSAA, women in landowning households are most relevant to the reform and experienced a larger increase in education than women in non-landowning households (Roy 2013). Although the data do not reveal whether the mother came from a landowning household, the landowning status of the child's household is available and should be utilized with care.

The second issue is how mothers allocate their own time. Heath and Tan (2013) find that the HSAA increases women's labor supply, but the NFHS-3 data do not have information about the hours of working outside and working at home, such as for child care and other home production. Besides, if a more empowered mother starts to run her own microenterprise, child labor might increase due to the higher labor demand of family work. Future research may use more detailed data to study mother's time allocation and its impact on child labor.

The third issue is child mortality. Although many studies show positive influences on girls through the HSAA, Rosenblum (2014) finds that the female child mortality increases. Future research may explore how this might change the child labor through channels such as the sex compostion of children or the family size.

3.6 Conclusion

By using the exogenous variation in women's unearned income due to the HSAA, I find that the increase in mothers' bargaining power is associated with a lower probability of child labor, and this negative impact is especially strong for teenage daughters. A daughter of 12 to 14 years old is less likely to be counted as working by 30 percentage points if her mother is exposed to the HSAA. After dividing work into non-household work, household chores, and family work, the treated mothers only show significant difference for children doing family work, and the reduction is especially strong for daughters of 12 to 14 years old. The HSAA also increases school enrollment. These results reject the unitary model and are consistent with the model and previous empirical studies by Galasso (1999) and Reggio (2011).

I also find interesting differential impact for families of different sizes and wealth levels. When mothers are exposed to the HSAA, children in larger families are less likely to work while treated children in smaller families are more likely to work. Children in the poorest families experience the largest reduction of child labor while children in richer families are more likely to work. This differential impact might be driven by the dinimishing marginal benefit of bargaining power or different types of work chosen by children in different families. The exact mechanism awaits further investigation.

The findings of this paper suggest that reforms which increase women's bargaining power can reduce child labor, especially for the more disadvantaged – teenage daughters, larger families, and poorer families. This result is most relevant to countries where poverty and child labor is high and women have lower status and education attainment. In situations where direct bans on child labor is not feasible or more likely to generate perverse consequences (Bharadwaj et al. 2013), policies targeting women's empowerment may have spillover effects on child labor.

Tables

Table 3.1: The Timing of HSA Amendments

Year	State
1976	Kerala
1986	Andhra Pradesh
1989	Tamil Nadu
1994	Maharashtra and Karnataka
2005	all states

Table 3.2: Summary Statistics (N = 45,073)

Variable	Mean	Std. Dev.
child's gender (male=1)	0.52	0.50
child's age	9.36	2.83
attending school	0.76	0.42
urban	0.43	0.50
mother's years of schooling	4.12	4.85
father's years of schooling	6.31	5.07
wealth	-0.18	0.95
owns land	0.44	0.50
mother works away from home	0.39	0.49
number of living children	3.67	1.70
mother's treatment status (treated=1)	0.13	0.34
in the past week...		
child was working*	0.09	0.29
worked for non-hh member	0.06	0.24
for ... hours (2,656 reported)	12.16	20.64
helped with hh chores	0.52	0.50
for ... hours (23,252 reported)	8.93	8.55
did other family work	0.05	0.23
for ... hours (2,423 reported)	12.86	13.64

Notes:
* A child is considered to be involved in child labor under the following conditions: (i) children 5 to 11 years old who, during the reference week, did at least one hour of economic activity or at least 28 hours of household chores, or (ii) children 12 to 14 years old who, during the reference week, did at least 14 hours of economic activity or at least 28 hours of household chores.

Table 3.3: The Percentage of child labor and school enrollment by age

	child labor		school enrollment	
child age	girls	boys	girls	boys
5	3%	3%	26%	24%
6	4%	4%	53%	52%
7	6%	6%	76%	77%
8	8%	8%	85%	86%
9	9%	11%	89%	91%
10	14%	13%	87%	92%
11	14%	14%	90%	94%
12	11%	9%	85%	90%
13	14%	12%	82%	87%
14	15%	15%	80%	82%
Total	9%	9%	75%	77%

Table 3.4: Child work

	OLS	IV-all	IV 10+	IV 12+	IV-boys 12+	IV-girls 12+
treat	-0.010	-0.051***	-0.088**	-0.213***	-0.114	-0.300***
	(0.009)	(0.020)	(0.039)	(0.051)	(0.071)	(0.072)
male	-0.004	-0.004*	-0.010**	-0.017***		
	(0.004)	(0.002)	(0.004)	(0.004)		
child age	0.017***	0.018***	0.007***	0.038***	0.039***	0.038***
	(0.001)	(0.000)	(0.002)	(0.003)	(0.004)	(0.005)
urban	-0.046***	-0.046***	-0.080***	-0.090***	-0.069***	-0.106***
	(0.006)	(0.003)	(0.005)	(0.006)	(0.008)	(0.008)
mean dep var	-0.082	-0.082	0.367***	-0.040	0.032	-0.511***
	(0.115)	(0.112)	(0.120)	(0.133)	(0.149)	(0.174)
N	45,073	45,073	21,773	13,054	6,900	6,154

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
All IV regressions have treatment instrumented by fixed effects for Hindu X year of birth X state and include a dummy for Hindu and fixed effects for year of birth, state, month of survey, Hindu X year of birth, Hindu X state, and state X year of birth. The Hindu dummy also includes Sikhs, Buddhists, and Jains, as described in section 4. All regressions include sampling weights. Boostrap standard errors in brackets, clustered at the level of the primary sampling unit.

Table 3.5: Non-household work, household chores, and family work

	non-hh work all	12+	hh chores all	12+
treat	-0.017	0.013	-0.057	-0.095
	(0.016)	(0.056)	(0.043)	(0.079)
male	0.008***	0.026***	-0.133***	-0.181***
	(0.002)	(0.005)	(0.004)	(0.007)
child age	0.010***	0.010***	0.072***	0.012**
	(0.000)	(0.003)	(0.001)	(0.005)
urban	-0.004	-0.018***	-0.071***	-0.091***
	(0.002)	(0.005)	(0.005)	(0.009)
mean dep var	0.107	0.299**	-0.111	0.697***
	(0.094)	(0.132)	(0.143)	(0.157)
N	45,073	13,054	45,073	13,054
	family work all	**12+**	**boys 12+**	**girls 12+**
treat	-0.054***	-0.171***	-0.060	-0.206***
	(0.014)	(0.042)	(0.074)	(0.055)
male	0.020***	0.051***		
	(0.002)	(0.005)		
child age	0.018***	0.022***	0.027***	0.011***
	(0.000)	(0.004)	(0.004)	(0.004)
urban	-0.056***	-0.116***	-0.121***	-0.106***
	(0.002)	(0.005)	(0.008)	(0.007)
mean dep var	-0.430***	-0.399***	-0.599***	-0.126
	(0.055)	(0.083)	(0.143)	(0.105)
N	45,073	13,054	6,900	6,154

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
All IV regressions have treatment instrumented by fixed effects for Hindu X year of birth X state and include a dummy for Hindu and fixed effects for year of birth, state, month of survey, Hindu X year of birth, Hindu X state, and state X year of birth. The Hindu dummy also includes Sikhs, Buddhists, and Jains, as described in section 4. All regressions include sampling weights. Bootstrap standard errors in brackets, clustered at the level of the primary sampling unit.

Table 3.6: Hours of working

In the past week, hours worked for	non-household member	household chores	family work
All children:			
treat	19.946***	0.429	-8.105
	(5.859)	(1.207)	(8.268)
male	1.371**	-2.286***	1.140***
	(0.616)	(0.089)	(0.310)
child age	3.537***	1.005***	1.973***
	(0.160)	(0.021)	(0.115)
urban	1.150*	-1.610***	1.557**
	(0.625)	(0.089)	(0.672)
mean dep var	0.674	6.985**	12.062
	(5.428)	(3.305)	(7.363)
N of selected equation	45,073	45,073	45,073
N of hours equation	2,656	23,252	2,423
10 years old and above:			
treat	4.528	-3.459	-5.285
	(7.557)	(2.510)	(8.492)
male	1.324*	-3.039***	1.360***
	(0.778)	(0.118)	(0.355)
child age	5.909***	1.119***	2.195***
	(0.353)	(0.052)	(0.205)
urban	0.845	-2.112***	1.849**
	(0.750)	(0.133)	(0.738)
mean dep var	-48.506***	9.140***	-10.376
	(7.198)	(2.728)	(11.250)
N of selected equation	21,773	21,773	21,773
N of hours equation	1,767	14,828	1,967

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
All IV regressions have treatment instrumented by fixed effects for Hindu X year of birth X state and include a dummy for Hindu and fixed effects for year of birth, state, month of survey, Hindu X year of birth, Hindu X state, and state X year of birth. The Hindu dummy also includes Sikhs, Buddhists, and Jains, as described in section 4. All regressions include sampling weights. Bootstrap standard errors in brackets, clustered at the level of the primary sampling unit.

Table 3.7: School enrollment

	OLS	IV-all	IV 10+	IV 12+	IV-boys 12+	IV-girls 12+
treat	0.022*	0.017	0.099**	0.130**	0.209**	0.054
	(0.013)	(0.032)	(0.039)	(0.053)	(0.087)	(0.089)
male	0.031***	0.031***	0.062***	0.059***		
	(0.005)	(0.004)	(0.004)	(0.005)		
child age	0.040***	0.039***	-0.033***	-0.040***	-0.041***	-0.042***
	(0.001)	(0.001)	(0.002)	(0.004)	(0.004)	(0.005)
urban	0.034***	0.034***	0.064***	0.079***	0.036***	0.122***
	(0.008)	(0.004)	(0.004)	(0.006)	(0.008)	(0.008)
mean dep var	-0.317*	-0.314***	0.844***	0.885***	0.577***	1.049***
	(0.176)	(0.107)	(0.118)	(0.139)	(0.161)	(0.172)
N	45,073	45,073	21,773	13,054	6,900	6,154

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
All IV regressions have treatment instrumented by fixed effects for Hindu X year of birth X state and include a dummy for Hindu and fixed effects for year of birth, state, month of survey, Hindu X year of birth, Hindu X state, and state X year of birth. The Hindu dummy also includes Sikhs, Buddhists, and Jains, as described in section 4. All regressions include sampling weights. Bootstrap standard errors in brackets, clustered at the level of the primary sampling unit.

Table 3.8: Child labor by number of children

	OLS	IV-all	IV 12+	IV-boys 12+	IV-girls 12+
4 or fewer children:					
treat	-0.008	0.052**	0.040	0.260***	-0.110
	(0.009)	(0.023)	(0.055)	(0.068)	(0.095)
male	-0.007	-0.006**	-0.017***		
	(0.004)	(0.003)	(0.005)		
child age	0.013***	0.013***	0.025***	0.021***	0.032***
	(0.001)	(0.001)	(0.004)	(0.004)	(0.006)
urban	-0.045***	-0.046***	-0.086***	-0.065***	-0.105***
	(0.006)	(0.003)	(0.006)	(0.009)	(0.010)
mean dep var	-0.148**	-0.167***	-0.200***	0.839***	-0.378***
	(0.065)	(0.047)	(0.073)	(0.096)	(0.134)
N	33,292	33,292	9,236	5,103	4,133
5 or more children:					
treat	-0.014	-0.273***	-0.664***	-0.708***	-0.656***
	(0.060)	(0.074)	(0.110)	(0.127)	(0.185)
male	0.006	0.005	-0.008		
	(0.008)	(0.005)	(0.012)		
child age	0.028***	0.028***	0.071***	0.093***	0.064***
	(0.002)	(0.001)	(0.006)	(0.010)	(0.009)
urban	-0.038***	-0.038***	-0.085***	-0.082***	-0.088***
	(0.014)	(0.007)	(0.012)	(0.019)	(0.017)
mean dep var	-0.606**	-0.712***	-1.242***	-0.428**	-0.588**
	(0.250)	(0.168)	(0.237)	(0.213)	(0.236)
N	11,781	11,781	3,818	1,797	2,021

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
All IV regressions have treatment instrumented by fixed effects for Hindu X year of birth X state and include a dummy for Hindu and fixed effects for year of birth, state, month of survey, Hindu X year of birth, Hindu X state, and state X year of birth. The Hindu dummy also includes Sikhs, Buddhists, and Jains, as described in section 4. All regressions include sampling weights. Bootstrap standard errors in brackets, clustered at the level of the primary sampling unit.

Table 3.9: Child labor by wealth index

	poorest	poorer	middle	richer	richest
treat	-0.206***	-0.015	-0.019	0.099***	0.033
	(0.079)	(0.065)	(0.044)	(0.036)	(0.032)
male	-0.011*	-0.018***	-0.000	0.005	0.010**
	(0.007)	(0.006)	(0.005)	(0.005)	(0.004)
child age	0.032***	0.028***	0.014***	0.011***	-0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
urban	-0.004	-0.035***	-0.007	-0.014**	-0.021***
	(0.017)	(0.009)	(0.006)	(0.006)	(0.006)
mean dep var	0.041	0.216	1.403***	-0.138	0.087
	(0.114)	(0.207)	(0.163)	(0.164)	(0.111)
N	6,959	8,400	9,508	10,337	9,869

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
All IV regressions have treatment instrumented by fixed effects for Hindu X year of birth X state and include a dummy for Hindu and fixed effects for year of birth, state, month of survey, Hindu X year of birth, Hindu X state, and state X year of birth. The Hindu dummy also includes Sikhs, Buddhists, and Jains, as described in section 4. All regressions include sampling weights. Bootstrap standard errors in brackets, clustered at the level of the primary sampling unit.

Table 3.10: The number of children by wealth status

	mean	std. dev.	obs
poorest	4.37	1.73	6,959
poorer	4.11	1.73	8,400
middle	3.83	1.71	9,508
richer	3.51	1.60	10,337
richest	2.82	1.30	9,869

Table 3.11: Robustness Check – Child work, adding controls

	OLS	IV
treat	0.009	-0.048**
	(0.009)	(0.019)
male	-0.002	-0.002
	(0.004)	(0.002)
child age	0.018***	0.017***
	(0.001)	(0.001)
urban	-0.011*	-0.011***
	(0.006)	(0.003)
mother's education	0.000	0.000
	(0.001)	(0.000)
father's education	-0.001**	-0.001***
	(0.001)	(0.000)
wealth	-0.021***	-0.021***
	(0.004)	(0.002)
number of living children	0.006***	0.006***
	(0.002)	(0.001)
mom works away from home	0.031***	0.031***
	(0.005)	(0.003)
mean dep var	-0.148	-0.143
	(0.108)	(0.117)
N	45,073	45,073

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
All IV regressions have treatment instrumented by fixed effects for Hindu X year of birth X state and include a dummy for Hindu and fixed effects for year of birth, state, month of survey, Hindu X year of birth, Hindu X state, and state X year of birth. The Hindu dummy also includes Sikhs, Buddhists, and Jains, as described in section 4. All regressions include sampling weights. Bootstrap standard errors in brackets, clustered at the level of the primary sampling unit.

Table 3.12: Robustness Check – Child work, excluding Jammu and Kashmir

	OLS	IV-all	IV 10+	IV 12+	IV-boys 12+	IV-girls 12+
treat	-0.010	-0.051***	-0.088**	-0.213***	-0.114*	-0.300***
	(0.009)	(0.019)	(0.043)	(0.048)	(0.059)	(0.069)
male	-0.004	-0.004	-0.010**	-0.017***		
	(0.004)	(0.003)	(0.004)	(0.005)		
child age	0.017***	0.018***	0.007***	0.038***	0.039***	0.038***
	(0.001)	(0.001)	(0.002)	(0.003)	(0.004)	(0.005)
urban	-0.046***	-0.047***	-0.080***	-0.090***	-0.069***	-0.106***
	(0.006)	(0.003)	(0.005)	(0.006)	(0.007)	(0.008)
mean dep var	-0.083	-0.082	0.365***	-0.043	0.028	-0.513***
	(0.115)	(0.119)	(0.123)	(0.125)	(0.148)	(0.138)
N	44,490	44,490	21487	12859	6,788	6,071

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
All IV regressions have treatment instrumented by fixed effects for Hindu X year of birth X state and include a dummy for Hindu and fixed effects for year of birth, state, month of survey, Hindu X year of birth, Hindu X state, and state X year of birth. The Hindu dummy also includes Sikhs, Buddhists, and Jains, as described in section 4. All regressions include sampling weights. Bootstrap standard errors in brackets, clustered at the level of the primary sampling unit.

BIBLIOGRAPHY

Abuya, Benta A., James Ciera, and Elizabeth Wambui Kimani-Murage, "Effect of mother's education on child's nutritional status in the slums of Nairobi," *BMC pediatrics*, January 2012, *12* (1), 80.

Afridi, Farzana, Abhiroop Mukhopadhyay, and Soham Sahoo, "Female Labour Force Participation and Child Education in India: The Effect of the National Rural Employment Guarantee Scheme," *Working Paper*, 2012.

Agarwal, Bina, *A field of one's own: Gender and land rights in South Asia*, New York: Cambridge University Press, 1994.

Aizer, Anna, "The Gender Wage Gap and Domestic Violence," *The American Economic Review*, 2010, *100* (4), 1847–1859.

Alderman, Harold and Victor Lavy, "Household Responses to Public Health Services: Cost and Quality Tradeoffs," *The World Bank Economic Review*, 1996, *11* (1), 3–22.

Alegria, Tito, Craig McIntosh, Gerardo Ordo nez, and Zenteno René, "Slum Infrastructure Upgrading and Budgeting Spillovers: The Case of Mexico's Hábitat Program," *Working Paper*, 2012.

Allendorf, Keera, "Do Women's Land Rights Promote Empowerment and Child Health in Nepal?," *World Development*, November 2007, *35* (11), 1975–1988.

Anderson, Siwan and Garance Genicot, "Suicide and property rights in India," *Working Paper*, 2014.

Archambault, Caroline S., Joost de Laat, and Eliya Msiyaphazi Zulu, "Urban Services and Child Migration to the Slums of Nairobi," *World Development*, September 2012, *40* (9), 1854–1869.

Atkin, David, "Working for the Future: Female Factory Work and Child Health in Mexico," *Working Paper*, 2011.

Baland, Jean-Marie and James A. Robinson, "Is Child Labor Inefficient?," *Journal of Political Economy*, 2000, *108* (4), 663–679.

Bardhan, Pranab and Christopher Udry, *Development Economics*, Oxford University Press, 1999.

Basta, Samir S., "Nutrition and Health in Low Income Urban Areas of the Third World," *Ecology of Food and Nutrition*, 1977, *6*, 113–124.

Basu, Kaushik, "Child Labor: Cause, Consequence, and Cure, with Remarks on International Labor Standards," *Journal of Economic Literature*, 1999, *XXXVII* (September), 1083–1119.

_ , "Gender and Say: A Model of Household Behaviour with Endogenously Determined Balance of Power," *The Economic Journal*, 2006, *116* (511), 558–580.

_ **and Pham Hoang Van**, "The economics of child labor," *American Economic Review*, October 1998, *88* (3), 412–27.

_ **and Ranjan Ray**, "The Collective Model of the Household and an Unexpected Implication for Child Labor: Hypothesis and an Empirical Test," *Working Paper*, 2002.

Becker, Gary S. and H. Gregg Lewis, "On the Interaction between Quantity and Quality of Children," *Journal of Political Economy*, 1973, *81* (2), S279–288.

Beegle, Kathleen, Elizabeth Frankenberg, and Duncan Thomas, "Bargaining power within couples and use of prenatal and delivery care in Indonesia.," *Studies in family planning*, June 2001, *32* (2), 130–46.

Behrman, Jere R and Anil Deolalikar, "Health and Nutrition," *Handbook of Development Economics*, 1988, *I*, 631–711.

Berhman, Jere R, "The Action of Human Resources and Poverty on One Another: What We Have Yet to Learn," *Working Paper*, 1990.

Bharadwaj, Prashant, Leah K. Lakdawala, and Nicholas Li, "Perverse Consequences of Well Intentioned Regulaition: Evidence from India's Child Labor Ban," 2013.

Blume, Jonas and Julika Breyer, "Microfinance and Child Labour," Technical Report 89, International Labour Office, Employment Sector, Social Finance Programme, Geneva 2011.

Brettell, Caroline and James Frank Hollifield, *Migration theory: talking across disciplines*, New York: Routledge, 2000.

Brockerhoff, Martin and Ellen Brennan, "The Poverty of Cities in Developing Regions," *Population and Development Review*, 1998, *24* (1), 75–114.

Brueckner, Jan K, "Slums in Developing Countries: New Evidence for Indonesia," *Journal of Housing Economics*, 2013, *22* (4), 278–290.

Burra, Sundar, "Towards a pro-poor framework for slum upgrading in Mumbai, India," *Environment and Urbanization*, April 2005, *17* (1), 67–88.

Cadavid, Paula Restrepo, "Moving in - Selling Out: the Outcomes of Slum Rehabilitation in Mumbai," *Working Paper*, 2010.

Carranza, Eliana, "Islamic Inheritance Law, Son Preference and Fertility Behavior of Muslim Couples in Indonesia," *World Bank Policy Research Working Paper*, 2012, *No. 5972.*

Cattaneo, Matias D, Sebastian Galiani, Paul J Gertler, Sebastian Martinez, and Rocio Titiunik, "Housing, health and happiness," *American Economic Journal: Economic Policy*, September 2009, *2009* (1), 75–105.

Cooper, Ryan, Sebastian Galiani, Paul Gertler, Sebastian Martinez, Adam Ross, and Raimundo Undurraga, "Shelter from the Storm: Upgrading Housing Infrastructure in Latin America's Slums," 2011.

de Soto, Hernando, *The mystery of capital: why captitalism triumphs in the West and fails everywhere else*, New York: Basic Books, 2000.

Deininger, Klaus, Aparajita Goyal, and Hari Nagarajan, "Womens Inheritance Rights and Intergenerational Transmission of Resources in India," *Journal of Human Resources*, 2013, *48* (1), 114–141.

Devoto, Florencia, Esther Duflo, Pascaline Dupas, William Parienté, and Vincent Pons, "Happiness on Tap: Piped Water Adoption in Urban Morocco," *American Economic Journal: Economic Policy*, 2012, *4* (4), 68–99.

Doorn, Judith Van and Craig Churchill, "Microfinance Against Child Labour," Technical Report February, International Labour Office, Social Finance Programme, Geneva 2004.

Duflo, Esther, "Grandmothers and Granddaughters: Old-Age Pensions and Intrahousehold Allocation in South Africa," *The World Bank Economic Review*, June 2003, *17* (1), 1–25.

Dye, Christopher, "Health and Urban Living," *Science (New York, N.Y.)*, February 2008, *319* (5864), 766–9.

Edmonds, Eric V, "Child labor," *Handbook of Development Economics*, 2007, *4.*

Ejrnaes, Mette and Claus C. Pörtner, "Birth Order and the Intrahousehold Allocation of Time and Education," *The Review of Economics and Statistics*, 2004, *86* (4), 1008–1019.

Emerson, Patrick M. and André Portela Souza, "Birth Order, Child Labor, and School Attendance in Brazil," *World Development*, September 2008, *36* (9), 1647–1664.

Ersado, Lire, "Child Labor and Schooling Decisions in Urban and Rural Areas: Comparative Evidence from Nepal, Peru, and Zimbabwe," *World Development*, March 2005, *33* (3), 455–480.

Fan, C Simon, "Child Labor and the Interaction between the Quantity and Quality of Children," *Southern Economic Journal*, 2004, *71* (1), 21–35.

Field, Erica, "Entitled to work: Urban property rights and labor supply in Peru," *Quarterly Journal of Economics*, 2007, *122* (4), 1561–1602.

_ , "Property rights and investment in urban slums," *Journal of the European Economic Association*, 2010, *3* (2-3), 279–290.

_ **and Michael Kremer**, "Impact evaluation for slum upgrading interventions," in "Doing Impact Evaluation Series #3, World Bank, July 2006." 2006.

Fotso, Jean-Christophe, "Child health inequities in developing countries: differences across urban and rural areas," *International Journal for Equity in Health*, January 2006, *5* (9).

_ , "Urban-rural differentials in child malnutrition: trends and socioeconomic correlates in sub-Saharan Africa," *Health & place*, March 2007, *13* (1), 205–23.

Fry, Sarah, Bill Cousins, and Ken Olivola, "Health of Children Living in Urban Slums in Asia and the Near East: Review of Existing Literature and Data," Technical Report 2002.

Galasso, Emanuela, "Intra-household Allocation and Child Labor in Indonesia," 1999.

Ghuman, Sharon J., "Women's Autonomy and Child Survival: A Comparison of Muslims and Non-Muslims in Four Asian Countries," *Demography*, 2003, *40* (3), 419–436.

Glewwe, Paul, "Why does mother's schooling raise child health in developing countries? Evidence from Morocco," *Journal of Human Resources*, 1999.

Gonzalez-Navarro, Marco and Climent Quintana-Domeque, "Slum Upgrading: Evidence from an Urban Road Pavement Experiment in Mexico," 2010.

Haddad, Lawrence, Marie T Ruel, and James L Garrett, "Are Urban Poverty and Undernutrition Growing? Some Newly Assembled Evidence," *World Development*, November 1999, *27* (11), 1891–1904.

Harari, Maria, "Women's Inheritance Rights and Bargaining Power: evidence from Kenya," *Working Paper*, 2013.

Heath, Rachel and Xu Tan, "Intrahousehold Bargaining, Female Autonomy, and Labor Supply: Theory and Evidence from India," *Working Paper*, 2013.

Heckman, James J., "The Common Structure of Statistical Models of Truncation, Sample Selection and Limited Dependent Variables and a Simple Estimator for Such Models," *Annals of Economic and Social Measurement*, 1976, *5* (4), 475–492.

Huchzermeyer, Marie, "The struggle for in situ upgrading of informal settlements: a reflection on cases in Gauteng," *Development Southern Africa*, March 2009, *26* (1), 59–73.

ILO-IPEC, *Marking progress against child labour - Global estimates and trends 2000-2012*, International Labour Office; ILO International Programme on the Elimination of Child Labour (IPEC), 2013.

International Institute for Population Sciences (IIPS) and Macro International, "National Family Health Survey (NFHS-3), 200506: India: Volume I," Technical Report, IIPS, Mumbai 2007.

Katz, Lawrence F, Jeffrey R Kling, and Jeffrey B Liebman, "Moving to opportunity in boston: early results of a randomized mobility experiment," *The Quarterly Journal of Economics*, 2001, *116* (2), 607–654.

Kimani-Murage, Elizabeth Wambui and Augustine M Ngindu, "Quality of water the slum dwellers use: the case of a Kenyan slum," *Journal of urban health: bulletin of the New York Academy of Medicine*, November 2007, *84* (6), 829–38.

Klawon, Emily and Jill Tiefenthaler, "Bargaining over family size: The determinants of fertility in Brazil," *Population Research and Policy Review*, 2001, *20* (5), 423–440.

Kling, Jeffrey R, Jeffrey B Liebman, Lawrence F Katz, and Lisa Sanbonmatsu, "Moving to Opportunity and Tranquility: Neighborhood Effects on Adult Economic Self-Sufficiency and Health from a Randomized Housing Voucher Experiment," *Working Paper*, 2004.

Kombe, Wilbard Jackson, "Land use dynamics in peri-urban areas and their implications on the urban growth and form: the case of Dar es Salaam, Tanzania," *Habitat International*, March 2005, *29* (1), 113–135.

Kovsted, Jens, Claus C. Pörtner, and Finn Tarp, "Child Health and Mortality: Does Health Knowledge Matter?," *Journal of African Economies*, 2003, *11* (1995), 542–560.

Lakdawala, Leah K., "From Loans to Labor: Access to Credit, Entrepreneurship and Child Labor," *Working Paper*, 2011, (October).

Lam, David and Suzanne Duryea, "Effects of schooling on fertility, labor supply, and investments in children, with evidence from Brazil," *Journal of Human Resources*, 1999, *34* (1), 160–192.

Lavy, Victor, John Strauss, Duncan Thomas, and Philippe de Vreyer, "Quality of health care, survival and health outcomes in Ghana," *Journal of health economics*, 1996, *15*, 333–357.

Legovini, Arianna, "Development Impact Evaluation Initiative: A World Bank-Wide Strategic Approach to Enhance Developmental Effectiveness," Technical Report 2010.

Lundberg, Shelly J, Robert A Pollak, and Terence J Wales, "Do Husbands and Wives Pool Their Resources? Evidence from the United Kingdom Child Benefit," *Journal of Human Resources*, 1997, *32* (3), 463–480.

Maitra, Pushkar, "Parental bargaining, health inputs and child mortality in India.," *Journal of health economics*, March 2004, *23* (2), 259–91.

Marx, Benjamin, Thomas Stoker, and Tavneet Suri, "The Economics of Slums in the Developing World," *Journal of Economic Perspectives*, November 2013, *27* (4), 187–210.

Mehta, Barjor and Arish Dastur, *Approaches to Urban Slums*, Washington, DC: World Bank Publications, February 2008.

Mukhija, Vinit, "Upgrading Housing Settlements in Developing Countries," *Cities*, 2001, *18* (4), 213–222.

Mullick, Mohammad Sayadul Islam and Robert Goodman, "The prevalence of psychiatric disorders among 5-10 year olds in rural, urban and slum areas in Bangladesh: an exploratory study," *Social psychiatry and psychiatric epidemiology*, August 2005, *40* (8), 663–71.

Murthy, Sharmila L, "Land security and the challenges of realizing the human right to water and sanitation in the slums of Mumbai, India," *Health and human rights*, January 2012, *14* (2), 61–73.

Mwabu, Germano, Martha Ainsworth, and Andrew Nyamete, "Quality of Medical Care and Choice of Medical Treatment in Kenya: An Empirical Analysis," *The Journal of Human Resources*, 1993, *28* (4), 838–862.

Newman, John, Menno Pradhan, Laura B Rawlings, Geert Ridder, Ramiro Coa, and Jose Luis Evia, "An Impact Evaluation of Education, Health, and Water Supply Investments by the Bolivian Social Investment Fund," *The World Bank Economic Review*, 2002, *16* (2), 241–274.

Okpala, D. C. I., "Upgrading slum and squatter settlements in developing countries: Is there a cost-effective alternative?," *Third World Planning Review1*, 1999, *21*, 1–18.

Patrinos, Harry Anthony and George Psacharopoulos, "Educational Performance and Child Labor in Paraguay," *International Journal of Educational Development*, 1995, *15* (1), 47–60.

_ and _ , "Family Size, Schooling and Child Labor in Peru – An Empirical Analysis," *Journal of Population Economics*, January 1997, *10* (4), 387–405.

Pitt, Mark M., Mark R. Rosenzweig, and Mohammad Nazmul Hassan, "Human Capital Investment and the Gender Division of Labor in a Brawn-Based Economy," *American Economic Review*, December 2012, *102* (7), 3531–3560.

_ , Shahidur R. Khandker, Omar Haider Chowdhury, and Daniel L. Millimet, "Credit Programs for the Poor and the Health Status of Children in Rural Bangladesh," *International Economic Review*, 2003, *44* (1), 87–118.

Pörtner, Claus C., "Sex Selective Abortions, Fertility and Birth Spacing," *Working Paper*, 2013.

Rangel, Marcos A., "Alimony Rights and Intrahousehold Allocation of Resources: Evidence from Brazil," *The Economic Journal*, 2006, *116* (513), 627–658.

Rasul, Imran, "Household bargaining over fertility: Theory and evidence from Malaysia," *Journal of Development Economics*, June 2008, *86* (2), 215–241.

Reggio, Iliana, "The influence of the mother's power on her child's labor in Mexico," *Journal of Development Economics*, September 2011, *96* (1), 95–105.

Rosenblum, Daniel, "Unintended Consequences of Womens Inheritance Rights on Female Mortality in India," *Economic Development and Cultural Change*, 2014, (forthcoming).

Rosenzweig, Mark R. and Robert Evenson, "Fertility, Schooling, and the Economic Contribution of Children of Rural India: An Econometric Analysis," *Econometrica*, 1977, *45* (5), 1065–1079.

_ **and T Paul Schultz**, "Estimating a Household Production Function: Heterogeneity, the Demand for Health Inputs, and Their Effects on Birth Weight," *Journal of Political Economy*, 1983, *91* (5), 723–746.

Roy, Sanchari, "Female Empowerment through Inheritance Rights: Evidence from India," *Working Paper*, 2008.

_ , "Empowering Women? Inheritance Rights, Female Education and Dowry Payments in India," *Working Paper*, 2013.

Santosa, Happy, Liana Arrieta de Bustillos, and Mark Napier, "Sustainable Livelihoods in the Informal Settlements," Technical Report, International Council for Research and Innovation in Building and Construction (CIB), Rotterdam 2005.

Stephens, P Wolanya, "The relationship between the level of household sanitation and child mortality: an examination of Ghanaian data," *Work*, 1984.

Stock, James H., Jonathan H. Wright, and Motohiro Yogo, "A Survey of Weak Instruments and Weak Identification in Generalized Method of Moments," *Journal of Business & Economic Statistics*, October 2002, *20* (4), 518–529.

Strauss, John and Duncan Thomas, "Human resources: Empirical modeling of household and family decisions," *Handbook of development economics*, 1995, *III*, 1883–2023.

The World Bank, "The Welfare Impact of Rural Electrification: A Reassessment of the Costs and Benefits," Technical Report, The Independent Evaluation Group (IEG), Washington, D.C. 2008.

_ , "Measuring Success in Human Settlements Development: An Impact Evaluation Study of the Upgrading of Informal Settlements Programme in selected projects in South Africa," Technical Report May 2011.

Thomas, Duncan, "Intra-Household Resource Allocation: An Inferential Approach," *The Journal of Human Resources*, 1990, *25* (4), 635–664.

_ , "Like Father, Like Son; Like Mother, Like Daughter: Parental Resources and Child Height," *Journal of Human Resources*, 1994, *29* (4), 950–988.

_ **, Dante Contreras, and Elizabeth Frankenberg**, "Distribution of Power within the Household and Child Health," *Working Paper*, 2002.

_ **, John Strauss, and Maria-Helena Henriques**, "How does mother's education affect child height?," *Journal of Human Resources*, 1991, *26* (2), 183–211.

Timaeus, Ian M and Louisiana Lush, "Intra-urban differential in child health," *Health Transition Review*, 1995, *5* (2), 163–190.

Torero, Maximo, "Impact Evaluation of Infrastructure in Ethiopia and Tanzania," Technical Report.

Turley, R, R Saith, N Bhan, E Rehfuess, and B Carter, "Slum upgrading strategies involving physical environment and infrastructure interventions and their effects on health and socio-economic outcomes," *Cochrane Database of Systematic Reviews*, 2013, (1).

UN-HABITAT, *The Challenge of Slums: Global Report on Human Settlements, 2003*, London; Sterling, VA: Earthscan Publications, 2003.

_ , "The State of African Cities 2008: A framework for addressing urban challenges in Africa," Technical Report 2008.

_ , "The Challenge of Slums: Global Report on Human Settlements 2003. The revised version of Chapter 1: Development Context and the Millennium Agenda," Technical Report September 2005 2010.

_ , *Cities and Climate Change: Global Report on Human Settlements 2011* 2011.

UNCHS (Habitat), "The Istanbul Declaration and The Habitat Agenda," Technical Report 1997.

UNICEF, "India - The big picture," 2014.

_ , "The State of the Worlds Children 2014 In Numbers: Every Child Counts Revealing disparities, advancing childrens rights," Technical Report 2014.

United Nations, *World Urbanization Prospects: The 2011 Revision*, United Nations, Department of Economic and Social Affairs, Population Division, 2012.

URT, "National human settlements development policy," Technical Report, The United Republic of Tanzania Ministry of Lands and Human Settlements Development 2000.

US Department of Labor's Bureau of International Labor Affairs, "India - 2012 Findings on the Worst Forms of Child Labor," Technical Report 1 2013.

Varanasi, Nalina, "Intrahousehold Bargaining and Fertility." PhD dissertation, University of Washington 2010.

Vlahov, David, Nicholas Freudenberg, Fernando Proietti, Danielle Ompad, Andrew Quinn, Vijay Nandi, and Sandro Galea, "Urban as a determinant of health," *Journal of urban health: bulletin of the New York Academy of Medicine*, May 2007, *84* (3 Suppl), i16–26.

Wang, Shing-Yi, "Property Rights and Intra-Household Bargaining," *Journal of Development Economics*, December 2013, *107*, 192–201.

Werlin, Herbert, "The Slum Upgrading Myth," *Urban Studies*, August 1999, *36* (9), 1523–1534.

Wolff, Christopher G, Dirk G Schroeder, and Mark W Young, "Effect of improved housing on illness in children under 5 years old in northern Malawi: cross sectional study," *BMJ*, 2001, *322* (May), 1209–1212.