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Shocks and the Opportunities of Children

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Shocks and the Opportunities of Children

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Abstract

This thesis consists of three chapters that set out to examine the effects of three different types of exogenous shocks - unpredictable deaths, pecuniary shocks and community level violent conflict - on the outcomes of children living in developing countries.

Chapter 1

The latest estimates from the United Nations Children's Fund show that there are approximately 153 million orphans around the world, a figure that includes children who have lost a mother, a father, or both parents. Chapter I, "Parental Loss and Children Wellbeing", examines the consequences of parental absence due to unpredictable death on children's welfare. Based on six administrative datasets from Taiwan, a uniquely large and detailed sample is assembled. The sample period covers deaths occurring between 1981 and 2003 of parents whose children were born between 1981 and 1985. This rich data set permits the derivation of a cause-of-death classification that is used to identify deaths representing exogenous shocks to children's wellbeing. The results show that the death of a parent has deleterious effects on children's human capital that are robust across time and gender. The derived cause of death classification reveals that the top causes of death claiming the lives of relatively young parents are often highly preventable.

This study has two main policy implications: First, policies aimed at protecting the educational opportunities of children who have experienced the loss of a parent should focus on low income children, and particularly girls, because they are more adversely affected by the loss of either parent; second, cost-benefit analyses of whether to carry out new screening and prevention programs, or whether to continue support for promising current efforts to prevent the loss of young parents should consider all the benefits from such efforts. In particular, the savings from both the decreased wages and worker productivity due to the lower educational attainment of bereaved children, as well as from the possible negative spillover on future generations.

Chapter 2

The United Nation's Food and Agriculture Organization estimates there are 925 million people who do not have enough to eat (FAO 2010). At the same time, the latest report from the World Health Organization (WHO 2011) describes an equally grim parallel development: by 2015, approximately 2.3 billion adults will be overweight and more than 700 million will be obese. This chapter analyzes the effects of pecuniary shocks on the anthropometric outcomes of mothers and children. The collective model of intra-household allocation in the presence of a public good is used as a starting point of the analysis. This model permits analyzing the resource allocation decisions made by parents within a structural framework that captures the household bargaining mechanism governing the intra-household allocation of resources. The data used in this chapter comes from the evaluation of the Colombian conditional cash transfer (CCT) program Familias en Acción (FA).

This chapter seeks to answer the following questions: Do CCTs, inasmuch as they represent an exogenous increase in female held income, increase a mother's bargaining power? If so, does this power shift matter for the nutritional outcomes of mothers and children? Are the nutritional outcomes of mothers and children Pareto efficient? Consistent with the predictions of the collective model, the income pooling hypothesis is rejected and the null hypothesis that intra-household allocations are Pareto optimal cannot be rejected. The empirical results suggest that CCTs increase the bargaining power of mothers. This power revision results in a reallocation of resources that indirectly improves children's anthropometric outcomes without having a negative effect on mothers' BMIs. Interestingly, we find that CCTs also have a direct effect on anthropometric outcomes, suggesting perhaps that participation in the CCT program has a behavioral effect on the treated households.

Chapter 3

The World Development Report (WDR 2011) reports that there are more than 1.5 billion people living in conflict countries. On the one hand, conflict affects individuals directly by disrupting their everyday activities, sources of livelihood, health and education. When high

levels of conflict are frequent or become the norm, the effect of conflict is likely to have severe lifelong impacts on wellbeing and to be particularly devastating to the more vulnerable (i.e. women, children and the disable). On the other hand, conflict also affects individuals indirectly, through the loss of physical capital and capacity of health and education systems to meet the needs of the population. Moreover, the destruction of capital and infrastructure may in turn lead to future conflict and to the proliferation of conflict related activities.

This chapter examines how wellbeing links to both security and conflict in the context of Afghanistan. The analysis presented in this chapter combines data from the National Risk and Vulnerability Assessment (NRVA) 2007-08 household level survey, the first nationally representative dataset available in Afghanistan, with confidential geo-coded data on violent incidents from the United Nations Department of Safety and Security. The empirical evidence presented shows an important two-directional causal pathway between conflict and access to basic services. This two-directional pathway, in which conflict (or the ensuing destruction) fuels more conflict and woe, is found to represent a significant barrier to donor assistance delivery. The results from this section highlight the importance of helping conflict affected countries like Afghanistan develop their basic infrastructure while making its access more widespread. Such efforts are well known to have positive effects on wellbeing, but in conflict affected Afghanistan they are also likely to have positive spillovers on conflict prevention.

Chapter 1

Parental Loss and Children's Wellbeing

Abstract

The latest estimates from the United Nations Children's Fund show that there are approximately 153 million orphans around the world, a figure that includes children who have lost a mother, a father, or both parents. Chapter I, "Parental Loss and Children Wellbeing", examines the consequences of parental absence due to unpredictable death on children's outcomes. Using six administrative datasets from Taiwan, a uniquely large and detailed sample is assembled. The sample period covers deaths occurring between 1981 and 2003 of parents whose children were born between 1981 and 1985. This rich data set permits the derivation of a cause-of-death classification that is used to identify deaths representing exogenous shocks to children's wellbeing. The results show that the death of a parent has deleterious effects on children's human capital that are robust across time and gender. The derived cause of death classification reveals that the top causes of death claiming the lives of relatively young parents are often highly preventable.

The findings of this study give rise to two main policy implications: First, policies aimed at protecting the educational opportunities of children who have experienced the loss of a parent should be targeted at low income children, and particularly girls, because they are more adversely affected by the loss of either parent; second, cost-benefit analyses of whether to carry out new screening and prevention programs, or whether to continue support for promising current efforts to prevent the loss of young parents should consider all the benefits from such efforts. In particular, the savings from both the decreased wages and worker productivity due to the lower educational attainment of bereaved children, as well as from the possible negative spillover on future generations.

1.1 Introduction

The latest estimates from the United Nations Children's Fund show that there are approximately 153 million orphans worldwide, a figure that includes children who have lost a mother, a father, or both parents.[1] Although the majority of orphans are from African and Asian countries, no country is immune to this woe. The loss of a parent has the potential to be particularly devastating for a child's future because it directly affects two important resources used in the production of human capital: income, if the deceased parent was the main income earner of the household; and time, if the deceased parent was an important source of mentorship, nurture, and stability.

Most empirical evidence on at the relationship between parental loss and children's welfare validates the existence of a negative association. This association is found to depend on the genders of the child and the deceased parent. For example, a World Bank (2002) report finds that losing a parent to the HIV-AIDS pandemic affects girls disproportionately more than boys, suggesting that policies aimed at helping bereaving children should be gender based. Several studies echo this report (Kobiané et al. 2005; Gertler et al. 2004; Fronstin et al. 2001). The studies that look for a causal pathway between childhood bereavement and children's outcomes often find that losing a parent is detrimental to children's educational attainments and health, in particular after the death of a mother (Evans and Miguel 2007; Beegle et al. 2006; Case and Ardington 2006). In terms of the persistence of the effects of bereavement there is less of a consensus because most studies focus on short-term outcomes.[2] Indeed, the empirical literature is vast, yet because the primary focus of this literature has been Sub-Saharan African countries, its

[1] Source: www.childinfo.org/hiv_aids_orphanestimates.php (accessed on April 2012).

[2] Two important exceptions are the works of Beegle et al. (2006) and Fronstin et al. (2001), both of which find significant long-term negative implications from losing a parent.

implications may be limited to children losing a parent in a country struck by the HIV-AIDS pandemic.[3]

Understanding the significance of losing a parent during childhood in a more general setting is difficult for at least three interconnected reasons. First and foremost, a large body of empirical evidence from the epidemiological literature has shown that certain causes of death are strongly correlated with the socio-economic status (SES) of the deceased (Link and Phelan 1995; Howard et al. 2000; Weires et al. 2008). Similarly, human capital research suggests that SES affects both parents' health (Grossman 2007) and children's educational attainments and health outcomes (Chou et al. 2010; Lin et al. 2007; Currie and Moretti 2003). The implications of these findings are that omitted variables (e.g., parental behavior, family genetics or environmental characteristics) are associated with both parental death and children's wellbeing, making orphanhood status endogenous. For example, it is possible that the omitted variables that make parents more likely to die also make a child more likely to experience adverse outcomes. Similarly, it may well be that the same omitted characteristics make a child better adapted to cope with various biological and environmental risks. In the former case, the bereavement effect is overstated; in the latter case it is understated.

Second, studies assessing the existence of long-term bereavement effects are as rare as datasets that include measures of long-term outcomes. As a result, even if most of the studies suggest that parental loss has a negative impact on children's outcomes, it is often only the short-term impact that is being analyzed. This is a key issue when trying to understand whether losing a parent has an effect on important lifelong decisions that children make later in their lives, for

[3] See Evans and Miguel (2007), Ainsworth and Filmer (2006), Beegle et al. (2006), Case and Ardington (2006), Kobiané et al. (2005) and Case et al. (2004); for exceptions, see Gertler et al. (2004), Fronstin et al. (2001) and Lang and Zagorsky (2001).

example, during their late teenage years or when they reach adulthood. Unaware of these later outcomes, we are unable to know whether losing a parent has in fact long-lasting implications for children's wellbeing. Finally, the fact that early parental death is a relatively rare event may lead to imprecise estimates of the bereavement effect.[4] A small sample of bereaved children also makes it difficult to capture differences between long, medium and short-term bereavement effects and, as is the case of nearly all studies available to date, to explore the possible interactions between experiencing the death of a parent and different SES levels.

In this paper, our goal is to identify and measure the effect of parental death on children's wellbeing. Using confidential identification information, we are able to assemble a large and detailed sample that links six administrative datasets from Taiwan. Our sample contains information collected at different points in children's lives and includes detailed cause-of-death and mortality records of all the deceased parents. Using this information, we first identify the causes of death that represent an exogenous shock to children's outcomes. Specifically, conditional on personal characteristics of the deceased we classify causes of death into two groups: those that are strongly correlated with measures of socio-economic status (termed informative cause-of-death, or ICOD) and those that are erratic in nature (termed uninformative cause-of-death, or UCOD). This strategy, from Espinosa and Evans (2008), allows us to introduce a source of exogenous variation. Although perfectly correlated with the death of a parent, the UCODs are by construction orthogonal to a child's socio-economic characteristics that are likely correlated with omitted third variables.

We identify differential bereavement effects related to the gender of the deceased parent

[4] For example, Fronstin et al. (2001), who make use of a relatively small sample of bereaved children (about 8 percent of the total sample of approximately 4,166 females, and 3,662 males), are unable to precisely identify the disruption effect by type (i.e. death versus divorce) or by age. It is worth noting that their study is also one of the few that analyze the long term bereavement effects in a non-Sub-Saharan setting.

by separating the analysis into death of a mother and death of a father. We ask first whether losing a parent has an effect on a child's likelihood of acquiring higher education and, if so, whether the effect of losing a parent has short-term or long-term implications for the child's educational attainments or the quality of education he/she receives. We investigate whether boys and girls are equally affected by the loss and whether there is an interactive effect between bereavement and income. Finally, we also examine other potential channels through which parental loss may curtail children's wellbeing. In particular, we ask whether children experiencing the loss of a parent are more likely to substitute higher education for a paying occupation, or whether they are at a higher risk of teenage marriage.

Our findings show that losing a parent is detrimental to children's prospects of acquiring higher education and to their wellbeing. We also find that children's educational attainment is, on average, more affected by the death of a mother than the death of a father. In terms of the persistence of the bereavement effect, while the effect of losing a parent is equally pronounced regardless of when in the child's life the death takes place, the short-term effect of a father's death is particularly deleterious for girls. Studying other channels through which the death of a parent may affect children's wellbeing, we observe two patterns. First, the quality of education of middle- and high-income children is significantly reduced, with high-income girls being the most severely affected following a father's death. Second, low- and middle-income boys are more likely to substitute an income earning occupation in place of higher education, whereas low-income girls are more likely to marry and to work during their teenage years.

1.2 Human Capital: Theoretical Framework

Becker and Tomes (1979) developed a robust theoretical framework that serves to analyze the linkage between the family "industry" and human capital formation. In their model, a

family is viewed as a production unit that uses inputs (e.g. time, income, genetic endowments) to generate utility increasing outputs (e.g. human capital, health). The family's preferences can be aggregated into a single utility function. Hence, a decision such as the level of investment in a child's human capital depends strongly on how profitable such an investment is (in terms of its expected contribution to the family's future income). One important assumption of Becker and Tomes' original model is the existence of perfect capital markets, allowing parents not only to borrow against children's future earnings but also to protect the investment in children's human capital from permanent or idiosyncratic shocks. Thus, following the death of a parent, the remaining household head should be able to completely smooth out any income loss. In other words, this model predicts that the loss of a parent would not have any effect on children's human capital investment, provided that perfect insurance is available.

Still, it is not clear whether perfect insurance is a reasonable assumption for a developing country, particularly for individuals residing in rural areas. A more suitable framework for studying the developing world, due to Becker (1986), relaxes the assumption of perfect insurance, allowing for liquidity constraints that may result in the reduction of both consumption and investments. This framework has been validated by several empirical studies.[5] Hence, following the loss of a parent, the lack of perfect insurance markets would cause the remaining household head to revise his/her investment decisions under a new budget constraint. For example, it is possible that after the death of a mother, the daughters' opportunity cost of education is higher; hence, marginal investments in daughters may be eliminated, causing some daughters to forgo acquiring higher education. That is, in this less restricted model it is possible

[5] For example, using a siblings sample from Taiwan, Parish and Willis (1991) discuss the idea that credit constraints and conditional altruism may result in older daughters faring poorly, as they assume the role of caregivers of their younger siblings.

that the death of a parent would have significant implications for the investment in children's human capital, even more so when the deceased was the main income earner in the family, and/or the family is unable to borrow against children's future income.

Another crucial assumption of Becker and Tomes (1979) is the effective altruism of the household head who can be seen as a benevolent, rational, and altruistic dictator whose preferences are taken to represent the family's utility function. This assumption, which allows for the aggregation of household members' preferences into a single utility function, has been rejected repeatedly by empirical evidence.[6] Hence, following the death of a parent, if the mother and the father have competing preferences, then one may expect to observe changes in investments in children's human capital that depend on the gender of the remaining household head. Although it is not our goal to test the single-preference assumption, these competing models suggest the importance of studying the bereavement effect separately for mothers and fathers.

Parents' preferences aside, it is possible that exogenous forces - such as those affecting labor market returns to human capital investments or those resulting from cultural norms- may cause altruistic parents to optimally choose one child over another based on the child's gender, particularly when resources (i.e. time, income) are scarce. In Taiwan, however, the rate of return to schooling offers clear incentives for both males and females to acquire higher education.[7] This

[6] Thomas (1990) studies single-headed families and finds that mothers (fathers) in Brazil tend to prefer to devote resources to improving the heights and weights of their daughters (sons). In addition, the study finds that a mother's income has a greater impact on offspring in general than a father's income, suggesting that parents' preferences may not be homogeneous. Similar findings are also found in the developed world. Han et al. (2003) focus on tertiary education in the United States and find that after controlling for income, single-mother families allot significantly higher investments in children's education than single-father families, indicating that mothers may value human capital more than fathers.

[7] Using Taiwan's Manpower Utilization Survey data of 1996, Chuang and Chao (2001) estimate that the annual rate of return to schooling is 2.30 percent for senior high-school, 3.98 percent for vocational school, 4.58 percent for junior college, and 12.20 percent for university. The same study finds that females have a higher rate of return to

suggests that prevailing gender-based differences in human capital investments are likely the consequence of the culturally defined roles that sons and daughters are expected to play in the family. For instance, in many Asian cultures the care of the elderly traditionally has been a responsibility that rests primarily on the shoulders of sons, because daughters are expected to leave their family and adopt the family of their husbands after marriage, which is sometimes referred to as ”virilocality”.[8] So, even if a son is ”the rotten kid” (Becker 1981), his economic incentives are often better aligned with those of his parents relative to those of a daughter, which renders the investment in boys an optimal decision. In other words, daughters may not necessarily be “rotten” but they are more likely to act that way, deeming investments in their human capital less productive than those made in their male siblings. Hence the parents' decision to allocate more of the family's resources into the formation of sons is both altruistic and optimal from the family's point of view. To capture any existing gender based differences, our analysis in the current study is separated by gender.

1.3 Parental Loss: Empirical Evidence

The developmental psychology literature suggests that the effect of parental loss may be quite heterogeneous across children and may strongly depend on such factors as: (1) the gender of the deceased and the gender of the child; (2) the age of the child when the death takes place; (3) the time elapsed since the death occurred; (4) the type of death; and (5) family composition and socio-economic status (Dowdney 2000).

A large body of empirical research already has examined the effect of parental loss or parental absence on children's outcomes. In terms of the gender of the deceased parent, most

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schooling than males.

[8] We refer the reader to a study of Levine and Kevane (2003) for a more extensive evaluation of the effects of virilocality on female disadvantage.

studies validate the existence of a negative effect of a mother's death or absence on the educational attainments of children. Interestingly, the link between the latter and paternal death has been substantiated less frequently (for exceptions, see Beegle et al. 2006; Gertler et al. 2004; Fronstin et al. 2001). Ainsworth et al. (2005) analyze a panel household survey from the Kagera region (Tanzania), focusing on short-and medium-term effects of adult death on the household's decision to send children to primary school. They find that school attendance of children 7-10 years old who have lost a mother is 10 percentage points lower than that of children with living parents or paternal orphans. Two-parent orphans suffer the same disadvantage as maternal orphans, though. Similarly, a study of a five-year individual-level panel from Busia District (Kenya) by Evans and Miguel (2007) finds that the impact of parental loss on primary school participation is more than twice as large following the death of a mother than a father. And using longitudinal data from KwaZulu-Natal (South Africa), Case and Ardington (2006) find a clear link between maternal death and children's school enrollment and years of completed schooling, although no such link is found for the death of a father.

Parental death also affects children differently depending on their gender. A World Bank (2002) report finds that losing a parent affects girls disproportionately more than boys, suggesting that policies aimed at helping bereaving children should be gender based. Several studies echo this report. Using a retrospective survey from Burkina, Kobian et al. (2005) investigate whether orphan status is detrimental to children's chances of attending school. They find that following the death of a parent, boys are more likely to enter school than girls. Gertler et al. (2004) use a large cross-sectional sample from Indonesia and find that the loss of a parent disproportionately increases the school drop-out rate of the eldest daughters. Fronstin et al. (2001) use the British national Child Development Survey to examine the long-term effects of

parental divorce or death on labor market outcomes. They find that females, but not males, appear to be adversely affected by father's death, particularly when death occurs before the child's 16th birthday.

In terms of the duration of the bereavement effect, Ainsworth et al. (2005) find that prior to an adult death children spent substantially less time at school, but following the adult death the hours spent at school are likely to return to normal levels. However, Evans and Miguel (2007) find no evidence that orphaned children return to their pre-parental-death academic performance levels after the loss of a parent. After they control for child fixed effects, they show that difference in school attendance between the orphans and the control group begins to widen two years prior to the death of a parent, and remains at a lower level for at least three years after the event. Beegle et al. (2006) are among the few that, like us, study the long-term effect of parental loss on the educational attainment of children. They use a sample of Tanzanian children who were first interviewed in 1991-94 and were re-interviewed in 2004. They find that the loss of a mother results in the permanent loss of about one year of schooling as compared to non-orphans.[9]

1.4 Data and Sample

We use six administrative datasets from Taiwan to construct our sample. As a first step, we merge three sources: (1) the Annual Birth Certificate Records (BCR); (2) the Annual Death Certificate Records (DCR); and (3) the College and University Joint Entrance Examination files (CUJEE). The first two sources contain records for the entire population of Taiwan and were

[9] Their study is similar to ours in that they are able to observe children when they reach adulthood (i.e. 18 years of age) and that they explore how parental death affects children's educational and non- educational outcomes. These authors also find that maternal loss affects children's health outcomes; in particular, maternal orphanhood is associated with anthropometric deficiencies for children between the age of 11 and 18 at the time of the mother's death.

assembled by Taiwan's Ministry of Interior Affairs. The third source covers the examination years 2000-2003 and was gathered by the College and University Entrance Examination Center of Taiwan's Ministry of Education.

The birth certificates have detailed information on a variety of personal and demographic characteristics including age, date of birth, gender, parent's age at the time of the child's birth, parental schooling, and county and town of residence at birth. From the death certificates, we can identify not only whether either parent is deceased but also the timing of death, as well as the medical diagnosis of the deceased (as coded by the International Classification of Diseases or ICD-9). The latter information is crucial for the construction of our cause-of-death classification. The CUJEE data provide college or university enrollment information for each student who gained admission. The data also allow us to identify whether the students took the entrance exam (CUJEE), the scores they obtained in every area tested, and whether they were offered admission to attend a private or a public college or university.

To construct our sample, we restrict children's cohorts to those students who were born between 1981 and 1985 to parents that were between 16 and 50 years of age. In other words, we only consider students who would have turned 18, the age of taking the CUJEE, in 2000-2003. We construct five child cohorts from birth certificates based on both the children's date of birth and the official cutoff date for school enrollment.[10] We use the parents' personal identification numbers found in the children's BCR (1981-1985) to merge parents who died to their respective DCR (1981-2003). We merge parents to the Government Employee Insurance and Labor and Farmer Insurance files to obtain information on the wages of all insured parties. Using this

[10] The cohorts include children who were 18 years old on September 1 of each of the years 2000 through 2003 (i.e. children born between September 2, 1981 and September 1, 1985).

information, we create a proxy for the aggregate monthly income of the child's family.[11]

In the next step, we merge this sample with the CUJEE (2000-2003) by the students' ID and the year in which each cohort was scheduled to take the CUJEE. We then use the personal identification number of each child to merge this sample to: (4) the National Military Enrollment (NME) records, 1998-2003; (5) the Labor Insurance (LI), Farmer Insurance (FI) and Government Employee Insurance (GEI) files, 1998-2003; and (6) the National Marriage Certificate records (NMC), 1998-2003. Datasets (4) and (6) are maintained by the Ministry of Interior Affairs. The LI and FI files come from the Bureau of Labor Insurance and GEI files are obtained from the Central Trust of China.

1.4.1 Sample Statistics

Our final sample contains 1,402,196 observations.[12] Among these, 65,220 (21,886) children become paternal (maternal) orphans before taking the CUJEE. 68,363 (22,918) children become paternal (maternal) orphans before turning 20 years of age. Table 1 shows the descriptive statistics of the mortality variables found in our final sample. Using the BCR of each child we create indicator to control for child-level characteristics including first-born son or daughter, gender, whether the child was one of a pair of twins, whether the child was born out of wedlock or was abandoned by his/her biological parents, and the child's year of birth. These controls help us capture any differences in educational attainment and other outcomes that may arise from children's ascribed characteristics.

[11] The uninsured in Taiwan are often low-SES unemployed individuals. Still, it is possible that some high-SES individuals simply have opted out of the labor insurance. For this reason, we check whether those who have no insurance records also live in the poorest areas. We use the township income-tax data for each of the 359 towns in Taiwan. These data are collected by the Financial Data Center of Taiwan's Ministry of Finance. We find that all the uninsured individuals live in the lowest income towns (the towns belonging to the lowest income-tax quartile).

[12] The sample sizes for the death of a mother and the death of a father differ slightly because observations having invalid or missing values in any of the variables used in the cause of death classification were dropped from the final sample, separately for mothers and fathers.

We obtain information on the parents' education from the child's birth certificate. We divide parental education into six categories: illiteracy to primary school attainment (0-6 years); junior high-school level (7-9 years); high-school level (10-12 years), college level without a degree (13-14 years); college and university with a degree (15-16 years), and higher education (16+). The illiteracy to primary school was the omitted category in all the regressions. Table 2 presents the descriptive statistics for the explanatory variables.

We measure children's outcomes using six binary variables and a set of continuous variables. First, we look at educational attainment and the quality of education that children receive. To measure educational attainment we use an indicator of college or university enrollment. To measure the quality of education we rely on an indicator for public college or university enrollment, versus enrollment at a less prestigious private college and university, or no enrollment at all.[13] The top panel of Table 1.3 presents the descriptive statistics for all of the binary dependent variables corresponding to the educational outcomes, separately for bereaved and non-bereaved children. We also analyze whether parental loss affects the probability of taking the CUJEE exam and, for the subsample of children who undertook this examination, whether bereaved children have a systematically different test performance (measured by children's standardized test scores) relative to non-bereaved children in the same cohort. The subjects we considered are Chinese, English, Math for Engineers, Math for Social Sciences, Chemistry, Physics, Biology and History.[14]

In addition to educational outcomes, we also analyze three non-educational outcomes (see bottom panel of Table 1.3). First, the NMC files allow us to identify children who married

[13] While it would be ideal to focus on a broader range of outcomes, we do not have information on children's completed years of schooling.

[14] Descriptive statistics, as well as regression results, on each test subject are available upon request.

and the date of their marriage. Combining this information with the child's year of birth, we can construct an indicator variable that equals one if the child got married before turning the age of 20 (i.e. during the child's teenage years). Second, the LI files contain information on enrollment into Labor Insurance, which covers most of the workers in the country's private sector.[15] Using the enrollment date and the child's year of birth, we can proxy the date the job began to construct an indicator variable that equals one if the child participated in the labor force before turning the age of 20. Finally, the information contained in the NME files allows us to identify the boys who decided to enlist in the military, their date of enlistment, and the date of release. We use the date of entry into the military, combined with the exam year, to investigate whether bereaved boys are more likely to enlist in the military shortly after high-school (within one, two, three, or four years following high-school graduation) rather than deferring their enlistment until after obtaining higher education (i.e. more than five years after high-school graduation).

1.5 Empirical Model

The empirical literature proposes different methods for identifying bereavement effects. Some authors treat death as an exogenous shock (Corak 2001; Lang and Zagorsky 2001; Ainsworth and Semali 2000; Lloyd and Blanc 1996), ignoring its potential endogeneity at the risk of biasing the estimated bereavement effect. Many of the more recent studies that do address the endogeneity of death use panel data to control for household or individual level fixed effects (Evans and Miguel 2007; Beegle et al. 2006; Case and Ardington 2006; Fronstin et al. 2001). However, when using panel data researchers face other important challenges. First, very few panels follow children long enough to capture long-term bereavement effects. Second, there is a

[15] Self-employed workers could obtain Labor Insurance if they were members of an occupational union. It is very unlikely that teenagers would work for the government sector because government workers who are civil servants must pass very demanding examinations.

disproportionately higher probability of attrition among the bereaved compared to the non-bereaved, because families that have recently experienced the death of a mother or father may be more likely to relocate and hence to drop out of the survey (Ford and Hosegood 2005). An alternative empirical method is to use unexpected deaths, such as accidents, as exogenous causes of death (Chen et al. 2009). However, certain unexpected deaths, including those from motor vehicle or job related accidents, often are correlated with SES (Beaver 2003; Whitlock et al. 2003; Baker et al. 1992; Loomis 1991). That is, it is not clear whether this approach is satisfactory, given that the ultimate decision to include a particular cause-of-death is determined arbitrarily by the researcher.

We follow the procedure proposed by Espinosa and Evans (2008) to classify causes of death as either Informative or Uninformative. First, we re-group the ICD-9s using the Clinical Classification Software (CCS) developed by the Agency for Healthcare Research and Quality (AHRQ, 2010).[16] We then use ordinary least squares (OLS) to categorize each of the ICD-9 groupings according to their degree of correlation with family SES. The linear probability model (LPM) we estimate for each COD group is as follows:

$$COD_{ict}^{d} = \alpha_0^d + \sum_{k=2}^{4}\left[I\left(INCk_{ict}^{d}=1\right)\beta_k^d + I\left(EDUk_{ict}^{d}=1\right)\gamma_k^d + I\left(EDUSk_{ict}^{d}=1\right)\eta_k^d\right] + \delta_c^d + \tau_t^d + X_{ict}^{d}\theta^d + \varepsilon_{ict}^{d}, \quad (1)$$

where COD_{ict}^{d} is an indicator for parent *i* who resided in county c and died from cause-of-death d in year t; α_0^d is a constant; δ_c^d and τ_t^d represent county and year of death fixed effects, respectively. $I(INCk=1)$ equals one when the family income of parent *i* falls in the k^{th} income quartile; $I(EDUk=1)$ is an indicator for the educational level k attained by the deceased parent

[16] The CCS re-grouping allows us to collapse ICD-9s into clinically meaningful diagnosis categories: 181 COD groups for deceased fathers and 178 COD groups for deceased mothers.

i, $I(EDUSk = 1)$ is an indicator for the educational level k attained by the spouse. X includes four dummies of age at the time of death and an indicator for urban residence. Finally, ε_{ict}^{d} is an idiosyncratic error term.

We estimate Equation (1) using all the parents who died before their child turned the age of 20. We perform the estimations separately for mothers and fathers. The classification of causes of death into informative (ICOD) or uninformative (UCOD) rests on testing whether the coefficient estimates for the income variables, β_k^d, the education indicators for the deceased, γ_k^d, the education indicators for the spouse of the deceased, η_k^d, and all three sets, income, own education, and spousal education indicators, respectively, are jointly zero. If we reject any of the four null hypotheses at the 10 percent confidence level, then the COD is classified as informative; otherwise, the COD is considered uninformative. The resulting dichotomous variables, ICOD and UCOD, are then used in lieu of parental death.

While the ICOD indicator identifies individuals who died as the result of a predictable cause-of-death, the UCOD indicator identifies individuals who died as a result of a likely random cause. Hence, the UCOD indicator constitutes a source of exogenous variation that is orthogonal to the socio-economic characteristics of both the child and her/his parents. On the other hand, the effect measured by the ICOD is expected to be biased by omitted third variables. A priori, the direction of the bias is not evident. For instance, because low-SES children already are exposed to various biological and environmental risks, the incremental damage caused by parental loss could be smaller for these children. However, children from high-SES families may be better prepared to deal with the death financially. In either case, unobservables are likely to cause the ICOD coefficient to be biased towards zero relative to the UCOD coefficient.[17] On the other

[17] An alternative explanation for the attenuation of the bereavement effects is provided by Fortson (2008), who finds

hand, low-SES children are both more likely to experience parental loss and more frequently exposed to risk factors such as medical illness and family stress. These biological and environmental risk factors may interact synergistically leading these children to have worse outcomes. In this case, the adverse effect captured by the ICOD indicator will be overestimated.

1.5.1 COD Classification

Table 1.4 reports the top ten ICODs and UCODs, separately for mothers (top panel) and fathers (bottom panel). These CODs are obtained by estimating Equation (1) separately for each CCS group found in the mortality sample. Grouping all of the cancer related deaths, we observe that cancer is the number one cause-of-death for both mothers and fathers. Given that many of the listed cancers are highly preventable and often related to behavioral risk factors, it is not surprising to find them primarily under the ICOD group. About 80 percent of fathers' deaths are informative. This is greater than the percentage of informative deaths for mothers (63 percent), which is consistent with the findings from the epidemiological literature.[18] For fathers, we find that about 72 percent of the informative deaths have a statistically significant income gradient, whereas 54 (43) percent have a statistically significant own (spouse's) education gradient. For mothers, only 30 percent of the informative deaths have a statistically significant income gradient, whereas 69 (40) percent have a statistically significant own (spouse's) education gradient. That is, while it is income that is the most significant SES-predictor of mortality for fathers, it is own education for mothers.

As for fathers, we find motor vehicle accidents (13.5 percent), other liver diseases (12.4 percent)

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that HIV-infection is positively associated with SES in Sub-Saharan Africa.

[18] Mustard and Etches (2003) systematically review 136 published papers that look at the gender differences in mortality risk factors and select 58 studies to be included in their analysis. For 90 percent of the selected studies the authors find that, when absolute measures of inequality are used, male mortality is more unequal than female mortality across socioeconomic groups.

and cancer of liver and intrahepatic bile duct (8.6 percent) to be among the three most common ICODs (top left panel of Table 1.4). The three most common UCODs for fathers (top right panel of Table 1.4) include acute crushing injury or internal injury (4.2 percent), superficial injury, contusion (3.2 percent) and diabetes mellitus (2.5 percent). For mothers, the most common ICOD is breast cancer (8.1 percent), while the second and the third most common ICODs are acute cerebrovascular disease (4.5 percent) and cancer of the cervix (4.1 percent). The three most common UCODs among mothers include motor vehicle accidents (11.5 percent), suicide (6.8 percent) and respiratory failure (1.4 percent).

While an in depth analysis of mortality risk factors is beyond the scope of this study, it is worth discussing some of the CODs in detail. We consider in turn suicide, congestive heart failure and diabetes. The finding that suicide is an ICOD for fathers and a UCOD for mothers may be counter-intuitive at first glance; however, several studies echo this finding. For example, Cubin et al. (2000) examine the association between education, employment, income, and death rates for both men and women. The authors find that while women with low level of educational attainment have generally higher death rates relative to women with higher educational attainment, suicide is the exception to this rule. Similarly, Lorant et al. (2005) find that while a low level of educational attainment for men is a risk factor for suicide in eight out of ten countries they examine, the educational inequalities for suicide are overall smaller and less consistent for women (see also, Sher 2006 and Lin 2006).

As for congestive heart failure and diabetes, many studies document a strong negative health gradient where those at the bottom of the economic hierarchy have both higher incidence rates as well as worse adverse outcomes (e.g. Hawkins et al. 2012, Kaplan and Keil 1993). However, several review articles also find that although consistently strong across high-income

countries, the corresponding association is less evident for middle and low-income countries.[19] One explanation for our seemingly paradoxical finding is that the epidemiology of disease depends strongly on a country's economic development. For example, rheumatic heart disease is the major cause of heart failure in Asia, while coronary artery disease is the single most common cause of heart failure in western developed countries (Mendez and Cowie 2001). The former has a less clear association with socioeconomic status (Steer et al. 2002), whereas the latter has more consistent association with unhealthy life styles and socioeconomic status. As developing countries undergo the epidemiological transition and socio-economic development, the etiology of diseases also becomes increasingly similar to that of western societies. It is the transition to western lifestyle and the attendant increase in the risk of chronic diseases like diabetes and heart failure, both of which normally occur initially among the more affluent, that may render the SES-health gradient in a society ambiguous (Schooling et al. 2010).[20]

In what follows, a statistically significant UCOD coefficient will be interpreted as evidence of a causal relationship between parental loss and educational outcome; a statistically significant ICOD coefficient that is different from the corresponding UCOD coefficient will be interpreted as simple correlation between parental loss and outcome.

1.5.2 Parental Loss and Children's Outcomes

Empirical research shows that children growing up in single parent families are at a higher risk of teenage pregnancy, early marriage, dropping out of school, delinquency, adult depression, and other possible negative outcomes (Amato 2005; Kendler et al. 2002; McLanahan

[19] For example, see review articles by Manrique-Garcia et al. (2011) for acute myocardial infarction, Agardh et al. (2011) and Chaturvedi (2004) for diabetes, and Mendez and Cowie (2001) and Blair et al. (2002) for heart failure.

[20] It is important to point out that Taiwan experienced significant socio-economic development during our study period (1981-2003). As a result of this and of the attendant epidemiological transition, it becomes difficult to distinguish the informative from the uninformative CODs based solely on the existing epidemiological literature. This issue highlights the relevance of using statistical methods as we do in this study.

and Sandefur 1994). We first study the effects of parental loss on children's educational attainment, measured by the enrollment rate in college or university, and the quality of education children receive, measured by the type of college or university the child attends (public versus private).

Entrance to prestigious institutions of higher education is highly competitive in Taiwan, and the CUJEE is the most important factor in any admission decision. If losing a parent affects children's educational outcomes or the quality of education children's receive, then one of the potential channels is through children's performance on the CUJEE. We investigate this hypothesis by focusing first on an indicator for whether or not the child has taken the CUJEE as the outcome variable. Depending upon how well students perform in the entrance exam, they are then assigned to a major in a particular College or University. Hence, for the subsample of test-takers we explore whether children who have lost a parent perform systematically differently from children with living parents when taking the CUJEE.

We also study whether the death of a parent significantly affects other dimensions of children's lives. Specifically, we consider whether children who have lost a parent before turning 20 years of age are more likely to marry or to work during their teenage years, both of which are potential substitutes for higher education. Military enlistment is also an alternative income earning occupation for boys. While military service is compulsory for all boys 19 years of age, if a boy chooses to attend college or university the draft can be deferred until after obtaining a higher education degree. Hence, we investigate whether bereaved boys are more likely to enlist in the military soon after high-school graduation than non-bereaved boys.

After the death of a father (mother), boys (girls) may naturally respond to the loss by assuming the role of the deceased. To better capture the gender-bereavement gradient, we run all

regressions by the gender of the deceased parent and separately for boys and girls. Similarly, the bereavement effect may be different depending on the time elapsed between the death and the observed outcomes under study. To study the time-bereavement gradient, we construct time-death interactions that classify the effect of parental loss into three categories: the long-term effect, corresponding to more than 9 years between the parent's death and the relevant year[21]; the medium-term effect, corresponding to 3-9 years between the parent's death and the relevant date; and the short-term effect, corresponding to up to 3 years between the parent's death and the relevant year. Finally, the bereavement effect is also likely to depend on the socio-economic status of the family. To analyze the SES-bereavement gradient we use the insured income of parents as a proxy for family income. Using this proxy, we classify children into four income quartiles, with the first quartile corresponding to the lowest income level.

The reduced form linear probabilty model (LPM) we estimate is as follows:

$$O_{ict} = \alpha_1 + \delta_c + \sigma_t + ICOD_i\theta_1 + UCOD_i\theta_2 + X_{ict}\mu + \varepsilon_{ict}, \quad (2)$$

where the dependent variable O_{ict} is the outcome of child *i* who was born in county *c* and belongs to the exam cohort *t*; α_1 is a constant; θ_1 (θ_2) is the estimated effect of parental death on the child's educational outcome given that the cause-of-death is informative (uninformative); respectively, $ICOD_i$ and $UCOD_i$ defined as in the previous section; X_{ict} is a vector of all other explanatory variables to be included in the estimation, and ε_{ict} is an idiosyncratic error term. These include variables related to the socio-economic status of the child's family (family income level and five dummies of maternal and paternal education), the type of birth (whether the child was abandoned or born out of wedlock), as well as the ascribed characteristics of the child (gender, year of birth, birth order, and twin status). In all of our regressions, we also control for

[21] For the educational outcomes, the relevant date is the year the child is due to take the CUJEE. For the non-educational outcomes, the relevant date is the year the child turns 20 years of age.

county-of-child-birth fixed effect, δ_c, and exam-year fixed effect, σ_t.

1.6 Results

1.6.1 Educational Attainment: UCOD versus ICOD

In Panel A of Table 1.5, we present the estimated coefficient for the effect of the loss of a father (first three columns) and of the loss of a mother (last three columns) on the educational attainment of young adults (age 18-19). Both the UCOD and ICOD coefficients are reported. Comparing the coefficients for each of the groups (All, Boys, and Girls), we find that the ICOD coefficients suffer from attenuation bias, especially for the loss of a mother. The bias makes the UCOD and ICOD coefficients statistically different at the 5 percent significance level for all three samples (All, Boys, and Girls) after the death of a mother; and marginally significant for all children and for boys after the death of a father.[22] These results have interesting implications. On the one hand, the unobserved factors that govern maternal loss are more likely to be negatively correlated with children's adverse outcomes. This is not surprising given that maternal education is an important predictor of informative maternal loss and is likely to be positively correlated with children's educational attainment. For a paternal loss, it is possible that the sources of bias either cancel out or that the unobserved factors are not correlated with children's educational outcomes.

We pool the mother and father samples and test whether the bereavement effect is independent of the gender of the deceased parent. When looking at all children, we find that the effect of maternal bereavement has a significantly larger negative impact on the probability of acquiring higher education than the paternal effect. However, when testing the difference between these coefficients using separate regressions for boys and girls, the difference is no

[22] For brevity, in the remaining panels of Table 1.6, as well as in the following tables, we only report the UCOD indicator, which produces the coefficients of interest.

longer statistically significant.[23] This finding provides some support to those of Evans and Miguel (2007) and Ainsworth et al. (2005), who suggest that losing a mother has on average a more significant effect on scholastic performance of children than losing a father.

In Panel B of Table 1.5, we report the coefficient estimates for the short-, medium-, and long-term effect of the loss of a father (first three columns) and of the loss of a mother (last three columns). For boys, the negative impact from losing a father is robust across time, ranging from -0.019 to -0.026. For girls, while we do observe a significant gradient for each of the three time interactions, the short-term effect after the death of a father (-0.040) is significantly larger than the medium- and long-term effects (-0.014 and -0.015, respectively). For the loss of a mother, the coefficient estimates on all three time-bereavement interactions are statistically significant and of similar magnitude. Although ranging from -0.022 to -0.036, we cannot reject the null hypothesis that the negative effect of losing a mother is the same regardless of when it takes place.

In order to ascertain whether the effect of parental loss varies with family income, we fully interact the death of a father (mother) with each of the income quartiles. These results are reported in Panel C of Table 1.5. We find that the death of a father has a significant negative effect on the educational attainment of all children from families falling in the two lowest income quartiles (-0.016, -0.038, respectively for boys, and -0.015, -0.032, respectively for girls). For the highest income quartile, although the coefficients are only significant for all children and marginally for boys, we cannot rule out the possibility that the educational attainment of these children may in fact be more negatively affected by a father's death than that of low-income children.[24] Following the death of a mother, children from families in the three lowest income

[23] The results from these tests are available from the authors upon request.

[24] In the case of high-income girls, later in the text we verify that the size of their corresponding coefficient is driven primarily by the decline in the quality of education these girls receive that results from the death of their father (see

quartiles see significant declines in their educational attainment whereas the coefficient corresponding to children in the highest income quartiles are not statistically significant. We also run separate regressions for the death of a father versus the death of a mother using the four-level parental education cut-off described above as an alternative measure of SES (not reported). Overall, the results from these regressions are consistent with those from using the income measure.

1.6.2 Quality of Education: UCOD versus ICOD

We measure quality with a binary indicator of whether or not the child is enrolled in a national college or university. Results are presented in Table 1.6. Both the UCOD and ICOD coefficients are reported for the average effect. Comparing the coefficients for each of the groups (All, Boys, and Girls), we find that the attenuation bias is generally less evident; however, when the difference between the UCOD and ICOD coefficients is statistically significant, the bias again causes the ICOD coefficient to underestimate the maternal bereavement effect.

The time-bereavement gradients for the quality of education received are reported in Panel B of Table 1.6. Boys (girls) experience a negative and significant long-term effect after the death of a father (mother). Girls also experience a significant short-term effect after the death of either parent, whereas boys only after the death of a mother. In terms of income, the reductions in the quality of education received are primarily driven by children from middle- to high-income level families. This is true for both the income and the parental education interactions. In fact, the most detrimental effect is experienced by girls in the highest-income quartiles after the death of a father (-0.05), followed by all children in the middle-income quartiles after the death of either parent. Overall, these results suggest that a mother's presence is most relevant for

Table 1.6, Panel C, column 3).

determining the quality of education received by girls from low- to middle- income families, whereas a father's presence for children from middle- to high-income families.

1.6.3 Avenues for the Bereavement Effect

Looking for potential avenues for the bereavement effect, we first investigate whether losing a parent causes a change in children's probability of taking the CUJEE (Table 1.7). In Panel A, we observe that parental loss significantly reduces the probability of taking the CUJEE, regardless of the gender of the deceased parent. We also note that, similar to the college enrollment outcome, the bereavement effect is underestimated when measured by the ICOD indicator. With the exception of girls after the death of a father, the difference between the UCOD and ICOD coefficients is statistically significant for all subsamples.

In Panel B, we report the time-bereavement gradients for the probability of taking the CUJEE. We find that the bereavement effect is significant regardless of when in the child's life the loss of the parent takes place and of the gender of the deceased parent. In terms of the magnitude of the bereavement effect, we observe that the death of a father has the most deleterious effect in the long-term for boys and in the short-term for girls, respectively, while the effect of the death of a mother remains equally large across time and gender of the child. The income-bereavement interactions, presented in Panel C, show that the probability of taking the CUJEE is particularly affected when children come from the two (three) lowest income quartile families after the death of a father (mother). For brevity, the results for the standardized test scores are not reported in the tables. These results show that, in general, the loss of a father has important negative consequences for the standardized test scores attained by children from third and fourth income quartile families, whereas the loss of a mother does so for children from the three lowest income quartile families.

Taken together, the regression results for the probability of taking the CUJEE and the performance during the exam suggest three different avenues for the income-bereavement effect. First, children from lower-income families are less likely to take the CUJEE altogether. Hence, it is not surprising to find that they are less likely to attend college or university. Second, following the death of a father, children from higher-income families may still take the CUJEE, but perform systematically worse than non-bereaved children when taking this exam. Since a child's performance in the CUJEE is the most important determinant of the quality of education he/she receives, the latter finding also provides a plausible mechanism that explains why bereaved children, and in particular those from middle- to high-income families, experience significant reductions in the quality of their education following a father's death. Third, children who have lost a mother are both less likely to take the CUJEE and more likely to do worse when taking it. The final remark is related to the finding that, for boys, the negative effect of bereavement on the probability of taking the CUJEE increases with the average education of parents (not reported in the tables). It is possible that following the death of a father, when high-SES families are unable to recover financially, boys experience the most significant declines in educational attainment as they assume some of the responsibilities of the deceased.

1.6.4 Teenage Marriage, Teenage Employment, and Military Enrollment

Tables 1.8 through 1.10 summarize the results of the analysis of the effect of parental loss on teenage marriage, teenage employment, and military enrollment. Table 1.8 shows that while the loss of either parent has virtually no effect on the probability of teenage marriage for boys, it has a significant positive effect on girls. Moreover, as is evident from Panel B, the increase in the likelihood of teenage marriage for girls who experience parental death remains the same regardless of when in the girl's life the loss takes place. As for the income-bereavement

interaction, we find that the death of either parent has the largest impact on the probability of teenage marriage for girls from the two lower-income quartile families or from families with low educational attainment. Finally, we also note that when the ICOD and UCOD coefficients are statistically different, the ICOD estimates again suffer from attenuation bias.

In terms of the probability of working during their teenage years, from Panel A of Table 1.9 we observe that children who have lost a parent are, on average, more likely to work than those with living parents. Similar to the case of educational outcomes, Panel B shows that the loss of a father has a larger long-term (short-term) effect for boys (girls), respectively whereas following the loss of a mother (and regardless of the gender of the child) both the medium- and long-term effects are the most pronounced. Studying the income-bereavement interactions (Panel C), we conclude that while virtually all boys and girls from families falling in the two lowest income quartiles are more likely to work following the death of either parent, the probability of working for children from families that belong to the highest-income quartile is not affected by the death of either parent.[25] Lastly, we note that for the teenage work outcome the estimated coefficients corresponding to the UCOD and ICOD indicators are practically the same.

The results in Panel A of Table 1.10 show that the likelihood of military enrollment also increases after the death of either parent. From Panel B we learn that boys are more likely to enlist in the military after either a short-term or a long-term loss of a father, a result that is again consistent with the educational outcomes. Note however, that it is only the long-term effect that drives the differences between bereaved and non-bereaved boys after the death of a mother. The results for the income gradient, reported in Panel C, are similar to those of taking the CUJEE. In particular, we see that while boys from families falling in the three lower income quartiles are

[25] We also note that the results are virtually the same when family SES is measured using parental education.

more likely to substitute higher education for military enlistment (i.e. a paying occupation), when parental education is used as the SES measure (not reported in the Tables), all boys regardless of the educational attainment of their parents are more likely to enroll in the military sooner. This suggests that the major driver of the decision to join the military is the financial need that follows the death of a parent and, in particular, the death of a father. Finally, when looking at the effect of parental loss on military enrollment more than five years after high school graduation, the UCOD coefficients are all insignificant.

1.7 Robustness Checks

As described above, the CCS re-grouping allows us to aggregate ICD-9s into more than 100 clinically meaningful diagnosis categories (see footnote 17). We check the robustness of our findings by employing an alternative COD classification, the ICD-9 72 grouping of the Center for Disease Control and Prevention. This grouping allows us to collapse ICD-9s into 72 selected CODs, as defined by the National Center for Health Statistics (NCHS) for analysis of mortality data. Following the same estimation methods decribed in Section 3, the results obtained using this alternative COD grouping confirm the robustness of the main results for each of the six outcomes (Table 1.11).

As a second validity check we use the large set of explanatory variables at hand to estimate the conditional probability of receiving the treatment (i.e. parental death) or propensity score function for each of the subsamples. The estimated propensity score is divided into q intervals, with the optimal number of intervals q chosen such that individuals falling in a particular interval have on average the same propensity score. For each of the q intervals, the difference between the average outcome of the treatment and the control (or ATT) is obtained. Finally, the sample ATT is then constructed as the average of the ATTs across all of the q

intervals, where the contribution of each interval to the sample ATT is given by the proportion of treated units in each block. This alternative method allows us to use a scalar to summarize background characteristics that help explain the likelihood of selection into the treatment while abstaining from making any distributional assumption about the relationship between the treatment and the outcome. The results from this exercise confirm our main findings (Table 1.12).

1.8 Discussion

The primary aim of our study is to analyze how the loss of a parent affects children's wellbeing. The identification strategy that we use shows that ignoring the endogeneity of parental death has a clear potential to underestimate the bereavement effect, particularly for educational outcomes. This attenuation bias is consistent with the bereavement literature, which suggests that families that have experienced the loss of a parent as a result of a foreseen and/or predictable death - as opposed to an unforeseen or random death - may be more likely to be better prepared to assimilate the loss and, when possible, to have made arrangements to deal with it emotionally and financially (Vera 2006; Iserson 2000).[26] Our results show that losing either parent has significant effects on many dimensions of children's lives. Still, we find that maternal bereavement negatively affects the educational attainment of children more uniformly across both time and income.

While highly active in the labor force, women in Taiwan are largely in charge of the family chores, of which childrearing is perhaps the most important. As a result, a mother is more

[26] In fact, the inconsistency of findings from studies that analyze the effect of parental bereavement on outcomes of children from Sub-Saharan Africa has often been credited to the fact that extended family networks are ubiquitous in the region (Kobiané et al. 2005, Foster and Williamson 2000). Given that death from HIV-AIDS is highly foreseen, it is likely that as the disease reaches its final stage, relatives would play an important role in mitigating the negative effects of the loss by caring for the child and by helping the child to transition to his/her new life without a parent.

intertwined with her children's everyday activities and provides their lives with structure. When a mother is lost, the surviving father must provide the child with comfort and procure to fill the void left by the mother's death. Tremblay and Israel (1998) point out that open communication, emotional support, adequate care, and family environment allow the child to greave and to successfully adjust to the loss. However, a vast number of studies suggest that such level of communication may be particularly difficult for a father who, while besieged with new responsibilities, is also trying to cope with the loss of his wife and adapt to the new family structure. Additionally, children accustomed to having their mother in charge of dealing with the affective life of the family may be less inclined to open-up and to share their feelings with their fathers (Silverman et al. 1992). Consequently, it is not surprising to find that the death or absence of a mother in the child's life has, in general, a more uniform impact on the child's educational attainment than the death of a father.

We also find that the effect of bereavement on educational outcomes is persistent across time irrespective of the gender of the parent; still, following the loss of a father the short-term effect is larger for girls. These results suggest that while time may help to weaken the negative impact of paternal loss on girls' educational outcomes, the latter may be particularly affected when the loss is more recent. The finding is also consistent with the hypothesis that income constrained mothers who are unable to make up for the loss of the main income earner in the family would be more likely to choose to invest in their sons' education than in their daughters'. This decision may be reinforced by the traditional role that Taiwanese sons play as caregivers for their elderly parents.

In terms of the SES-bereavement gradients, we find these to be quite heterogeneous. On the one hand, the negative father-son SES-bereavement gradient for the educational outcomes is

driven by two extremes, the high-SES and the low-SES families, whereas the negative father-daughter SES-bereavement gradient is driven by relatively lower education and lower income families, the low- to middle-SES families. The large negative effect of the loss of a father on the educational attainment of boys from the highest-SES families and the finding that the long-term effect is particularly large for boys are suggestive of the drastic role changes that a high-income family must undergo after the death of a main income earner. For instance, given Taiwan's patrilineal tradition, it is possible that boys rather than girls would be expected to assume the role of the head of the family following the father's death, causing them to search for a job or to take charge of the family business instead of pursuing higher education. On the other hand, the negative mother-son and mother-daughter SES-bereavement gradient is driven by the low- to middle-SES families. Finally, it is also interesting to note that the avenue for the bereavement effect is different for children from the highest-SES families. In particular, while bereavement affects most of the outcomes we have analyzed for children from the lower and middle income families, the most significant effect for children from the highest income families is the decline in the quality of education that they receive and one of the direct reasons appears to be their lower performance when taking the CUJEE.

1.9 Conclusion

Our main results suggest that losing a parent can severely curtail human capital accumulation for girls and, in particular, girls in the lowest-income quartiles because it not only decreases their college or university enrollment ratios, but also makes them more likely to marry and to work during their teenage years. Similarly, boys who have lost a parent are more likely to be occupied with income earning activities before becoming adults, suggesting that the financial pressure felt after the death of a parent causes boys to substitute earning income in place of

higher education. The need to earn income and the possibility of early marriage and parenthood are expected to introduce new priorities into the child's life, thus limiting the child’s chances of continuing her/his education.

Our study gives rise to two main policy implications: (1) Policies aimed at protecting the educational opportunities of children who have experienced the loss of a parent should help alleviate the financial pressure felt, in particular, by children from low- and middle-income families who are likely to be affected disproportionately by the loss of either parent. (2) Cost-benefit analyses undertaken to decide whether to carry out new screening and prevention programs, or whether to continue support for promising current efforts to prevent the early loss of parents should take into consideration all the potential costs savings from such efforts. These include the savings from both the decreased wages and worker productivity due to the lower educational attainment of bereaved children, as well as from the possible negative spillover on future generations due to both early marriage and lower educational attainment.

Table 1.1

Descriptive Statistics I – Mortality Variables

Variable	Death of a Father		Death of a Mother	
	Mean	St. Dev.	Mean	St. Dev.
Deceased and child < 20	0.049	0.216	0.016	0.126
Deceased before CUJEE	0.047	0.211	0.016	0.124
Parent's age when deceased [a]	43.25	8.290	38.61	7.172
Child's age when parent died [a]	12.26	4.931	12.05	5.050

This table shows the summary statistics for all the mortality related variables. Observations are at the child level. [a] Statistics include all children who have lost a parent before turning 20 years of age. Sample size for the death of a father (mother): N = 68,363 (22,918).

Table 1.2

Descriptive Statistics II – Explanatory Variables

Variable	Mean	St. Dev.	Variable	Mean	St. Dev.
	Child Variables			Father's Education	
Eldest daughter	0.186	0.389	Junior high-school	0.239	0.426
Eldest son	0.199	0.399	High-school	0.298	0.457
Male	0.516	0.499	College without a degree	0.082	0.275
Twin	0.008	0.094	College with a degree	0.066	0.248
Out of wedlock	0.005	0.075	More than college education	0.002	0.049
Abandoned	0.000	0.002			
Birth year 1981	0.092	0.289		Mother's Education	
Birth year 1982	0.262	0.440			
Birth year 1983	0.251	0.433	Junior high-school	0.246	0.431
Birth year 1984	0.246	0.430	High-school	0.273	0.445
Birth year 1985	0.147	0.354	College without a degree	0.045	0.208
Family Income[a]	32,719	22,422	College with a degree	0.030	0.173
			More than college education	0.000	0.020

This table shows the summary statistics for all the explanatory variables. N = 1,402,196.
[a] 1994-95 average exchange rate: US$ 1 = NT$ 26.462.

Table 1.3

Descriptive Statistics III – Binary Dependent Variables

	Death of a Father (N = 1,397,538)			Death of a Mother (N = 1,402,196)		
Variable	Bereaved	Non-Bereaved	Diff.[a] *(p-value)*	Bereaved	Non-Bereaved	Diff.[a] *(p-value)*
			Educational Outcomes[b]			
Educational Attainment	0.102	0.182	0.079 (0.000)	0.111	0.179	0.068 (0.000)
Quality of Education	0.031	0.062	0.030 (0.000)	0.036	0.061	0.024 (0.000)
Take CUJEE	0.153	0.260	0.106 (0.000)	0.165	0.256	0.091 (0.000)
			Other Outcomes[c]			
Teenage Marriage	0.034	0.015	-0.018 (0.000)	0.032	0.016	-0.015 (0.000)
Teenage Work	0.252	0.184	-0.067 (0.000)	0.247	0.187	-0.059 (0.000)
Military Enrollment[d]						
1 year	0.102	0.080	-0.022 (0.000)	0.099	0.080	-0.018 (0.000)
2 year	0.251	0.194	-0.057 (0.000)	0.245	0.196	-0.048 (0.000)
3 year	0.302	0.236	-0.066 (0.000)	0.293	0.238	-0.054 (0.000)
4 year	0.332	0.266	-0.066 (0.000)	0.320	0.269	-0.050 (0.000)
+5 year	0.054	0.052	-0.001 (0.265)	0.051	0.053	0.001 (0.429)

[a] Difference in outcome means between bereaved and non-bereaved children (p-value).
[b] Bereaved includes children that have lost a father (mother) before the CUJEE.
[c] Bereaved includes children that have lost a father (mother) before turning 20 years of age.
[d] Sample only includes boys: N = 721,304 for the death of a father and N = 723,635 for the death of a mother.

Table 1.4

Top 10 Causes of Death: CCS Classification

Informative Cause						Uninformative Cause					
Variable	Mort. Rate	Father Educ.	Mother Educ.	Income	All	Variable	Mort. Rate	Father Educ.	Mother Educ.	Income	All
					Death of a Father (N = 55,423)						
Motor vehicle accident	0.135	0.050	0.050	0.428	0.004	Crushing, internal injury	0.042	0.463	0.333	0.271	0.126
Other liver diseases	0.124	0.000	0.016	0.153	0.000	Superficial injury	0.032	0.422	0.106	0.420	0.104
Cancer – liver and intrahep.	0.086	0.043	0.016	0.000	0.000	Diabetes mellitus	0.025	0.202	0.932	0.776	0.518
Acute CVD	0.061	0.234	0.047	0.473	0.139	Congestive heart failure	0.015	0.859	0.735	0.753	0.931
Cancer – head and neck	0.057	0.733	0.579	0.002	0.053	Septicemia (exc. in labor)	0.006	0.601	0.332	0.349	0.400
Suicide	0.035	0.005	0.102	0.082	0.007	Pancreatic disorders	0.005	0.814	0.217	0.161	0.282
Cancer – respiratory	0.028	0.000	0.051	0.000	0.000	Coronary atherosclerosis	0.005	0.126	0.586	0.724	0.343
Open wounds: extremities	0.023	0.033	0.371	0.870	0.002	Accidental Fall	0.005	0.730	0.353	0.674	0.793
Acute myocardial infarct.	0.022	0.067	0.082	0.663	0.000	Pleurisy, pneumothorax	0.003	0.907	0.510	0.538	0.831
Respiratory failure	0.019	0.424	0.012	0.000	0.000	Ill-defined CVC	0.003	0.711	0.495	0.396	0.510
					Death of a Mother (N = 18,942)						
Cancer – breast	0.081	0.000	0.000	0.000	0.000	Motor vehicle accident	0.115	0.794	0.491	0.237	0.450
Acute CVD	0.045	0.358	0.044	0.999	0.006	Suicide	0.068	0.243	0.303	0.104	0.112
Cancer – cervix	0.041	0.349	0.598	0.229	0.024	Respiratory failure	0.014	0.157	0.404	0.170	0.226
Cancer – respiratory	0.037	0.235	0.193	0.004	0.000	Acute renal failure	0.013	0.884	0.374	0.239	0.548
Other liver diseases	0.034	0.112	0.114	0.001	0.000	Myocarditis [a, b]	0.011	0.846	0.490	0.652	0.551
Crushing, internal injury	0.032	0.745	0.379	0.073	0.060	Acute myocardial infarct.	0.011	0.688	0.294	0.687	0.307
Cancer – stomach	0.031	0.222	0.008	0.000	0.000	Congestive heart failure	0.010	0.622	0.988	0.542	0.791
Superficial injury	0.025	0.495	0.684	0.000	0.002	Cancer – rectum and anus	0.010	0.942	0.713	0.348	0.836
Cancer – liver and intrahep.	0.025	0.012	0.362	0.010	0.005	Poisoning	0.009	0.829	0.538	0.753	0.858
Cancer – head and neck	0.023	0.741	0.646	0.012	0.075	Pneumonia	0.008	0.297	0.433	0.266	0.276

This table reports the top ten CODs' mortality rates and p-values for the joint F-tests performed after estimating Equation 1. Observations are at the parent level.
CVD = Cerebrovascular disease. [a] Includes peri-, endo-, and myocarditis, cardiomyopathy. [b] Except that caused by tuberculosis or sexually transmitted disease.

Table 1.5

OLS Estimates of Parental Death on University or College Attendance

		Death of a Father			Death of a Mother		
	Coefficient	All	Boys	Girls	All	Boys	Girls
Panel A	U	-0.022[a]	-0.025[a]	-0.020[a]	-0.029[a]	-0.030[a]	-0.029[a]
		(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.005)
	I	-0.018[a]	-0.019[a]	-0.016[a]	-0.017[a]	-0.017[a]	-0.017[a]
		(0.001)	(0.002)	(0.002)	(0.003)	(0.004)	(0.004)
F-test	U=I	2.917	2.290	0.855	9.230	4.853	4.108
Panel B	U*S	-0.029[a]	-0.019[b]	-0.040[a]	-0.036[a]	-0.036[a]	-0.036[a]
		(0.005)	(0.008)	(0.008)	(0.007)	(0.009)	(0.010)
	U*M	-0.020[a]	-0.025[a]	-0.014[b]	-0.031[a]	-0.027[a]	-0.035[a]
		(0.004)	(0.006)	(0.007)	(0.006)	(0.008)	(0.008)
	U*L	-0.021[a]	-0.026[a]	-0.015[b]	-0.026[a]	-0.028[a]	-0.022[a]
		(0.004)	(0.005)	(0.006)	(0.005)	(0.006)	(0.007)
F-test	U*S=U*M	1.811	0.396	6.487	0.372	0.549	0.014
	U*M=U*L	0.021	0.016	0.003	0.511	0.023	1.431
	U*L=U*S	1.656	0.587	7.005	1.685	0.431	1.411
Panel C	U*1	-0.016[a]	-0.016[a]	-0.015[a]	-0.023[a]	-0.024[a]	-0.022[a]
		(0.003)	(0.004)	(0.005)	(0.004)	(0.005)	(0.006)
	U*2	-0.035[a]	-0.038[a]	-0.032[a]	-0.036[a]	-0.034[a]	-0.037[a]
		(0.005)	(0.006)	(0.007)	(0.007)	(0.009)	(0.010)
	U*3	-0.015	-0.025	-0.005	-0.039[a]	-0.041[a]	-0.037[b]
		(0.013)	(0.018)	(0.020)	(0.010)	(0.013)	(0.015)
	U*4	-0.051[b]	-0.053[c]	-0.048	-0.042	-0.024	-0.062
		(0.023)	(0.030)	(0.035)	(0.028)	(0.038)	(0.042)
F-test	U*1=U*2	11.39	7.687	4.310	2.607	0.903	1.754
	U*2=U*3	1.934	0.436	1.679	0.079	0.176	0.000
	U*3=U*4	1.850	0.623	1.147	0.009	0.178	0.322
	U*1=U*4	2.384	1.440	0.896	0.440	0.000	0.897
Obs.		1,397,538	721,304	676,234	1,402,196	723,635	678,561

We include five indicators corresponding to the level of parental education of each parent, child's gender, year of birth, birth order, type of birth, twin status, family income level, and both county and exam year fixed effects. Superscripts [a], [b], and [c] denote the significance at 1%, 5%, and 10% levels, respectively. U = Uninformative cause of death. I = Informative cause of death. t = S, M, L: short-(S), medium-(M), or long-(L) term dummy interaction. n = 1, 2, 3, 4: n-th income quartile dummy interaction. Standard errors in parentheses.

Table 1.6

OLS Estimates of Parental Death on Quality of Education

		Death of a Father			Death of a Mother		
	Coefficient	All	Boys	Girls	All	Boys	Girls
Panel A	U	-0.006[a]	-0.006[a]	-0.007[a]	-0.009[a]	-0.007[b]	-0.011[a]
		(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
	I	-0.007[a]	-0.008[a]	-0.005[a]	-0.005[a]	-0.008[a]	-0.002
		(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.003)
F-test	U=I	0.0564	0.792	0.341	2.068	0.0485	5.432
Panel B	U*S	-0.010[a]	-0.007	-0.015[a]	-0.014[a]	-0.013[b]	-0.015[a]
		(0.003)	(0.005)	(0.004)	(0.004)	(0.005)	(0.006)
	U*M	-0.004	-0.003	-0.006	-0.006[c]	-0.005	-0.007
		(0.003)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
	U*L	-0.006[b]	-0.008[b]	-0.003	-0.008[a]	-0.006	-0.011[a]
		(0.002)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
F-test	U*S=U*M	2.241	0.373	2.602	2.252	0.930	1.363
	U*M=U*L	0.151	1.104	0.272	0.300	0.00306	0.522
	U*L=U*S	1.541	0.0625	4.764	1.309	0.988	0.410
Panel C	U*1	-0.001	-0.001	-0.001	-0.006[a]	-0.005	-0.007[b]
		(0.002)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)
	U*2	-0.012[a]	-0.010[b]	-0.015[a]	-0.007	-0.003	-0.012[b]
		(0.003)	(0.004)	(0.004)	(0.004)	(0.006)	(0.006)
	U*3	-0.012	-0.024[b]	0.000	-0.018[a]	-0.016[c]	-0.020[b]
		(0.008)	(0.010)	(0.013)	(0.006)	(0.009)	(0.009)
	U*4	-0.032[b]	-0.018	-0.050[a]	-0.030[c]	-0.029	-0.032
		(0.013)	(0.020)	(0.017)	(0.018)	(0.024)	(0.027)
F-test	U*1=U*2	11.56	3.255	9.236	0.0355	0.133	0.598
	U*2=U*3	0.000	1.788	1.294	2.154	1.556	0.614
	U*3=U*4	1.642	0.082	5.465	0.436	0.252	0.194
	U*1=U*4	5.409	0.701	8.054	1.831	0.960	0.889
Obs.		1,397,538	721,304	676,234	1,402,196	723,635	678,561

We include five indicators corresponding to the level of parental education of each parent, child's gender, year of birth, birth order, type of birth, twin status, family income level, and both county and exam year fixed effects. Superscripts [a], [b], and [c] denote the significance at 1%, 5%, and 10% levels, respectively. U = Uninformative cause of death. I = Informative cause of death. t = S, M, L: short-(S), medium-(M), or long-(L) term dummy interaction. n = 1, 2, 3, 4: n-th income quartile dummy interaction. Standard errors in parentheses.

Table 1.7

OLS Estimates of Parental Death on the Probability of Taking CUJEE

		Death of a Father			Death of a Mother		
	Coefficient	All	Boys	Girls	All	Boys	Girls
Panel A	U	-0.034[a]	-0.036[a]	-0.031[a]	-0.041[a]	-0.037[a]	-0.045[a]
		(0.003)	(0.004)	(0.004)	(0.004)	(0.005)	(0.006)
	I	-0.026[a]	-0.028[a]	-0.024[a]	-0.023[a]	-0.024[a]	-0.024[a]
		(0.002)	(0.002)	(0.002)	(0.003)	(0.004)	(0.005)
F-test	U=I	4.969	3.359	1.801	13.33	4.164	9.530
Panel B	U*S	-0.037[a]	-0.023[b]	-0.051[a]	-0.041[a]	-0.043[a]	-0.038[a]
		(0.006)	(0.009)	(0.009)	(0.008)	(0.011)	(0.012)
	U*M	-0.026[a]	-0.032[a]	-0.021[a]	-0.042[a]	-0.035[a]	-0.049[a]
		(0.005)	(0.007)	(0.008)	(0.007)	(0.009)	(0.010)
	U*L	-0.038[a]	-0.047[a]	-0.028[a]	-0.040[a]	-0.035[a]	-0.045[a]
		(0.005)	(0.006)	(0.007)	(0.005)	(0.008)	(0.008)
F-test	U*S=U*M	1.502	0.565	6.259	0.008	0.284	0.502
	U*M=U*L	2.629	2.459	0.513	0.025	0.000	0.090
	U*L=U*S	0.018	4.591	4.016	0.001	0.329	0.256
Panel C	U*1	-0.027[a]	-0.029[a]	-0.026[a]	-0.040[a]	-0.036[a]	-0.045[a]
		(0.004)	(0.005)	(0.005)	(0.004)	(0.006)	(0.006)
	U*2	-0.049[a]	-0.055[a]	-0.044[a]	-0.042[a]	-0.037[a]	-0.047[a]
		(0.006)	(0.008)	(0.008)	(0.008)	(0.011)	(0.012)
	U*3	-0.024	-0.031	-0.016	-0.042[a]	-0.043[a]	-0.042[b]
		(0.015)	(0.020)	(0.022)	(0.011)	(0.015)	(0.017)
	U*4	-0.016	-0.003	-0.030	-0.024	-0.013	-0.036
		(0.026)	(0.036)	(0.039)	(0.031)	(0.041)	(0.045)
F-test	U*1=U*2	10.65	8.068	3.269	0.040	0.010	0.029
	U*2=U*3	2.694	1.290	1.418	0.000	0.084	0.074
	U*3=U*4	0.057	0.430	0.096	0.324	0.460	0.013
	U*1=U*4	0.166	0.471	0.011	0.286	0.303	0.036
Obs.		1,397,538	721,304	676,234	1,402,196	723,635	678,561

We include five indicators corresponding to the level of parental education of each parent, child's gender, year of birth, birth order, type of birth, twin status, family income level, and both county and exam year fixed effects. Superscripts [a] and [b] denote the significance at 1% and 5% levels, respectively. U = Uninformative cause of death. I = Informative cause of death. t = S, M, L: short-(S), medium-(M), or long-(L) term dummy interaction. n = 1, 2, 3, 4: n-th income quartile dummy interaction. Standard errors in parentheses.

Table 1.8

OLS Estimates of Parental Death on Teenage Marriage

		Death of a Father			Death of a Mother		
	Coefficient	All	Boys	Girls	All	Boys	Girls
Panel A	U	0.010[a]	0.001	0.020[a]	0.015[a]	0.001	0.030[a]
		(0.002)	(0.001)	(0.003)	(0.002)	(0.001)	(0.004)
	I	0.011[a]	0.001[b]	0.021[a]	0.004[a]	-0.000	0.009[a]
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)
F-test	U=I	0.139	0.232	0.0782	18.32	0.214	20.38
Panel B	U*S	0.010[a]	-0.001	0.022[a]	0.016[a]	0.004	0.029[a]
		(0.003)	(0.002)	(0.006)	(0.004)	(0.003)	(0.008)
	U*M	0.008[a]	-0.001	0.017[a]	0.009[a]	-0.000	0.021[a]
		(0.003)	(0.002)	(0.005)	(0.004)	(0.002)	(0.007)
	U*L	0.012[a]	0.002	0.022[a]	0.018[a]	-0.000	0.037[a]
		(0.003)	(0.002)	(0.005)	(0.003)	(0.002)	(0.006)
F-test	U*S=U*M	0.190	0.000	0.310	1.308	1.145	0.534
	U*M=U*L	0.927	0.782	0.520	3.148	0.001	2.897
	U*L=U*S	0.211	0.735	0.008	0.184	1.371	0.668
Panel C	U*1	0.014[a]	0.002	0.027[a]	0.019[a]	0.002	0.037[a]
		(0.002)	(0.002)	(0.004)	(0.003)	(0.002)	(0.006)
	U*2	0.004	-0.003[c]	0.011[b]	0.013[a]	-0.000	0.027[a]
		(0.003)	(0.002)	(0.005)	(0.004)	(0.003)	(0.008)
	U*3	0.009[c]	0.003	0.016[c]	0.006[c]	0.000	0.013[c]
		(0.005)	(0.004)	(0.009)	(0.004)	(0.003)	(0.007)
	U*4	0.014[c]	0.006	0.021	0.011	-0.004[a]	0.027
		(0.008)	(0.007)	(0.016)	(0.009)	(0.000)	(0.019)
F-test	U*1=U*2	7.849	3.458	5.438	1.273	0.279	1.006
	U*2=U*3	0.912	1.802	0.194	1.464	0.019	1.770
	U*3=U*4	0.208	0.128	0.084	0.175	2.781	0.438
	U*1=U*4	0.000	0.387	0.112	0.688	6.951	0.290
Obs.		1,397,538	721,304	676,234	1,402,196	723,635	678,561

We include five indicators corresponding to the level of parental education of each parent, child's gender, year of birth, birth order, type of birth, twin status, family income level, and both county and exam year fixed effects. Superscripts [a], [b], and [c] denote the significance at 1%, 5%, and 10% levels, respectively. U = Uninformative cause of death. I = Informative cause of death. t = S, M, L: short-(S), medium-(M), or long-(L) term dummy interaction. n = 1, 2, 3, 4: n-th income quartile dummy interaction. Standard errors in parentheses.

Table 1.9

OLS Estimates of Parental Death on Teenage Employment

		Death of a Father			Death of a Mother		
	Coefficient	All	Boys	Girls	All	Boys	Girls
Panel A	U	0.035[a]	0.036[a]	0.034[a]	0.037[a]	0.037[a]	0.037[a]
		(0.004)	(0.006)	(0.005)	(0.005)	(0.007)	(0.007)
	I	0.036[a]	0.040[a]	0.032[a]	0.035[a]	0.036[a]	0.034[a]
		(0.002)	(0.003)	(0.003)	(0.004)	(0.005)	(0.005)
F-test	U=I	0.0178	0.374	0.244	0.124	0.008	0.163
Panel B	U*S	0.040[a]	0.025[b]	0.057[a]	0.018[b]	0.021[c]	0.015
		(0.008)	(0.011)	(0.011)	(0.009)	(0.013)	(0.013)
	U*M	0.032[a]	0.032[a]	0.031[a]	0.044[a]	0.045[a]	0.043[a]
		(0.007)	(0.010)	(0.009)	(0.009)	(0.012)	(0.012)
	U*L	0.035[a]	0.047[a]	0.023[a]	0.043[a]	0.041[a]	0.046[a]
		(0.006)	(0.009)	(0.008)	(0.007)	(0.010)	(0.010)
F-test	U*S=U*M	0.636	0.258	3.046	4.392	1.773	2.579
	U*M=U*L	0.152	1.331	0.452	0.004	0.063	0.029
	U*L=U*S	0.231	2.686	6.024	4.961	1.439	3.760
Panel C	U*1	0.035[a]	0.038[a]	0.031[a]	0.041[a]	0.039[a]	0.043[a]
		(0.005)	(0.007)	(0.007)	(0.006)	(0.009)	(0.009)
	U*2	0.039[a]	0.039[a]	0.041[a]	0.042[a]	0.037[a]	0.048[a]
		(0.007)	(0.010)	(0.010)	(0.010)	(0.014)	(0.014)
	U*3	0.028[b]	0.025	0.031[c]	0.021[b]	0.034[b]	0.008
		(0.013)	(0.019)	(0.018)	(0.010)	(0.015)	(0.014)
	U*4	0.024	0.006	0.046	0.024	0.018	0.030
		(0.020)	(0.027)	(0.031)	(0.024)	(0.035)	(0.033)
F-test	U*1=U*2	0.269	0.000	0.595	0.010	0.027	0.090
	U*2=U*3	0.593	0.388	0.194	2.187	0.025	4.044
	U*3=U*4	0.032	0.339	0.176	0.007	0.157	0.365
	U*1=U*4	0.291	1.305	0.235	0.495	0.340	0.147
Obs.		1,397,538	721,304	676,234	1,402,196	723,635	678,561

We include five indicators corresponding to the level of parental education of each parent, child's gender, year of birth, birth order, type of birth, twin status, family income level, and both county and exam year fixed effects. Superscripts [a], [b], and [c] denote the significance at 1%, 5%, and 10% levels, respectively. U = Uninformative cause of death. I = Informative cause of death. t = S, M, L: short-(S), medium-(M), or long-(L) term dummy interaction. n = 1, 2, 3, 4: n-th income quartile dummy interaction. Standard errors in parentheses.

Table 1.10

OLS Estimates of Parental Death on Military Enrollment

		Death of a Father					Death of a Mother				
	Coeff.	1 yr.	2 yr.	3 yr.	4 yr.	+5 yr.	1 yr.	2 yr.	3 yr.	4 yr.	+5 yr.
Panel A	U	0.014[a]	0.028[a]	0.034[a]	0.036[a]	0.003	0.012[a]	0.027[a]	0.030[a]	0.026[a]	-0.004
		(0.004)	(0.006)	(0.006)	(0.006)	(0.003)	(0.004)	(0.007)	(0.007)	(0.007)	(0.003)
	I	0.011[a]	0.022[a]	0.027[a]	0.029[a]	0.006[a]	0.006[c]	0.022[a]	0.027[a]	0.026[a]	0.005[c]
		(0.002)	(0.003)	(0.003)	(0.003)	(0.001)	(0.003)	(0.005)	(0.005)	(0.005)	(0.003)
F-test	U=I	0.581	1.282	1.119	1.241	0.676	1.223	0.351	0.156	0.000	3.970
Panel B	U*S	0.018[b]	0.036[a]	0.045[a]	0.046[a]	0.002	0.001	0.014	0.015	0.004	-0.004
		(0.007)	(0.011)	(0.011)	(0.012)	(0.005)	(0.008)	(0.012)	(0.013)	(0.013)	(0.006)
	U*M	0.012[c]	0.016	0.020[c]	0.023[b]	0.007	0.009	0.014	0.013	0.020	-0.000
		(0.007)	(0.010)	(0.010)	(0.010)	(0.005)	(0.008)	(0.011)	(0.012)	(0.013)	(0.006)
	U*L	0.013[b]	0.033[a]	0.038[a]	0.040[a]	0.001	0.021[a]	0.042[a]	0.050[a]	0.043[a]	-0.005
		(0.006)	(0.009)	(0.009)	(0.009)	(0.004)	(0.007)	(0.010)	(0.010)	(0.011)	(0.005)
Panel C	U*1	0.016[a]	0.026[a]	0.030[a]	0.033[a]	-0.000	0.014[b]	0.027[a]	0.027[a]	0.024[b]	-0.004
		(0.005)	(0.007)	(0.008)	(0.008)	(0.003)	(0.006)	(0.009)	(0.009)	(0.010)	(0.004)
	U*2	0.010	0.034[a]	0.042[a]	0.041[a]	0.003	0.008	0.031[b]	0.039[a]	0.033[b]	-0.001
		(0.007)	(0.010)	(0.011)	(0.011)	(0.005)	(0.009)	(0.013)	(0.014)	(0.015)	(0.007)
	U*3	0.024[c]	0.037[b]	0.045[b]	0.054[b]	0.020[c]	0.016	0.025[c]	0.028[c]	0.026	-0.004
		(0.014)	(0.019)	(0.020)	(0.021)	(0.012)	(0.010)	(0.015)	(0.015)	(0.016)	(0.008)
	U*4	-0.018	0.010	-0.001	0.004	0.018	-0.006	-0.017	0.017	0.010	-0.009
		(0.013)	(0.026)	(0.028)	(0.030)	(0.019)	(0.021)	(0.032)	(0.036)	(0.038)	(0.020)
Obs.		721,304	721,304	721,304	721,304	721,304	723,635	723,635	723,635	723,635	723,635

We include five indicators corresponding to the level of parental education of each parent, child's gender, year of birth, birth order, type of birth, twin status, family income level, and both county and exam year fixed effects. Superscripts [a], [b], and [c] denote the significance at 1%, 5%, and 10% levels, respectively. U = Uninformative cause of death. I = Informative cause of death. t = S, M, L: short-(S), medium-(M), or long-(L) term dummy interaction. n = 1, 2, 3, 4: n-th income quartile dummy interaction. Standard errors in parentheses.

Table 1.11

OLS Estimates of Parental Death on All Outcomes under Alternative Cause of Death Grouping (ICD9-72)

	Death of a Father					
	Attendance	Quality	Take CUJEE	Marriage	Work	Military (1yr.)
UCOD	-0.024[a]	-0.008[a]	-0.030[a]	0.011[a]	0.041[a]	0.014a
	(0.003)	(0.002)	(0.004)	(0.002)	(0.004)	(0.004)
ICOD	-0.018[a]	-0.006[a]	-0.027[a]	0.011[a]	0.035[a]	0.011[a]
	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)
Obs.	1,397,538	1,397,538	1,397,538	1,397,538	1,397,538	721,304
UCOD=ICOD	4.636	0.820	0.507	0.004	1.700	0.745
	Death of a Mother					
	Attendance	Quality	Take CUJEE	Marriage	Work	Military (1yr.)
UCOD	-0.028[a]	-0.008[a]	-0.037[a]	0.014[a]	0.042[a]	0.012[a]
	(0.003)	(0.002)	(0.004)	(0.002)	(0.005)	(0.004)
ICOD	-0.017[a]	-0.005[a]	-0.025[a]	0.004[a]	0.032[a]	0.006[c]
	(0.003)	(0.002)	(0.003)	(0.001)	(0.004)	(0.003)
Obs.	1,402,196	1,402,196	1,402,196	1,402,196	1,402,196	723,635
UCOD=ICOD	7.679	1.532	5.737	17.270	3.327	1.288

We include five indicators corresponding to the level of parental education of each parent, child's gender, year of birth, birth order, type of birth, twin status, family income level, and both county and exam year fixed effects. Superscripts [a], [b], and [c] denote the significance at 1%, 5%, and 10% levels, respectively. U = Uninformative cause of death. I = Informative cause of death. Standard errors in parentheses.

Table 1.12

Propensity Score Matching Estimates of Parental Death on All Outcomes

	ATT	Standard error[1]	T-Statistic
	Death of a Father		
Attendance	-0.025	0.003	-8.992
Take CUJEE	-0.035	0.003	-11.257
Quality	0.006	0.011	0.578
Work	0.033	0.004	8.672
Marriage	0.009	0.002	5.363
Military (1yr.)	0.013	0.004	3.267
	Death of a Mother		
Attendance	-0.033	0.003	-10.653
Take CUJEE	-0.045	0.003	-12.966
Quality	-0.015	0.013	-1.184
Work	0.037	0.005	7.950
Marriage	0.016	0.002	7.435
Military (1yr.)	0.013	0.006	2.286

The propensity score model includes five indicators corresponding to the level of parental education of each parent, child's gender, year of birth, birth order, type of birth, twin status, family income level, and both county and exam year fixed effects. ATT = stratified propensity score matching estimate of the average treatment effect on the treated.
[1] Bootstrapped standard errors.

Chapter 2

Anthropometric Outcomes: Can Intra-Household Allocation Help Us Explain Them?

Abstract

The United Nation's Food and Agriculture Organization estimates that there are 925 million people who do not have enough to eat (FAO 2010). At the same time, the latest report from the World Health Organization (WHO 2011) describes an equally grim parallel development: by 2015, approximately 2.3 billion adults will be overweight and more than 700 million will be obese. This chapter analyzes the effects of pecuniary shocks on the anthropometric outcomes of mothers and children. The collective model of intra-household allocation in the presence of a public good is used as a starting point of the analysis. This model permits analyzing the resource allocation decisions made by parents within a structural framework that captures the household bargaining mechanism governing the intra-household allocation of resources. The data used in this chapter comes from the evaluation of the Colombian conditional cash transfer (CCT) program Familias en Acción (FA).

This chapter seeks to answer the following questions: Do CCTs, inasmuch as they represent an exogenous increase in female held income, increase a mother's bargaining power? If so, does this power shift matter for the nutritional outcomes of mothers and children? Are the nutritional outcomes of mothers and children Pareto efficient? Consistent with the predictions of the collective model, the income pooling hypothesis is rejected and the null hypothesis that intra-household allocations are Pareto optimal cannot be rejected. The empirical results suggest that CCTs increase the bargaining power of mothers. This power revision results in a reallocation of resources that indirectly improves children's anthropometric outcomes without having a negative effect on mothers' BMIs. Interestingly, we find that CCTs also have a direct effect on anthropometric outcomes, suggesting perhaps that participation in the CCT program has a behavioral effect on the treated households.

2.1 Introduction

The millennium development goal 1.c. (MDG1C): "Reduce by half the proportion of people who suffer from hunger" is falling short of expectations. The United Nation's Food and Agriculture Organization estimates there are 925 million people who do not have enough to eat (FAO 2010). At the same time, the latest report from the World Health Organization (WHO 2011) talks of an equally grim parallel development: by 2015, approximately 2.3 billion adults will be overweight and more than 700 million will be obese. While these numbers are shocking, more troublesome is the fact that underweight and overweight people may dwell in the same areas, or even in the same households. At the micro level, households that fit this profile are sometimes referred to as "dual-burden" (DB) households, a term which rightly alludes to the dual challenge that such phenomenon poses to public health systems.[27] The concomitance of these two trends is well documented in both the epidemiology and nutrition literatures (Barquera et al., 2007; FAO 2006; Doak et al., 2005; Garret and Ruel, 2005; Khor and Sharif, 2003; de Menezes et al., 2001). The presence of a large number of individuals in the tails of the body mass index (BMI) distribution has been dubbed the nutrition transition (Popkin, 1994), and it is associated with changes in diet, technology driven changes in physical activity, and economic development (Popkin, 2002; Popkin, 2003).

Developing countries undergoing the nutrition transition need to develop creative ways to fight the two faces of malnutrition: hunger and obesity.[28] While the economics literature that focuses on the health and nutritional outcomes of children in developing countries is vast (Attanazio et al. 2009; Djebbari 2005; Duflo 2000; Glewwe 1999; Thomas et al. 1997; Thomas

[27] We will use this term, coined by Doak et al. (2005), when referring to such households.

[28] Hunger is defined as the result of chronic under-consumption of food and/or nutritious food products (Lenhart and Read 1989). Similarly, obesity is defined as abnormal or excessive fat accumulation that may impair health (WHO, 2006). BMI > 30 for adults or BMI > 95% of gender- and age-specific BMI growth chart for children.

1990; Wolfe and Behrman 1987), little is known about the mechanisms that drive the anthropometric outcomes of families and, in particular, of mothers and children. This piece of the puzzle is essential for the design and implementation of successful nutrition and health policies. Well-designed policies can help fight malnutrition and lessen the burden on health systems stressed by the cost of the clash of two battle fronts: the old war against communicable diseases and the new war against non-communicable chronic diseases related to obesity (FAO 2006).

The present chapter aims to fill this gap. We use the collective model of intra-household allocation in the presence of a public good (Blundell et al. 2005) as a starting point. The framework develop by these authors is the first to provide the theoretical foundations for testing the effectiveness of targeting transfers to mothers, for example, as opposed to fathers. It allows us to analyze the consumption decisions made by parents within a structural framework that captures the household bargaining mechanism governing the intra-household allocation of resources. Hence, it serves as the basis for the empirical model that we use to analyze the impact of changes in income distribution on the anthropometric outcomes of mothers and their children. By doing so, we seek to answer the following questions: Do CCTs, inasmuch as they represent an exogenous increase in female held income, increase a mother's bargaining power? If so, does this power shift affect the nutritional outcomes of mothers and children? Are the nutritional outcomes of mothers and children Pareto efficient? And finally, what role do CCTs play in determining nutritional outcomes of mothers and children?

To answer these questions, we use quasi-experimental data from the evaluation of the Colombian conditional cash transfer (CCT) program Familias en Acción (FA).[29] FA provides

[29] This is a publicly available dataset. It can be found at: http://www.dnp.gov.co/PortalWeb/Programas/Sinergia/EvaluacionesEstrat%C3%A9gicas/Evaluaci%C3%B3ndeImpactoProgramaFamiliasenAcci%C3%B3n/tabid/712/Def

two types of conditional grants: health-nutrition grants and education grants. To receive the former, mothers must attend training courses on nutrition, hygiene and contraception and children must undergo regular medical check-ups. To be eligible for the latter, the children must be enrolled in school and attend at least eighty percent of classes during the school year. Like most CCT programs, the FA grants are given to the mother. As a result and under the assumption that receiving the cash transfer is as good as random, these grants generate an exogenous variation in women's income, and are a potential source of variation for the sharing rule within the households.

The CCT grants facilitate testing of the restrictions placed on the unitary model (Becker 1991) under the hypothesis that mothers and fathers are the only decision makers in the household (Attanasio and Lechene 2002). By testing these, we can determine whether targeting transfers toward mothers plays an important role in the determination of anthropometric outcomes of mothers and children in the Colombian context. In particular, if targeting transfers toward mothers shifts the balance of power within the household, we should observe that the cash transfers received by mothers increase the demand for goods consumed by mothers. Under this framework, we can also test whether "mothers care more for children" than fathers. That is, we can check whether a shift in bargaining towards mothers results in either an increase in the demand for nutritional items consumed by children or in an improvement in the anthropometric outcomes of children (i.e. we can test whether mothers' willingness to pay for children's health is more responsive to changes in income than that of fathers').

The design of Familias en Acción program also allows us to test whether the anthropometric outcomes of mothers and children resulting from the intra-household resource allocation mechanisms are Pareto optimal. The test entails verifying whether households'

ault.aspx.

allocation decisions respond proportionally to exogenous changes in the distribution factors; that is, to shocks affecting the bargaining position of decision makers in the family but having no effect either on their preferences or their joint budget set (Chiappori et al. 2001). In particular, we test whether the ratio of the distribution factor effects is the same for all goods both privately and publicly consumed. To perform this test we exploit the availability of two distributional factors: FA grants and rainfall information at the department level.[30] While the former affects mother's bargaining power by exogenously increasing mother's income, the latter affects total household income as most households in our sample reside in rural areas and so their income is directly dependent on the overall rainfall. This empirical approach to testing Pareto optimality was first proposed by Bobonis (2009).

Our study is unique in that we not only look at the factors affecting adult women and children's outcomes separately, but we also analyze the factors determining their joint outcomes. We find that the CCTs shift bargaining power in favor of mothers. This power revision results in a reallocation of resources that improves children's anthropometric outcomes without having a negative effect on mothers' BMIs. In particular, we find that families receiving the CCTs allocate more money towards corn/flour and meat/protein products and that the latter is associated with higher body mass index. Interestingly, we find that the CCTs also have a direct effect on anthropometric outcomes, suggesting perhaps that participation in the FA program has a behavioral effect on the treated households. The income pooling hypothesis implied by the unitary household model is rejected. Also in line with the predictions of the collective model, the null hypothesis of Pareto optimality cannot be rejected. Overall, our results suggest that mothers' willingness to pay for the inputs in the production of the public good is higher than that of fathers'; as a result, targeting CCTs to mothers has positive effects on both intra-household

[30] Colombia is divided into 34 administrative departments that are sub-divided into 1,123 municipalities.

allocation and distribution of resources. In particular, we conclude that the FA program has had a positive effect on children's health outcomes without leading to higher obesity among mothers.

This chapter is organized as follows. In Section 2.2, we provide an overview of the nutrition transition in developing countries and present a brief summary of the related literature. In Section 2.3, we follow with the description of the Familias en Acción conditional cash-transfer program, whereas in Section 2.4, we describe the FA evaluation data and the data sample used in the empirical part of the chapter. In Section 2.5, we describe the theoretical framework and the associated empirical specification. The empirical results are presented in Section 2.6, followed by the robustness checks in Section 2.7. Finally, Section 2.8 provides discussion of our results, and Section 2.9 concludes the chapter.

2.2 The Nutrition Transition in Developing Countries

Popkin (2003) defines the nutrition transition using three stages: receding famine, degenerative disease, and behavioral change. In the receding famine stage, significant amounts of energy are spent in the rudimentary production of food (i.e. manual planting and harvesting) and fruits and vegetables constitute the primary sources of nutrition. In the degenerative disease stage, diets are drastically changed by the introduction of foods that are rich in fat, calories and sugar. Food comes from new sources (i.e. animals), and new ways of production that require less time and effort (i.e., physical activity is decreased mainly due to technological improvements and specialization in food production). Finally, in the behavioral change stage, the ingestion of high calorie fat-rich foods is decreased. This stage is characterized by an increase in the consumption of fiber-rich foods, a decrease in the ingestion of saturated fat, and the re-introduction of physical activity that is unrelated to food production (FAO, 2006).

Because the nutrition transition is tied to economic development, it is reasonable to

observe that the major nutrition problem that women and children face in low-income and middle-income countries is undernutrition (Deribew et al. 2010; Black et al. 2008; Popkin 2001; Mason et al. 1999). Undernutrition is the underlying cause of 53 percent of all deaths in children younger than 5 years of age (Bryce et al. 2005). Similarly, undernutrition in utero or during childhood has strong repercussions on health and SES later in life.[31] For example, after presenting evidence that the prevalence of early childhood stunting and of people living in absolute poverty are strong predictors of poor cognitive and educational performance in children, Grantham-McGregor et al. (2007) estimate that the attendant human capital losses result in a 20 percent deficit in adult income. The literature linking child anthropometric outcomes to cognitive abilities is vast (see, e.g., Grantham-McGregor et al., 2007; Bryan et al., 2004; Daniels and Adair, 2004). Similarly, research shows that women who are chronically undernourished during childhood grow up to be undernourished mothers and are more likely to have low birth weight babies (Allen and Gillespie 2001). In turn, low birth weight is a strong predictor of both infant underweight (Mason et al. 1999) and low birth weight in future generations (Currie and Moretti 2007).

To complicate matters, obesity is quickly penetrating low and middle-income nations worldwide, affecting first the urban middle-aged adults, but increasingly spreading to semi-urban and rural areas, and to younger age groups (Prentice 2006). Sahn (2009) examines BMI trends of women to quantify the prevalence of obesity for this group. He examines the entire BMI distribution to determine whether the rising BMIs observed in the population are in fact happening evenly across the distribution. The estimated BMI growth curves, indicating the percent increase in BMI at each point along the distribution, suggest that there has been an increase in inequality in BMIs. In particular, individuals located in the upper tail of the BMI

[31] See, e.g., Black et al. (2008); Barker et al. (1993).

distribution are experiencing larger increases in BMI than the remainder of the population. Similarly, in some areas, the prevalence of overweight among children is higher than the prevalence of underweight (or stunting); see e.g., FAO (2006) for the case of Egypt. According to FAO (2006), increasing rates of overweight and obesity in children signal a very alarming trend. For example, research shows that half of the children who are obese at the age of six go on to become obese adults (Center on an Aging Society, 2002). Obesity is also a risk factor for a range of chronic health problems, including coronary heart disease, type II diabetes, stroke and some types of cancer (WHO, 2000), and the early onset of obesity is associated with higher risk of developing obesity-related chronic diseases (Eckhardt 2006; FAO 2006).

What are the implications of the overlap of these two macro-trends? The relationship between the nutrition transition and the simultaneous presence of underweight and overweight members in the same household is examined by Doak et al. (2000). Using data from national surveys, these authors find that the prevalence of dual burden households ranges from eight percent in China and Russia to eleven percent in Brazil. For all three countries the authors note that the most common form of the DB household consists of an underweight child coexisting with an overweight non-elderly adult. While DB households are more likely to reside in urban areas, they find no particular relationship between DB and income. Analyzing the 1993 China Health and Nutrition Survey, Doak et al. (2002) find that DB households are more likely to reside in urban areas, have higher income and, after controlling for socio-economic status (SES), are more likely to own durable assets. Interestingly, while the diet in these households is higher in fat and protein compared with "underweight only" and normal weight households, it is statistically indistinguishable from the diet of "overweight only" households.

Garrett and Ruel (2003) collect data on the socio-economic background and food intake

frequencies of 54 underweight child/overweight mother pairs and compare them to normal weight mothers and children. They note that overweight mothers are less educated, are more likely to be unemployed, and are more likely to have lower incomes than normal weight mothers. However, these differences are not statistically significant, perhaps due to their small sample size. Interestingly, the dietary, illness, and energy consumption patterns of these two groups are also found to be very similar. In a more recent study, Doak et al. (2005) analyze national surveys from seven countries to document the prevalence of the DB phenomenon. This time, the authors find that the DB households are becoming more common: in six of the seven countries studied 22 to 66 percent of households have at least one underweight and one overweight member. Garret and Ruel (2005) use Demographic and Health Surveys from Africa, Asia, and Latin America to look at the same phenomenon but focus on pairs of stunted children and overweight mothers. They find that this disturbing outcome is more prevalent in Latin America than in Africa, yet not necessarily more prevalent in urban than in rural areas.

2.3 Familias en Acción Program

2.3.1 Overview of Familias en Acción Program

The Familias en Acción conditional transfer program was introduced in December 2000 as part of a wider response by the Colombian government to mitigate the adverse effects of a series of macroeconomic shocks that affected Colombia towards the end of the 1990s. These shocks had a particularly pronounced impact on poorer families (Attanasio et al., 2004), as evidenced by declining levels of school attendance and nutritional intake among the members of poorer households. The program was initially designed to provide targeted cash transfers to 340,000 households (about 4.6% of the country population), conditional on school attendance and the use of basic health care. Following the pilot stage of the program, which ended in March

2001, and two initial expansions during the following year, the program reached the planned number of households from 631 Colombian municipalities (of the total of 1,060) by March 2002. By 2005, the program covered approximately 400,000 households in 700 municipalities (Overseas Development Institute, 2006). More recently, it has expanded to poor urban areas and, as of the end of 2008, reached more than 1.5 million households (Attanasio et al., 2009).

The Familias en Acción program provides two types of grants: health-nutrition grants and education grants. The health-nutrition grants consist of cash transfers to all beneficiary families with children younger than seven years. These monetary supplements are granted to qualifying families contingent on children's participation in regular medical checkups (including vaccinations and growth and development checks) as well as on their mother's attendance at courses on nutrition, hygiene and contraception (Attanasio, et al. 2008). If the conditions are not met, the monetary supplements to the beneficiary family are suspended. The value of the supplement is 46,500 pesos (≈ US$ 18.6) and is independent of the number of children in the household.[32] The education grants are available to families with children between seven and eighteen years and range from 14,000 pesos (≈ US$ 5.60) for each child attending primary school (2nd to 5th grade) to 28,000 pesos (≈ US$ 11.2) for each child attending secondary school (6th to 11th grade). The grants are conditional on children being enrolled at school and attending at least eighty percent of classes during the school year.[33] The types of grants as well as the relevant conditions are also summarized in Table 2.1.

The municipalities participating in the program were selected based on several eligibility criteria. It was necessary for the municipality to have access to basic education and health

[32] Here, as later in the text, the US$ equivalents are calculated based on the average historical exchange rate corresponding to January 1, 2002 to January 1, 2003 period: US$ 1 ≈ COP 2,500 (COP: Colombian pesos).

[33] As discussed in Attanasio et al. (2008), making the grant conditional on school attendance effectively decreases the relative price of education, at least for those households for which increased schooling comes at the expense of reductions in income generation activities.

infrastructure; to have at least one bank; to have fewer than 100,000 inhabitants; to not be the capital of a regional district; and to not be in the coffee region that received special help as a consequence of the 1995 earthquake. In addition, the local authority had to register the municipality to the program and provide a number of documents, including the lists of SISBEN level 1 beneficiaries (Attanasio et al. 2004). A basic welfare indicator collected for all families in Colombia, SISBEN (System for Identifying and Selecting Beneficiaries)[34] is used to divide Colombian households into categories based on their estimated level of income. SISBEN level 1, which represents more or less the lowest quintile of the Colombian households income distribution, was used to determine the eligibility of a household for either grant. Attanasio et al. (2005) report that take-up of the program was about 90 percent among eligible households.

2.4 Familias en Acción Evaluation Data

The data used in this study were collected as part of a large scale initiative by the Colombian government to evaluate the program and its effects. While the original intention was to implement the program randomly across municipalities, this was not possible for political reasons when the program started; consequently, a quasi-experimental approach based on a comparison of representative stratified samples of treatment and control municipalities was adopted, with the first group randomly selected from among those eligible for the program and the latter group chosen from among those excluded from the program.

Treatment municipalities are a stratified random sample of municipalities where the program is operating. The stratification was performed as follows. First, the municipalities were grouped according to the number of eligible families into so called Primary Sampling Units (PSU).[35] The PSU's were in turn divided into 25 strata based on a number of demographical and

[34] More information on the SISBEN index, including its scope and coverage, can be found in Vélez et al. (1998).
[35] See Attanasio et al. (2004) for a detailed description of the stratification procedure.

health/infrastructure characteristics, including the region of the stratum, the number of eligible households, the level of urbanization, the health and education infrastructure, and the quality of life index. The strata were used as a basis for selecting the control municipalities according to their similarity to the treatment municipalities (found in the same stratum) in terms of the population, size, as well as the other characteristics just mentioned.[36] Attanasio et al. (2005) report that, while most of the control municipalities would have qualified in terms of health and education infrastructure, many of them were excluded from the program because they lacked a bank. Finally, a random draw of 10 (3 urban and 7 rural) geographical clusters was performed within each municipality and, within each cluster, 20 SISBEN level 1 households were selected.

In its final form, the evaluation sample contains approximately 11,500 households corresponding to 122 (57 treated and 65 control) municipalities that were interviewed between June and October 2002. Of these, 10,742 households were re-contacted during the second wave of interviews between July and October 2003. Given the timing of the first stages of the program, about a half of the families belonging to the treatment group were interviewed before the program started (these families are referred to as "treated without payment"), whereas the other half were interviewed when the program was already well under way in their area (these families are referred to as "treatment with payment").

2.4.1 The Sample

We pool the 2002 and 2003 samples and restrict observations to include children that (1) were less than 6 years old in the first round of the survey; (2) were from families with more than one adult member; (3) had non-missing consumption and anthropometric information; and (5)

[36] The question of how similar the two treatment and control groups were is worth pursuing further. Indeed, the control municipalities often failed to satisfy basic criteria applied to the treatment group (e.g., the presence of a bank). Still, Attanasio et al. (2008) provide evidence that the treatment and control areas are very similar for a broad range of observable household and municipal characteristics.

were either treated with payment or in the control group.[37] Our final sample is composed of 10,285 observations.[38] There are 4,981 (5,304) children in the treatment (control) group.[39] Tables 2.2.A and 2.2.B present the descriptive statistics for the whole sample.

On average, there are 3.86 minors (under 18 years of age) and 2.31 adults in each household. About 4 (3) percent of the adult women (men) have "high-education" (i.e. have graduated from secondary school) and 7 (61) percent of the adult women (men) are wage laborers. The sample is divided into three groups according to the population density of the area: 46 (45) percent of the sample resides in "cabecera" ("centro poblado") areas whereas less than 10 percent reside in "rural disperso" areas.[40] While electricity coverage is widespread, covering 84 percent of the sample, access to other basic services such as water pipe, sewer, trash collection and gas is less common.

We identify two woman-specific assignable goods: adult women clothing and adult women shoes; and four man-specific assignable goods: adult men clothing, adult men shoes, tobacco, and alcohol. We also identify five types of child-specific goods; these include: clothing, shoes, hygiene goods for child consumption, school allowances and toys. Finally, the household goods include: bus tickets, cleaning supplies for the home, combustible, entertainment, books, and health related goods, including medicine, doctors and hospital expenses, expenses on glasses, health exams and insurance. Table 2.2.A presents the means of the levels of these variables and of their shares in the total expenditure budget.

To capture each child's health we use two measures of morbidity: the incidence of

[37] If the "treated without payment" households are included in the analysis, this would result in the underestimation of the program effects.

[38] The details pertaining to the derivation of our final sample are included in Appendix 2.2.

[39] The treatment group includes children in families receiving FA grants.

[40] The sample is collected only from rural areas. "Cabecera" refers to the most densely populated parts of rural areas and "rural disperso" to the least densely populated parts.

diarrhea and the flu over the last 15 days. To capture each child's anthropometric characteristics, we use the weight and height of each child in each round to compute two z-score measures: height for age (ZHFA) and weight for age (ZWFH). The z-scores are computed using age and gender specific anthropometric measures using WHO's child growth standards (WHO, 2010).[41] Using the ZWFA, we also classify children into three categories of nutritional status: underweight (ZWFA < –1.64), overweight (ZWFA > 1.64), and normal weight (|ZWFA| < 1.64). We use weight and height measures to compute female BMI. Women are classified into three groups according to their nutritional status: underweight (BMI < 18.5); normal weight ($18.5 \leq$ BMI < 25); and overweight or obese ($25 \leq$ BMI). Mother/child pairs are also classified into five different groups according to their joint weight status. Table 2.2.B reports the descriptive statistics for these measures.

The sample is merged with monthly rainfall data covering the years 2001-2004, obtained from the IRI/LDEO Climate Data Library.[42] Rainfall is measured at the department level. Using an average yearly rainfall measure, we compute the mean and standard deviation for the four-year period. Whenever the yearly rainfall was one standard deviation below the mean in the year prior to the data collection, the variable rain-shock takes the value of one indicating a below average rainfall record for that year (this is true for 34 percent of the sample); it is zero otherwise.

2.5 Framework

The main purpose of this paper is to analyze the anthropometric outcomes of mothers and children living in the context of a middle income country undergoing the nutrition transition. We first describe the collective model of intra-household allocation decisions, which will serve as the

[41] For more information, see http://www.who.int/childgrowth/en.

[42] The data is freely available at: http://iridl.ldeo.columbia.edu/. Special thanks go to Remi Cousin for helping us navigate this website.

basis for our empirical analysis. Our starting point is the framework developed by Blundell et al. (2005). Blundell et al. (2005) extend Chiappori's (1992) labor supply collective model with two decision makers by introducing public good consumption and household production.

Consider a household composed of one father (*f*) and one mother (*m*), which consumes two types of commodities: a private and assignable commodity Q_i, $i = \{f, m\}$, a collective consumption good F_k and a commodity good Q_k (k is the subscript used to represent collective consumption). In our setting, F_k represents different food types, which are not assignable and are to be consumed by the household. We interpret F_k as inputs in the production of anthropometric outcomes of mothers and children. The utility function of parent i is a function of family welfare, V_k, which is in turn a function of health, H_k. Parent i derives direct utility from her own consumption of the private good (Q_i). Parents do not derive utility from their spouse's private consumption. Still, each parent cares for, and derives direct utility from, the overall family welfare as measured by the anthropometric outcomes of mothers and children and indirect utility from the consumption of the collective good (Q_k). In other words, parents are egoistic with respect to private consumption and altruistic with respect to the collective goods, and their preferences can be represented by the following utility function:

$$U_i\ (Q_i, V_k(H_k\ (F_k), F_k), Q_k;\ \mathrm{x}(.),\ \zeta\ ) \tag{2.1}$$

where $x(\cdot)$ is a vector of exogenous parameters and ζ is a vector of child level heterogeneity.

Following the health and nutrition literatures (see e.g., Behrman and Deolalikar, 1988), we assume that the anthropometric outcome of mothers and children, or family welfare in our set-up, is a function of health and a vector of parental characteristics and environmental parameters (e.g., parental education, genetic make-up, access to potable water, and sewage), μ_k. While health is in turn a function of nutritional intake, N (F_k; ξ). Family welfare can be

represented as: $V_k = V$ (H (N(F_k)); μ_k). The family nutritional intake, N (F_k ; ξ), is a linear function of food consumption (non-food consumption carrying zero weight), and of parental and environmental characteristics, represented by vector ξ, which are likely to impact the usage and quality of nutrient intake.

Parents decide how to allocate their resources among the different consumption goods, both public and private. According to the standard literature on collective models of intra-household allocation in the presence of public goods (Blundell et al. 2005; Bourguignon et al. 2009), the decisions made by the household are assumed to be Pareto efficient. This assumption implies that household decisions are the solution to the following maximization problem:

$$\max_{Q_i, Q_k, F_k} \sum_i \lambda_i U_i \ (Q_i, V_k(H_k \ (F_k), F_k), Q_k; \ \mathrm{x}(\cdot), \ \zeta \ ),$$

subject to the full income constraint

$$\sum_i p_i Q_i + p_k Q_k + \sum_{j=1\ldots6} p_j F_j \leq (w_m + w_f)T + y_m + y_f + y_k,$$

and the Pareto weight

$$\lambda_i = \lambda(p_m, p_f, p_k, p_1 .. p_6, w_m, w_f, y, z; \ \mathrm{x}(.), \ \zeta \ ) \qquad (2.2)$$

where time endowment and the price of the composite good are each normalized to one y_i is the unearned income of parent i, $i = \{f, m\}$, and y_k is the joint income of f and m; λ_i is the Pareto weight of parent i, and ($\lambda_m + \lambda_f$) = 1, as in Chiappori (1988). The Pareto weight measures the relative decision making power of parent i and is a function of wages (w_m and w_f), non-labor income y, and distribution factors z. Pareto efficiency of intra-household allocation decisions is the main testable hypothesis of the collective household model.

It follows from the second welfare theorem of economics that the household maximization problem can be split into a two-stage process. In the first stage, parents decide how to use their resources for the production of the public good. The first order conditions of this

two-stage process imply that parents use their resources to produce the public good up to the point where the marginal rate of technical substitution between any two production inputs just equals the ratio of their respective costs (i.e., productive efficiency). In the first stage, parents also agree (or bargain) on how to split the residual non-labor income; the result of this agreement is known as the sharing rule. In the second stage, each parent separately maximizes his (her) own utility conditional on the sharing rule.

The solutions to (2.2) are functions of prices, wages, income, total household resources (*r*), and the Pareto weight:

$$x_j = x\big(p_m, p_f, p_k, p_1..p_{6,} w_m, w_{f,}\, y, r, \lambda(.);\ \mathrm{x}(.),\ \zeta\ \big),$$

$$\text{for } x_i \epsilon \big\{ Q_{\,m,} Q_{\,f,} Q_{k,}\, F_{1,}..F_6 \big\}. \tag{2.3}$$

Using this framework, we can also test whether targeting CCT benefits to mothers results in additional welfare improvements. In particular, Blundell et al. (2005) show that increasing the bargaining power of one decision maker increases the consumption of the public good if and only if this decision maker's willingness to pay for the public good is more sensitive to income changes than that of the other decision maker. Hence, if the CCT affects the intra-household bargaining and mothers care for children more than fathers (i.e. mothers derive more utility from children's welfare than fathers), the cash given to mothers should increase the consumption of children specific goods (i.e. of goods consumed by children or of goods that improve children's outcomes).

2.6 Empirical Approach

We are interested in analyzing the role of income in the hands of mothers, as opposed to income in the hands of fathers or of joint income, on the determination of anthropometric outcomes of mothers and children. To undertake this analysis, we use the framework proposed

by Blundell et al. (2005). The framework develop by these authors is the first to provide the theoretical foundations for testing the effectiveness of targeting transfers to mothers, for example, as opposed to fathers. In particular, this framework allows us to verify whether variations in distribution factors[43] that affect the relative intra-household bargaining power of household members result in changes in the intra-household decision process. By doing so, it also allows us to understand the implications of such changes.

Adapting this framework to our empirical question, we can test whether targeting CCTs towards mothers has an effect on intra-household bargaining (or the sharing rule). In particular, Blundell et al. (2005) show that if mothers' bargaining power increases as a result of their higher income, we should observe an increase in the household demand for the goods consumed by mothers (i.e. those goods from which mothers derive the most utility). Furthermore, we can alto test whether "mothers care for children more than fathers". For instance, the authors show that if bargaining power is shifted towards mothers and mothers' willingness to pay for children's health or wellbeing is more responsive to changes in income than that of fathers', we should see an increase in the demand for inputs used in the production of children's welfare, e.g. children specific goods.[44]

As noted earlier, while FA's CCT is specifically targeted towards mothers, selection into the program was only pseudo-randomized in our sample. Because testing these hypotheses demands and exogenous variation in mothers' specific income, we instrument program participation with a binary variable that equals one whenever there is at least one bank in the municipality. As discussed in Section 3, due to the design of both the program and the evaluation

[43] Blundell et al. (2005) define distribution factors as "variables that can affect group behavior only through their impact on the decision process".
[44] Moreover, if bargaining power is shifted towards mothers, we may also observe a reduction in fathers' specific expenditures.

survey, the presence of a bank is likely to affect the probability of selection into the program. The conditional moment restriction that the instrument is uncorrelated with the error term is impossible to check in the just identified case.[45] Yet, because control municipalities within each stratum were chosen so as to be as similar as possible to the treatment municipalities,[46] there is no *a priori* reason to believe that the presence of a bank should be directly linked to the anthropometric outcomes and expenditures of households.[47]

Using this framework, we can also test income pooling hypothesis, assumed under the unitary household model, as well as Pareto optimality, the underlying assumption of the collective model. Put simply, income pooling assumption implies that, conditional on total household resources all household income is pooled and, as a result, income in the hands of the mother is the same as income in the hands of the father. Empirically, this implies that, after controlling for overall household resources, the coefficient estimates on individual specific income (e.g. mother and/or father specific income) should all equal zero. Under Pareto optimality (sometime referred to as "collective rationality"), and conditional on overall household resources, we should observe that changes in distribution factors result in changes in consumption of each of the goods that are equally proportional to the distribution factors effect in the intra-household bargaining power.[48]

[45] In Section 2.7, we revisit the validity if the instrument using an alternative specification.

[46] As reported in Attanasio et al. (2005), the control municipalities were chosen so as to be as similar as possible to the treatment municipalities in terms of population size, percentage of urbanization and an index of quality of life.

[47] While the presence of a bank in the municipality is likely to increase access to financial services and thus affect the wellbeing of borrowers, research shows that this is unlikely to be the case for the rural poor. For example, even when banks are present, the poor often refrain from using formal financial services because they lack information about the availability and purpose of such services (Ramji 2009). Similarly, because they are often the ones lacking the pledge-able collateral required for banks to extend credit to them, the poor are less likely to benefit from bank financing.

[48] More explicitly, Pareto optimality requires that the ratio of the change in the Pareto weight corresponding to mothers (or change in the relative bargaining power of mothers) resulting from the increase in women specific income to the change in the Pareto weight corresponding to mothers (or change in the relative bargaining power of

To test these hypotheses, we estimate both reduced form demand functions and structural demand systems for a set of 10 consumption goods.[49] Each demand equation is given by:

$$x_{jim} = \alpha_j + \beta_{sj} Shock_{im} + \beta_{Tj} CCT_{im} + r_{im}\vartheta_j + \boldsymbol{\delta}_{im}\gamma_j + \boldsymbol{G}\xi_j + \varepsilon_{jim}, \text{ for } \forall j \quad (2.4)$$

where x_{jim} is the budget share (or expenditure share) corresponding to good *j* of the household of child *i*; where β_{sj} is the effect of the rain-shock faced by child *i* residing in municipality *m* on the budget share of good *j* of the household of child *i;* β_{Tj} is the effect of the CCT, received by the mother of child *i*, on household consumption; r_{im} represent total household resources; $\boldsymbol{\delta}_{im}$ is a vector of child specific characteristics (gender) as well as characteristics of the child's family (number of minors and adults living in the household, whether the child's mother is married, parental educational attainment of each parent, whether the mother and/or the father is a wage laborer) and household (whether the household has any of the following amenities: electricity, gas, water pipe, sewage system, municipal trash collection service); and $\boldsymbol{G}$ is a vector of geographic fixed effects (cabecera, centro poblado, and four regional dummies).

In order to test the collective model assumption of Pareto optimality, we follow the empirical strategy proposed by Bobonis (2009). In particular, we use our constructed measure of localized rain-shocks as a second source of exogenous variation in total household resources. Having instrumented program participation with the presence of a bank, the CCT represents a distribution factor that affects the intra-household bargaining power of women by affecting their

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mothers) resulting from the change in overall household income should be equal to the ratio of changes in the demand of each of the goods *j* (nine in our case) resulting from the increase in women specific income to the change in the demand of each of the goods *j* (there are nine in our case) resulting from the change in overall household income (Bourguignon et al., 2009). Using the notation from equation 2.3, this implies that the necessary and sufficient conditions for Pareto optimality are:

$$\frac{\partial Q_m/\partial y_m}{\partial Q_m/\partial y_O} = \frac{\partial Q_f/\partial y_m}{\partial Q_f/\partial y_O} = \frac{\partial F_j/\partial y_m}{\partial F_j/\partial y_O} = \frac{\partial Q_k/\partial y_m}{\partial Q_k/\partial y_O} = \frac{\partial \lambda/\partial y_m}{\partial \lambda/\partial y_O}, \text{ for all goods } j = 1,\ldots,9.$$

[49] The excluded demand is the "Household" group.

woman-specific income. Similarly, the rain-shock is a distribution factor that affects the overall household income. Hence, under Pareto optimality, we should find that the coefficient estimates corresponding to the rain-shock and the treatment variables from all of the 9 demand equations are jointly zero:

$$\frac{\beta_{Tj}}{\beta_{sj}} = \frac{\beta_{Tl}}{\beta_{sl}}, \text{ for } \forall j, l, j \neq l.$$

In other words, the ratio of the coefficients corresponding to the treatment and the rain-shock variables should be equal across all the goods in our system.[50]

Finally, to test for the direct impact of exogenous changes in household resources on the health outcomes of mothers and children, we estimate the following reduce form equation for each of our health measures:

$$AO_{him} = \gamma_h + \alpha_{sh} Shock_{im} + \alpha_{Th} CCT_{im} + \boldsymbol{F}\theta_h + \boldsymbol{H}\mu_h + r_{im}\vartheta_h + \boldsymbol{\delta}_{im}\gamma_h + \boldsymbol{G}\xi_h + \varepsilon_{him}, \quad \text{for } \forall h \text{ (2.4-b)}$$

where AO_{him} is the health outcome *h* of child *i* who resides in municipality *m*; α_{sh} is the effect of the rainfall shock faced by child *i* residing in municipality *m* on the health outcome *h* of child *i;* α_{Th} is the direct effect of the CCT on health; $\boldsymbol{F}$ is a vector of food budget shares corresponding to 6 food groups (meat/protein, milk/dairy, corn/flour, vegetables, fats, and other-foods); $\boldsymbol{H}$ is a vector of child health indicators (incidence of diarrhea and flu); r_{im} represents total household resources; $\boldsymbol{\delta}_{im}$ is a vector of child-specific characteristics (gender, age) and health endowments (linear and quadratic controls for mother's BMI) as well as characteristics of the child's family (number of minors and adults living in the household, whether the child's mother is married,

[50] The treatment (rain-shock) increasing milk/dairy consumption by 20 (60) percentage points and decreasing vegetables consumption by 15 (30) violates Pareto optimality because the marginal rates of substitution across the two goods is not equal; - in other words, the utility of the household could be increased further while making no household member worse off.

parental educational attainment of each parent, whether the mother and/or the father is a wage laborer) and the child's household (whether the household has any of the following amenities: electricity, gas, water pipe, sewage system, municipal trash collection service); and ***G*** is a vector of geographic fixed effects (cabecera, centro poblado, and four regional dummies).

We run similar regressions for all the anthropometric outcomes *h* of the mother of child *i* as well as for the joint anthropometric outcomes *h* of mothers and children. For these two sets of outcomes, the linear and quadratic controls for mother's BMI are omitted. Similarly, the vector ***H*** (child health indicators) is omitted from the regressions corresponding to all outcomes *h* of the mother of child *i*.

2.6.1. Rain-shocks and Total Household Income

The rationale for using rain-shocks as a source of exogenous changes in household income is that, because households in our sample reside in rural areas, extreme weather conditions are likely to have a significant negative impact on total household income. To provide support for this assertion, we control for the average precipitation in the department, multiple household level determinants of income[51] and geographic fixed effects,[52] and regress total household income on the rain-shock measure. The results from this regression are presented in Table 2.3.A. The rain-shock has a negative and statistically significant effect on total household expenditures equivalent to -14,661 COP.

We also use a *t*-test to check whether the average both raw and predicted total household income of households living in the areas affected by a rain-shock is significantly different from that of households living in non-shock areas. The results from these tests suggest that both the

[51] These include: mother and father hours at work and at home, whether either parent is a wage laborer, the educational attainment of each parent, the number of adults and minors in the household, and whether the mother is married.

[52] Among these are two indicators for "cabecera" and "centro poblado" areas and four regional dummies.

raw and the conditional mean differences are statistically significant. Individuals living in rain-shock affected areas suffer a statistically significant decline in their monthly incomes (~14,000 COP). [53, 54]

2.6.2 CCTs and Household Expenditures

We first explore the impact of the CCT on household expenditures.[55] The two-stage least square (2SLS) estimates for the effect of the CCT on total household expenditures are presented in Table 2.3.B. We find that receiving the CCT results in a significant increase in household expenditures equivalent to approximately COP 168,118 (approximately US$ 67).[56] Under-identification is strongly rejected (Kleibergen-Paap rk LM statistic = 39.562). Similarly, the value of the Kleibergen-Paap rk Wald *F*-statistic for the power of the instrument is 280.701, significantly exceeding the benchmark proposed by Stock and Yogo (2005). The null hypothesis that participation in the program can be treated as exogenous to total expenditures is also strongly rejected (all the test statistics are reported in the top panel of Table R 2.4). Overall, these results provide some support to the validity of the instrument.

2.6.3 The Effect of CCTs and Rain-shocks on the Intra-household Resource Allocation

The results from the reduced form equations are presented in Tables 2.4.A and 2.4.B.[57] Tables 2.4.A and 2.4.B show the coefficients for the consumption goods in budget shares and in

[53] Note that this income loss is equivalent in magnitude to the CCT grant given to mothers with children attending primary school.

[54] We also check whether participation in the program is exogenous to total household income. The null hypothesis that participation in the program can be treated as exogenous to total household income cannot be rejected. The result of this test is reported in the top panel of Table 2.10.

[55] Household expenditures as defined in the present analysis include a subset of total household expenditures.

[56] The result is robust to using nonparametric bootstrap to compute the standard errors. Please refer to Table R 2.3.C in Appendix 2.1.

[57] The results corresponding to the validity of the instrument for each of the estimated reduced form demand equation are presented in Table R 2.4.C in Appendix 2.1. Under-identification and weak identification is strongly rejected for all the specifications. The exogeneity of program participation is rejected for all the food groups and for the household good.

levels, respectively. The treatment decreases the shares of vegetables and fats and increases the shares of children's goods, meat/protein and corn/flour foods. In levels, we also observe statistically significant increases in the expenditures on children's goods (COB 11,192), meat/protein (COB 20,142), and a large increase in the expenditures on corn/flour foods (COB 131,001). Finally, while we do find a decrease in the relative shares of vegetables and fats, the absolute decrease is only statistically significant for vegetables (– COB 12,005).

The results from estimating the SUR system of 9 equations are presented in Table 2.5. The results are similar to those obtained after running the reduced form regressions. They tell us that the treatment is linked to an increase in the budget share of children's goods and meat/protein. Similarly, the budget shares of the treated households corresponding to vegetables are also significantly reduced. These results suggest that households reassess their purchase decisions and reallocate resources towards children-specific goods and relatively more luxurious foods (protein and corn based food).

Moreover, the χ^2 (8) test statistics corresponding to null of Pareto optimality, or the equality of the 16 marginal rate of substitution ratios, is 4.42 (p-value = 0.817) implying that Pareto optimality cannot be rejected. On the other hand, the test of the income pooling hypothesis, which equates all of the 18 coefficients belonging to the two distribution factors to zero, is rejected (χ^2 (18) = 82.97, p-value = 0.000).

Because the consumption of certain groups is zero for a large number of households,[58] the linear regression coefficients are likely to be biased, thus likely to invalidate the post-estimations tests. With this concern in mind, we estimate a seemingly unrelated regression

[58] Specifically, 12, 14 and 67 percent of the households demand adult man goods, adult woman goods and children's goods, respectively. The demand for all the other goods is around 85 percent or higher.

system for fully recursive mixed processes.[59] In particular, we estimate a system of 3 IV-Tobit regressions (corresponding to the Adult man, Adult woman and Children goods) and 6 linear IV-regressions (corresponding to the six food groups). The results are presented in Table 2.6. The results are consistent with our previous findings. As before, in line with the collective model assumptions, Pareto optimality cannot be rejected (χ^2 (8) = 4.30, *p*-value = 0.828) and the income pooling hypothesis is strongly rejected (χ^2 (18) = 81.42, *p*-value = 0.000).

2.6.4 The Effect of CCTs on Anthropometric Outcomes

As a next step in the analysis, we study whether the CCT has a direct effect on the anthropometric outcomes of children and their mothers.[60] First, we explore whether the CCT is directly linked to changes in z-scores and/or in the incidence of diarrhea or the flu among children. The results for children's outcomes are presented in Table 2.7. We observe that the program has no effect on the height for age z-scores (ZHFA), yet it has a positive and statistically significant effect on the weight for age z-scores (ZWFA). In particular, receiving the CCT is associated with a 0.128 increase in ZWFA (or 1/8 of a standard deviation). Similarly, the probability of having a normal-weight child increases by 4.3 percentage points, whereas the probability of having an under-weight child decreases by 3.8 percentage points.

We see no direct impact of the program on other measures of child health, yet we note that while the incidence of diarrhea and flu episodes is negatively associated with children's health, the consumption of meat/protein, milk/dairy, corn/flour and vegetables are all positively associated with children's health, with both the meat/protein and corn/flour items having the largest statistically significant negative effect. In particular, a child having diarrhea over the past

[59] This system is estimated using simulated likelihood methods. For more details, see Roodman (2011).

[60] The results corresponding to the validity of the instrument for each of the estimated reduced form outcome equation are presented in Table R 2.4.C in Appendix 2.1. Under-identification and weak identification is strongly rejected for all the specifications. With the exception of diarrhea and the joint outcome of "BMI-Mother >18.5, Under-weight child", the exogeneity of program participation cannot be rejected for all the remaining outcomes.

15 days increases the probability of her being underweight by about 4.4 percentage points and decreases the probability of her being normal weight by 4.2 percentage points. Diarrhea is also negatively associated with ZHFA and ZWFA. On the other hand, an increase in the household consumption of corn/flour and vegetables is negatively associated with anthropometric outcomes.

Interestingly, while the rain-shock had no statistically significant effect on household expenditures, it has a negative effect on ZWFA and increases the underweight incidence for children.

The results for mothers are presented in Table 2.8. The results suggest that mothers receiving the treatment experience no statistically significant change in their BMI. On the other hand, the rain-shock has a negative and statistically significant impact on both mothers' BMI (-0.610). Moreover, the rain-shock increases the probability of a mother being underweight by 2.6 percentage points (a 57 percent increase). We also find that while increases in the consumption of meat/protein, milk/dairy, and corn/flour are negatively associated with mothers' BMI, they are also associated with an increase in the probability of a mother being of normal weight, although the coefficient corresponding to the meat/protein goods is imprecisely estimated.

Interestingly, an increase in the household consumption of meat/protein goods is also associated with a 12.6 percentage point decline in the probability of a mother being overweight (a 40 percent decrease in the probability of having an overweight mother), and while an increase in the consumption of milk/dairy and vegetables is associated with a decline in the mother's probability of being overweight, the opposite is true for the "fats" group.

The results for mother/child pair outcomes are reported in Table 2.9. Being treated increases the likelihood of being a "normal pair", i.e. the probability of having both mother and child falling in

the normal BMI range for their anthropometric group, by 7 percentage points (or 16 percent). The treatment also decreases the probability of both "dual burden" (BMI-Mother > 25 and under-weight child) and single burden (BMI-Mother > 18.5 and under-weight child) and has no statistically significant impact on the remaining joint outcomes. Finally, we also note that an increase in the household consumption of milk/dairy products and fats is positively associated with being a "normal pair".

2.7 Robustness Checks

The conditional moment restriction that the instrument is uncorrelated with the error term is impossible to check in the just identified case. In order to compute the Hansen test for overidentying restrictions, we make use of a constructed variable, the rural sex ratio by age group, which is available for a subset (N = 8,823) of our final sample.[61, 62] This variable varies by department and by mothers' age group (seven *5-year* interval age groups in total). For each age group, the ratio measures the number of males per female. For a given age group, a sex ratio higher than 1 would indicate that there are more males per females in the population at that particular age group.

A high sex ratio is indicative of women higher bargaining power in the marriage market; in particular, the larger the pool of potential husbands, the more likely a woman is to find a "good" mate[63] and hence less likely to participate in the program. While testing this claim is beyond the scope of this paper, using a natural experiment, Angrist (2002) provides evidence in

[61] We are unable to merge this instrument to every mother in the sample because the age information was missing for some mothers. Nevertheless, because the single IV-specification is more powerful than the over-identified specification, it remains our preferred specification. In either case, while the results are not reported here, the second stage results from using this alternative specification are also consistent with our reported findings.

[62] The population estimates by age and gender are available from Colombia's national statistical department (Departamento Administrativo Nacional de Estadística – DANE). These estimates can be found at: http://www.dane.gov.co/index.php?option=com_content&view=article&id=238&Itemid=121.

[63] Here "good" should be understood as representing positive attributes in a mate (for example, higher income earning ability, higher education, better looks, better health, et cetera).

its favor. In particular, he finds that high sex ratios, as defined by the number of males per females, had a large positive effect on the likelihood of female marriage, and a large negative effect on female labor force participation. Moreover, the author also finds that higher sex ratios raised male earnings and the incomes of parents with young children. A priori we expect that higher sex ratios would decrease the probability of participation in the program.

We estimate 16 equations, corresponding to total household income, total household expenditures, the six food items (in budget shares and in levels) and the "household" good. The first stage coefficient estimates corresponding to *the presence of a bank* and to *the sex ratio* are reported in the top panel of Table 2.10. The results are consistent with our expectations. A higher sex ratio significantly decreases the probability of program participation. Using this instrument, the null hypothesis that the error term is uncorrelated with the instruments cannot be rejected for any of the equations at the 1 percent level. At 5 (10) percent level of significance, 1 (2) test(s) reject the null, respectively (see bottom panels of Table 2.10).

2.8 Discussion

Attanasio et al. (2005) and Attanasio and Mesnard (2006) evaluate the effects of the Familias en Acción CCT program on the food consumption of the participant families. Both studies provide evidence of higher energy consumption in CCT receiving households compared with families not receiving benefits. In particular, consistent with our findings, both studies find that participation in the program results in a considerable increase in the consumption of protein-rich food (meat, chicken and milk) whereas it has no significant effect on the consumption of tobacco and alcohol (components of the "adult male" good in our setting).

The analysis of the effects of Familias en Acción's cousin, Mexican CCT program Oportunidades (previously known as PROGRESA), showed similar results (Fernald et al. 2008a,

2008b, Hoddinott and Skoufias 2004). Studying the short-term impact of Oportunidades, Hoddinott and Skoufias (2004) find that families participating in the program were spending 70% of the cash transfer on better quality energy sources, including meat, fruits, and vegetables.

Focusing on health outcomes, Fernald et al. (2008c) evaluate the effect of Oportunidades on BMI, overweight, obesity, blood pressure, hypertension, and self-reported health fitness.[64] Having first defined an intervention group as a group of low-income (below the 20th percentile of income, nationally), rural, Mexican adults aged 30-65 years who received conditional cash transfers for the period of 3.5 to 5 years, and a comparison group as a group of newly recruited adults who had never been enrolled, the authors find that age- and sex-adjusted BMI, obesity, and overweight were all significantly lower in the intervention group relative to the comparison group. While these results are consistent with ours, they may be driven by measurement error. In particular, the authors note that while baseline information was available for all the individuals in the treatment group, they were forced to use self-reported retrospective for individual in the control group which, of course, represents a major limitation of their study.

Fernald et al. (2008a) use treatment and control groups from Oportunidades to analyze the effect of the program on adult health outcomes. They divide the sample into "early" and "late"[65] treatment groups and show that the doubling of cumulative cash transfers to the household is associated with higher BMI, overweight, and obesity in adult participants from the late treatment group. The authors speculate that access to increased economic resources may allow people to purchase and consume more high energy beverages or snack foods, which can then contribute to weight gain (ibid., p. 2251). To support their argument, they refer to the study of Hoddinott and Skoufias (2004) who indeed find that beneficiary families in the Oportunidades

[64] In this case, obesity (overweight) was defined as BMI $\geq$ 30.0 (25) kg/m^2, respectively.
[65] The adults in the "early" treatment groups were enrolled and participated in the program for an additional 18 months relative to adults in the "late" treatment group.

program consume a greater amount of energy than non-beneficiary families. Yet, the same study finds that an additional 18 months of participation in Oportunidades is associated with better health outcomes and both a "non-significant trend for increased program participation to be associated with lower prevalence of grade II obesity among man and women", and a "non-significant trend for increased program participation to be associated with lower BMI among women". Although the authors report these trends as "non-significant" and highlight the findings that the doubling of cumulative cash transfers to the household is associated with higher BMI, overweight, and obesity in adult participants, the trends suggesting that longer participation in Oportunidades is associated with lower BMI and obesity are in fact significant at the 10 percent level (each has a p-value of 0.06).

Like the present study, Fernald et al. (2008b) find that CCTs are positively associated with children's health and development. In particular, focusing on child growth, health, and development outcomes, these authors find that the doubling of cash transfers is associated with lower prevalence of stunting, lower body-mass index for age percentile, and lower prevalence of being overweight.

2.9 Conclusion

Using the Blundell et al. (2005) collective model framework of intra-household allocation we set out to understand the effects of CCTs targeted towards mothers on the determination of anthropometric outcomes of mothers and their children. Our study is unique in that we not only look at the factors affecting adult women and children's outcomes separately, but we also analyze the factors determining their joint outcomes. In particular, we analyze how a windfall of income affects the allocation of household resources across a diverse set of food items consumed by the household. We also test whether such resource reallocation has positive impacts on the

individual and joint anthropometric outcomes of mothers and children as well as in the health outcomes of children.

First, we find that CCTs affect children's anthropometric outcomes directly and indirectly. The direct effect causes an increase in children's WFA z-score, a 22 percent decrease in the probability of being underweight and a 5 percent increase in the probability of having normal-weight. The indirect effect works via a reallocation of resources towards meat/protein and corn/flour goods which are both negatively associated with the prevalence of diarrhea and the flu, both of which have a negative impact in children's health.

Second, we find that mothers receiving CCTs experience no change in their BMI. Moreover, while we find that increases in the consumption of meat/protein, milk/dairy, and corn/flour are negatively associated with mothers' BMI, the latter three are also positively associated with the probability of a mother being of normal weight. Finally, an increase in the household consumption of meat/protein goods is also associated with 40 percent decrease in the probability of having an overweight mother

Third, when looking at the joint anthropometric outcomes of mothers and children, we find that those from CCT-receiving households are 16 percent more likely to be "normal-weight", 37 percent less likely to be "dual-burden", and 27 percent less likely to be "single-burden".

Lastly, in line with the predictions of the collective household model, the income pooling hypothesis is rejected whereas the hypothesis of Pareto optimality cannot be rejected, suggesting that households' decisions are in fact optimal and subject to bargaining mechanisms.

Overall, our findings suggest that CCTs shift the bargaining power in favor of mothers. This power revision results in a reallocation of resources that indirectly improves children's

anthropometric outcomes without having a negative effect on mothers' BMIs. Interestingly, we find that CCTs also have a direct effect on anthropometric outcomes, suggesting perhaps that participation in the CCT program has a behavioral effect on the treated households.

A plausible hypothesis is that the observed improvements in child anthropometrics associated with the treatment (or direct effect) are a result of the program conditionalities rather than of the CCT transfer. For instance, because treated households are mandated to both attend nutrition and health related training sessions and to take their children to regular health checkups, the observed improvement in anthropometric outcomes may be the result of either their learning, of their better health care, or both. Of course, the validity of these hypotheses remains to be tested empirically. Nevertheless, our results suggest that mothers' willingness to pay for the inputs in the production of the public good is higher than that of fathers'; as a result, targeting CCTs to mothers has overall positive effects on both intra-household allocation and distribution of resources. In particular, we conclude that the FA program has had a positive effect on children's health outcomes without leading to higher obesity among mothers.

Table 2.1: Summary of CCT Conditions

Health-Nutrition Transfers		
Target Group	Beneficiary families with children between 0 and 6 years	
Monetary Value	46,500 pesos/month (2002)*	
Condition(s)	children: vaccination and growth and development checks mothers: courses on nutrition, hygiene and contraception	
Education Transfers		
Target Group	Beneficiary families with children between 7 and 17 years	
Monetary Value	Primary school children: Secondary school children:	14,000 pesos/month (2002)* 28,000 pesos/month (2002)*

Condition(s)both primary and secondary school children attending at least 80% of school classes during the school year.

*) The monetary value of the both health-nutrition and education transfers change over time. For example, in 2001 the value of education transfers to beneficiary families with primary (secondary) school children was set at 12,000 (24,000) pesos/month for the families with primary (secondary) school children, resp.

Table 2.2.A Descriptive Statistics - Household Expenditures and Characteristics

Expenditures	Mean-Levels	Std. Dev.	Mean-Shares	Std. Dev.
Total	376,086	637,352	1.00	–
	Assignable goods			
Adult-Woman	1,955	6,337	0.01	0.03
Adult-Man	1,357	4,756	0.01	0.02
	Public goods			
Children	13,505	17,224	0.06	0.08
Household	37,833	41,462	0.16	0.15
	Food			
Meat/Protein	35,050	70,394	0.12	0.11
Milk/Dairy	75,569	322,832	0.13	0.17
Corn/Flour	135,757	467,678	0.21	0.21
Vegetables	42,805	50,340	0.18	0.18
Fats	21,345	38,935	0.08	0.09
Other-foods	10,675	9,514	0.05	0.05

Characteristics	Mean	Std. Dev.
Male	0.51	0.50
Number of Minors	3.86	1.70
Number of Adults	2.31	0.75
Married	0.83	0.37
Mother-High Education	0.04	0.19
Father-High Education	0.03	0.18
Mother-Wage Laborer	0.07	0.26
Father-Wage Laborer	0.61	0.49
Cabecera	0.46	0.50
Centro Poblado	0.45	0.50
Gas	0.06	0.23
Electricity	0.84	0.37
Sewer	0.21	0.41
Water Pipe	0.57	0.50
Trash Collection	0.28	0.45
Sickness	0.12	0.33
Income	170,633.1	193,416.2

Note: there are 10,285 child level observations in the sample.

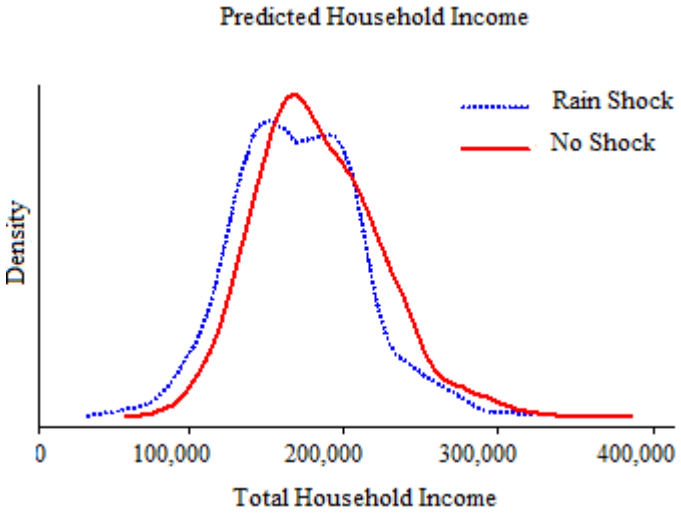
Table 2.2.B

Anthropometric and Health Outcomes (N = 10,285)

	Mean	Std. Dev.
Child Anthropometrics & Health		
Height-for-age	-1.371	1.086
Weight-for-age	-0.736	0.989
BMI-for-age	0.205	0.961
Under-weight	0.170	0.375
Normal-weight	0.818	0.386
Over-weight	0.013	0.112
Diarrhea	0.121	0.326
Flu	0.362	0.480
Mother Anthropometrics and Health		
BMI-Mother	24.77	4.58
BMI-Mother <18.5	0.045	0.208
18.5< BMI-Mother <25	0.533	0.499
25< BMI-Mother	0.422	0.494
Mother/Child Anthropometrics		
BMI-Mother <18.5, Under-weight child	0.016	0.127
Normal Pair	0.425	0.494
Over-weight pair	0.008	0.089
BMI-Mother >25, Under-weight child (Dual Burden)	0.048	0.214
BMI-Mother >18.5, Under-weight child	0.153	0.360

Table 2.3.A - The Effect of a Rain-Shock on Household Income

Controls	Income
Rain-shock	-14,661**
	(6,056)
Mean precipitation	-17*
	(9)
Hours at home – Father	-3,356
	(2,282)
Hours at home – Mother	1,516
	(1,952)
Hours at work – Father	2,322**
	(1,119)
Hours at work – Mother	2,848**
	(1,180)
Mother-High Education	28,764**
	(14,426)
Father-High Education	35,914**
	(15,392)
Mother-Wage Laborer	59,088***
	(12,884)
Father-Wage Laborer	7,181
	(8,595)
Cabecera	32,574**
	(13,654)
Centro Poblado	-6,495
	(13,571)
Male child	9,047
	(5,506)
Minors	2,826*
	(1,658)
Adults	-4,964
	(4,068)
Married	33,799***
	(7,347)
Constant	108,341***
	(29,492)
Observations	8,310



H0: Income (Rain-shock=1) = Income (Rain-shock=0)

Income (N = 10,285)			
Group	Mean	Std. Err.	Std. Dev.
No shock	173,427.5	2,519.9	208,536.2
Rain-shock	165,105.6	2,706.0	159,221
Difference	8,321.8		
T-test	Ha: diff < 0	Ha: diff ≠ 0	Ha: diff > 0
P-value	0.9805	0.0391	0.0195

H0: Predicted Income (Rain-shock=1) = Income (Rain-shock=0)

Predicted Income (N = 8,310)			
Group	Mean	Std. Err.	Std. Dev.
No shock	183,237	553	40,956.0
Rain-shock	170,117.9	761.6	40,490
Difference	13,119.1		
T-test	Ha: diff < 0	Ha: diff ≠ 0	Ha: diff > 0
P-value	1.0000	0.0000	0.0000

The table shows the IV regression results for the effect of the treatment on total household expenditures. Other controls: regional fixed effect. Municipality clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 2.3.B - The Effect of the Treatment on Total Expenditures – 2SLS

	1st Stage	2nd Stage
Banks	0.682	
	0.041	
Treated		168,118.092**
		(76,008.701)
Rain-shock	-0.034	-20,385.467
	0.033	(34,594.283)
Electricity	0.045	-97,179.319**
	0.039	(39,117.114)
Gas	-0.100	36,532.381
	0.083	(90,707.131)
Water pipe	0.076	-19,832.202
	0.033	(40,761.570)
Sewer	-0.044	99,441.886**
	0.047	(48,687.275)
Trash collection	-0.093	43,786.518
	0.039	(46,566.531)
Mother-High Education	0.013	91,947.279**
	0.045	(46,150.316)
Father-High Education	-0.064	33,729.824
	0.039	(44,878.985)
Mother-Wage Laborer	-0.028	-48,867.684
	0.036	(36,081.559)
Father-Wage Laborer	0.029	-68,609.188*
	0.023	(35,714.252)
Cabecera	-0.015	71,619.502
	0.048	(43,966.335)
Centro Poblado	0.075	89,996.675**
	0.048	(43,986.060)
Male	0.015	-13,832.350
	0.011	(14,106.220)
Minors	-0.003	20,279.275**
	0.005	(7,885.385)
Adults	-0.001	21,437.209
	0.008	(15,956.296)
Married	0.042	-22,306.658
	0.021	(25,512.196)
Observations		10,285

The table shows the IV regression results for the effect of the treatment on total household expenditures. Other controls: regional fixed effect. Municipality clustered standard errors in parentheses. ** $p < 0.05$ and * $p < 0.1$.

Summary results for first-stage regressions

Instrument: presence of at least one bank (mean: 0.72, std. dev.: 0.45) in the municipality
(there are 120 municipalities in the sample).

Kleibergen-Paap Wald rk F statistic: F (1) = 280.71

Stock-Yogo weak ID test critical values for single endogenous regressor:
10% maximal IV size = 16.38, 15% maximal IV size = 8.96
20% maximal IV size = 6.66, 25% maximal IV size = 5.53

Endogeneity test of endogenous regressors: χ^2 (1) = 5.219, p-val = 0.0223

Table 2.4.A - The Effect of the Treatment on Demand - Reduced Form Equations – 2SLS – Budget Shares

	Adult woman[v]	Adult man[v]	Children[v]	Household	Meat /Protein	Milk/ Dairy	Corn /Flour	Vegetables	Fats	Other food
Treated	0.015	-0.004	0.042***	-0.015	0.030***	0.023	0.062*	-0.095***	-0.026***	-0.007
	(0.019)	(0.005)	(0.015)	(0.022)	(0.011)	(0.022)	(0.035)	(0.028)	(0.009)	(0.007)
Rain-shock	0.010	0.001	0.009	0.002	0.006	0.000	-0.020	0.012	-0.010	0.000
	(0.007)	(0.003)	(0.008)	(0.009)	(0.006)	(0.012)	(0.017)	(0.011)	(0.008)	(0.003)
Electricity	0.006	0.000	0.009*	0.016*	-0.001	0.016**	-0.052***	-0.009	0.009**	0.012***
	(0.009)	(0.003)	(0.005)	(0.009)	(0.007)	(0.008)	(0.018)	(0.011)	(0.004)	(0.003)
Gas	-0.021*	-0.008**	0.020*	0.020	-0.034**	0.028	-0.024	-0.010	-0.012	0.020
	(0.011)	(0.003)	(0.011)	(0.025)	(0.013)	(0.021)	(0.039)	(0.021)	(0.008)	(0.014)
Water pipe	0.011	0.004*	0.009*	0.003	-0.012***	-0.004	-0.004	0.007	-0.003	0.004
	(0.007)	(0.002)	(0.005)	(0.008)	(0.004)	(0.009)	(0.013)	(0.010)	(0.004)	(0.003)
Sewer	0.003	0.004	-0.005	0.000	0.007	-0.013	0.036**	-0.015	-0.009*	-0.003
	(0.008)	(0.003)	(0.007)	(0.013)	(0.007)	(0.017)	(0.018)	(0.011)	(0.005)	(0.004)
Trash collection	-0.002	-0.000	0.004	-0.003	0.002	0.014	0.013	-0.029**	0.000	-0.000
	(0.008)	(0.003)	(0.007)	(0.013)	(0.007)	(0.014)	(0.020)	(0.011)	(0.005)	(0.004)
Mother-High Education	0.010	-0.003	0.026***	0.001	0.002	-0.003	0.004	-0.009	-0.005	-0.004
	(0.010)	(0.004)	(0.006)	(0.011)	(0.008)	(0.013)	(0.018)	(0.011)	(0.005)	(0.004)
Father-High Education	0.014	-0.007	-0.001	0.013	-0.009	-0.003	0.029	-0.019	-0.013**	0.002
	(0.013)	(0.005)	(0.008)	(0.013)	(0.009)	(0.014)	(0.020)	(0.013)	(0.006)	(0.004)
Mother-Wage Laborer	0.018*	-0.004	0.004	0.008	0.000	-0.003	-0.010	0.002	0.001	-0.004
	(0.011)	(0.003)	(0.008)	(0.010)	(0.007)	(0.008)	(0.011)	(0.011)	(0.005)	(0.003)
Father-Wage Laborer	-0.006	-0.005***	-0.009	-0.001	0.001	0.009	-0.017	0.015*	-0.001	0.001
	(0.006)	(0.002)	(0.006)	(0.006)	(0.005)	(0.007)	(0.012)	(0.008)	(0.003)	(0.002)
Cabecera	0.001	-0.011***	0.007	-0.003	-0.001	-0.009	0.036*	-0.021	-0.005	-0.001
	(0.011)	(0.003)	(0.009)	(0.011)	(0.010)	(0.017)	(0.019)	(0.018)	(0.007)	(0.004)
Centro Poblado	0.034***	-0.002	0.003	-0.003	-0.006	-0.021	0.014	0.032*	-0.011	-0.010**
	(0.012)	(0.003)	(0.010)	(0.013)	(0.011)	(0.017)	(0.020)	(0.017)	(0.007)	(0.005)
Male	-0.003	-0.002**	-0.000	0.004	-0.002	-0.006	0.002	0.004	-0.000	-0.000
	(0.004)	(0.001)	(0.003)	(0.004)	(0.002)	(0.005)	(0.006)	(0.004)	(0.002)	(0.001)
Minors	-0.005***	0.001	-0.000	-0.007***	-0.002	-0.003	0.008***	0.006***	-0.000	-0.001
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.003)	(0.002)	(0.001)	(0.001)

Table 2.4.A - The Effect of the Treatment on Demand - Reduced Form Equations – 2SLS – Budget Shares (cont.)

	Adult woman[r]	Adult man[r]	Children[r]	Household	Meat /Protein	Milk/ Dairy	Corn /Flour	Vegetables	Fats	Other food
Adults	0.003	0.004***	-0.005**	0.004*	0.001	0.000	0.001	-0.002	-0.004***	0.001*
	(0.003)	(0.001)	(0.002)	(0.003)	(0.002)	(0.004)	(0.004)	(0.003)	(0.002)	(0.001)
Married	-0.007	0.000	0.009**	0.002	-0.008	0.014**	-0.018**	0.004	-0.000	0.002
	(0.007)	(0.002)	(0.004)	(0.006)	(0.006)	(0.007)	(0.008)	(0.007)	(0.004)	(0.002)
Observations	10,285									

Municipality clustered standard errors in parentheses. Other controls: regional fixed effect. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

[r] Correspond to IV-Tobit regressions. The table shows the IV-regression results for the demand functions in budget shares.

Table 2.4.B - The Effect of the Treatment on Demand - Reduced Form Equations – 2SLS – Expenditures (COP)

	Adult woman[v]	Adult man[v]	Children[v]	Household	Meat/ Protein	Milk/ Dairy	Corn /Flour	Vegetables	Fats	Other food
Treated	4,231.9	827.7	11,192.4***	2,265.4	20,142.5***	15,477.0	131,001.8**	-12,005.6*	2,260.6	828.0
	(4,432.7)	(4,331.1)	(2,837.6)	(4,024.8)	(7,038.3)	(32,806.0)	(56,108.6)	(6,941.9)	(3,305.9)	(1,058.5)
Rain-shock	1,798.3	1,731.1	744.1	-1,176.2	4,295.7	-18,992.7	-4,109.6	3,400.1	-3,634.7	-668.7
	(1,578.4)	(1,819.5)	(1,382.9)	(1,805.3)	(4,440.7)	(14,266.0)	(27,226.1)	(3,508.6)	(3,486.3)	(443.2)
Electricity	1,006.0	-356.9	630.4	-1,675.5	-12,729.7**	7,875.1	-75,809.2***	-14,784.7***	-1,077.8	597.1
	(2,216.2)	(1,614.2)	(1,210.1)	(2,239.2)	(5,354.9)	(12,304.1)	(27,864.7)	(5,083.0)	(1,782.2)	(515.4)
Gas	-5,166.3**	-4,437.0*	4,245.5***	5,240.7	-11,096.2	25,559.4	11,379.3	1,215.8	-732.6	2,427.0***
	(2,431.6)	(2,676.5)	(1,282.3)	(3,670.3)	(7,515.3)	(33,149.1)	(66,448.4)	(5,111.7)	(3,974.5)	(793.0)
Water pipe	2,398.7	2,252.6	1,544.4	-490.3	-833.9	-10,282.9	-10,970.2	2,827.4	-2,126.1	482.1
	(1,721.4)	(1,394.3)	(947.2)	(1,984.9)	(3,806.9)	(14,263.9)	(30,408.3)	(2,272.9)	(1,623.3)	(455.6)
Sewer	1,418.1	2,294.5	376.6	1,520.0	13,189.8**	8,987.7	74,796.1***	-1,935.4	1,857.9	-82.9
	(2,012.0)	(2,079.4)	(1,341.6)	(2,684.8)	(5,623.3)	(31,719.1)	(27,637.7)	(2,626.3)	(2,456.4)	(545.7)
Trash col.	-808.6	709.4	447.1	-507.7	1,207.4	48,638.3*	920.0	-7,045.6***	423.0	-105.3
	(2,026.0)	(2,406.9)	(1,193.8)	(2,506.8)	(3,321.6)	(28,751.0)	(28,148.6)	(2,700.5)	(2,679.5)	(448.2)
Mother-HE	3,182.8	3,430.4	8,844.9***	6,677.9*	5,687.7	-182.8	65,170.2*	5,043.2*	1,531.0	1,211.4*
	(2,428.3)	(2,369.2)	(1,627.2)	(3,712.7)	(4,088.6)	(23,199.7)	(37,360.1)	(2,793.1)	(1,680.6)	(646.6)
Father-HE	2,686.2	441.9	1,317.6	7,371.0*	-3,885.7	-11,636.8	42,179.0	-2,137.9	-697.2	1,212.1*
	(2,859.3)	(2,843.2)	(2,057.6)	(4,341.8)	(3,823.1)	(20,963.4)	(39,739.0)	(3,330.6)	(4,442.0)	(689.3)
Mother-WL	4,418.7*	-500.4	-118.6	164.5	473.4	-13,378.0	-30,988.6	-3,122.7	-1,053.9	-1,351.5***
	(2,608.8)	(2,191.2)	(1,476.3)	(2,212.4)	(5,327.7)	(17,847.5)	(26,564.9)	(2,861.9)	(1,744.6)	(406.7)
Father-WL	-1,670.7	-4,687.4***	-2,147.0**	-3,426.2**	-5,842.2	-2,557.5	-53,168.1*	1,780.2	-3,056.9**	-228.4
	(1,356.6)	(1,099.4)	(926.7)	(1,438.2)	(4,098.9)	(11,803.9)	(27,954.5)	(1,983.9)	(1,527.9)	(349.2)
Cabecera	36.9	-3,646.5*	1,850.5	126.7	-838.0	2,139.1	70,753.5**	-3,084.2	620.2	624.1
	(2,622.9)	(1,922.8)	(1,704.7)	(2,479.1)	(5,617.2)	(22,721.9)	(33,121.6)	(4,666.0)	(3,216.8)	(671.9)
Centro PB	8,064.6***	4,556.8**	1,901.3	3,431.4	2,479.3	2,914.8	67,114.3**	11,380.1***	644.3	-657.4
	(2,792.8)	(2,270.3)	(1,914.8)	(2,616.6)	(6,648.1)	(23,166.0)	(30,755.0)	(4,023.5)	(2,781.5)	(709.7)
Male	-365.4	-721.5	-308.1	-500.2	-1,375.6	-12,129.8	364.1	1,680.9	-1,272.7**	-316.0
	(921.3)	(679.6)	(559.7)	(905.8)	(1,392.3)	(9,197.2)	(10,287.9)	(1,090.4)	(606.1)	(214.8)
Minors	-1,134.2**	-262.4	650.7**	-237.7	1,349.2	4,308.9	10,416.1*	2,955.7***	816.1**	344.1***
	(481.0)	(368.4)	(283.7)	(402.2)	(842.3)	(5,054.5)	(5,939.5)	(593.1)	(412.6)	(118.0)

Table 2.4.B - The Effect of the Treatment on Demand - Reduced Form Equations – 2SLS – Expenditures (COP) (cont.)

	Adult woman[ɣ]	Adult man[ɣ]	Children[ɣ]	Household	Meat/ Protein	Milk/ Dairy	Corn /Flour	Vegetables	Fats	Other food
Adults	932.4	1,435.1*	-525.9	3,051.8***	1,792.6	11,618.4	2,892.8	1,738.9**	-391.8	606.6***
	(719.3)	(750.3)	(437.0)	(829.0)	(1,554.0)	(10,308.0)	(9,877.7)	(886.9)	(816.9)	(170.3)
Married	-1,812.0	40.1	2,221.2**	560.8	-9,252.7*	6,393.2	-21,751.8	1,642.3	-1,457.9	469.7
	(1,582.4)	(1,391.3)	(942.8)	(1,318.8)	(5,241.4)	(14,195.1)	(16,632.0)	(2,096.3)	(1,651.4)	(421.6)
Observations	10,285									

Municipality clustered standard errors in parentheses. Other controls: regional fixed effect. *** p < 0.01, ** p < 0.05, and * p < 0.1.
ɣ Correspond to IV-Tobit coefficient estimates. The table shows the IV-regression results for the demand functions in levels.
HE denotes High-Education and WL denotes Wage-Laborer. Centro pb refers to Centro Poblado.

Table 2.5 - The Effect of the Treatment and Rain shocks on the System of Demand Equations: SUR for Linear Recursive Processes

	Treatment	Adult man	Adult woman	Children	Meat/ Protein	Milk/ Dairy	Corn/ Flour	Vegetables	Fats	Other food
Bank	**0.689*** **									
	(0.039)									
Treated		0.002	0.001	0.028***	0.034***	0.012	0.039	-0.084***	-0.022**	-0.004
		(0.002)	(0.002)	(0.010)	(0.012)	(0.021)	(0.029)	(0.027)	(0.009)	(0.006)
Rain shock	-0.036	0.002*	0.001	0.006	0.005	0.002	-0.017	0.011	-0.010	-0.000
	(0.032)	(0.001)	(0.001)	(0.006)	(0.006)	(0.012)	(0.014)	(0.010)	(0.008)	(0.003)
Total Household Expend.	-0.000**	-0.000***	-0.000***	-0.000***	-0.000***	0.000***	0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Mother-High Education	0.019	0.000	-0.001	0.017***	0.004	-0.009	-0.008	-0.003	-0.004	-0.003
	(0.044)	(0.002)	(0.001)	(0.005)	(0.008)	(0.012)	(0.016)	(0.010)	(0.004)	(0.003)
Father-High Education	-0.063	0.003	-0.001	-0.001	-0.008	-0.006	0.024	-0.017	-0.013**	0.002
	(0.039)	(0.003)	(0.002)	(0.006)	(0.008)	(0.013)	(0.017)	(0.012)	(0.006)	(0.003)
Mother-Wage Laborer	-0.031	0.003	-0.001	0.003	-0.001	0.000	-0.004	-0.001	0.000	-0.005
	(0.035)	(0.002)	(0.001)	(0.006)	(0.007)	(0.007)	(0.010)	(0.011)	(0.005)	(0.003)
Father-Wage Laborer	0.025	0.000	-0.002**	-0.008	-0.001	0.014*	-0.008	0.011	-0.002	0.000
	(0.022)	(0.001)	(0.001)	(0.005)	(0.005)	(0.007)	(0.010)	(0.008)	(0.003)	(0.002)
Cabecera	-0.011	-0.000	-0.003***	0.008	0.001	-0.014	0.026	-0.016	-0.003	0.000
	(0.047)	(0.001)	(0.001)	(0.006)	(0.010)	(0.016)	(0.017)	(0.017)	(0.007)	(0.004)
Centro Poblado	0.080*	0.004***	0.001	0.003	-0.004	-0.027*	0.002	0.037**	-0.009	-0.009*
	(0.048)	(0.001)	(0.001)	(0.007)	(0.011)	(0.016)	(0.018)	(0.016)	(0.007)	(0.005)
Electricity	0.040	0.002*	0.000	0.004	-0.004	0.023***	-0.039***	-0.015	0.007*	0.010***
	(0.038)	(0.001)	(0.001)	(0.003)	(0.007)	(0.009)	(0.015)	(0.010)	(0.004)	(0.003)
Gas	-0.098	-0.001	-0.001	0.016**	-0.033**	0.025	-0.029	-0.008	-0.012	0.021
	(0.081)	(0.001)	(0.001)	(0.008)	(0.014)	(0.022)	(0.031)	(0.021)	(0.008)	(0.013)
Water pipe	0.075**	0.002	0.002**	0.006*	-0.012***	-0.003	-0.001	0.006	-0.004	0.003
	(0.032)	(0.001)	(0.001)	(0.003)	(0.005)	(0.009)	(0.010)	(0.009)	(0.004)	(0.002)
Sewer	-0.039	0.000	0.001	-0.001	0.009	-0.020	0.022	-0.009	-0.007	-0.001
	(0.048)	(0.001)	(0.001)	(0.005)	(0.007)	(0.016)	(0.019)	(0.010)	(0.005)	(0.004)
Trash collection	-0.092**	0.000	0.001	0.003	0.003	0.011	0.007	-0.026**	0.001	0.000
	(0.038)	(0.001)	(0.001)	(0.005)	(0.007)	(0.012)	(0.019)	(0.011)	(0.005)	(0.003)

Table 2.5 - The Effect of the Treatment and Rain shocks on the System of Demand Equations: SUR for Linear Recursive Processes (cont.)

	Treatment	Adult man	Adult woman	Children	Meat/ Protein	Milk/ Dairy	Corn/ Flour	Vegetables	Fats	Other food
Male	0.014	-0.001	-0.000	-0.000	-0.002	-0.005	0.004	0.004	-0.000	-0.000
	(0.011)	(0.001)	(0.000)	(0.002)	(0.002)	(0.004)	(0.005)	(0.004)	(0.002)	(0.001)
Minors	-0.001	-0.001***	-0.000**	-0.000	-0.001	-0.004*	0.005**	0.007***	-0.000	-0.000
	(0.005)	(0.000)	(0.000)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
Adults	0.000	0.000	0.001	-0.003**	0.001	-0.001	-0.002	-0.000	-0.004**	0.002**
	(0.008)	(0.001)	(0.000)	(0.001)	(0.002)	(0.004)	(0.004)	(0.003)	(0.002)	(0.001)
Married	0.041**	-0.001	-0.000	0.005*	-0.009	0.016**	-0.015**	0.003	-0.001	0.002
	(0.020)	(0.001)	(0.001)	(0.003)	(0.006)	(0.007)	(0.007)	(0.007)	(0.003)	(0.002)
Constant	-0.067	0.007**	0.008***	0.032***	0.130***	0.047*	0.148***	0.297***	0.115***	0.050***
	(0.121)	(0.003)	(0.002)	(0.009)	(0.017)	(0.026)	(0.035)	(0.037)	(0.012)	(0.008)
Observations	10,285	10,285	10,285	10,285	10,285	10,285	10,285	10,285	10,285	10,285

The table shows the seemingly unrelated fully recursive mixed process regression results for the system of demand equations. Municipality clustered standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$. Other controls: department fixed effect.

Table 2.6 - The Effect of the Treatment and Rain shocks on the System of Demand Equations: SUR for Nonlinear Recursive Mixed Processes

	Treatment	Adult man¥	Adult woman¥	Children¥	Meat /Protein	Dairy /Milk	Corn /Flour	Vegetables	Fats	Other food
Bank	**0.689*** **									
	(0.039)									
Treated		0.014	-0.004	0.045***	0.034***	0.012	0.039	-0.084***	-0.022**	-0.004
		(0.016)	(0.005)	(0.014)	(0.012)	(0.021)	(0.029)	(0.027)	(0.009)	(0.006)
Rain shock	-0.036	0.008	0.001	0.008	0.005	0.002	-0.017	0.011	-0.010	-0.000
	(0.032)	(0.006)	(0.003)	(0.007)	(0.006)	(0.012)	(0.014)	(0.010)	(0.008)	(0.003)
Total household	-0.000**	0.000	-0.000	-0.000***	-0.000***	0.000***	0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Mother-High Education	0.019	0.009	-0.003	0.027***	0.004	-0.009	-0.008	-0.003	-0.004	-0.003
	(0.044)	(0.009)	(0.004)	(0.006)	(0.008)	(0.012)	(0.016)	(0.010)	(0.004)	(0.003)
Father-High Education	-0.063	0.009	-0.008	-0.001	-0.008	-0.006	0.024	-0.017	-0.013**	0.002
	(0.039)	(0.012)	(0.005)	(0.008)	(0.008)	(0.013)	(0.017)	(0.012)	(0.006)	(0.003)
Mother-Wage Laborer	-0.031	0.018*	-0.004	0.003	-0.001	0.000	-0.004	-0.001	0.000	-0.005
	(0.035)	(0.010)	(0.003)	(0.008)	(0.007)	(0.007)	(0.010)	(0.011)	(0.005)	(0.003)
Father-Wage Laborer	0.025	-0.003	-0.005***	-0.010*	-0.001	0.014*	-0.008	0.011	-0.002	0.000
	(0.022)	(0.005)	(0.002)	(0.006)	(0.005)	(0.007)	(0.010)	(0.008)	(0.003)	(0.002)
Cabecera	-0.011	0.002	-0.011***	0.008	0.001	-0.014	0.026	-0.016	-0.003	0.000
	(0.047)	(0.011)	(0.003)	(0.008)	(0.010)	(0.016)	(0.017)	(0.017)	(0.007)	(0.004)
Centro Poblado	0.080*	0.030***	-0.002	0.004	-0.004	-0.027*	0.002	0.037**	-0.009	-0.009*
	(0.048)	(0.011)	(0.003)	(0.009)	(0.011)	(0.016)	(0.018)	(0.016)	(0.007)	(0.005)
Electricity	0.040	0.004	-0.000	0.007	-0.004	0.023***	-0.039***	-0.015	0.007*	0.010***
	(0.038)	(0.008)	(0.003)	(0.005)	(0.007)	(0.009)	(0.015)	(0.010)	(0.004)	(0.003)
Gas	-0.098	-0.022**	-0.008**	0.020**	-0.033**	0.025	-0.029	-0.008	-0.012	0.021
	(0.081)	(0.010)	(0.003)	(0.010)	(0.014)	(0.022)	(0.031)	(0.021)	(0.008)	(0.013)
Water pipe	0.075**	0.010	0.004*	0.008*	-0.012***	-0.003	-0.001	0.006	-0.004	0.003
	(0.032)	(0.007)	(0.002)	(0.004)	(0.005)	(0.009)	(0.010)	(0.009)	(0.004)	(0.002)
Sewer	-0.039	-0.001	0.003	-0.003	0.009	-0.020	0.022	-0.009	-0.007	-0.001
	(0.048)	(0.008)	(0.003)	(0.007)	(0.007)	(0.016)	(0.019)	(0.010)	(0.005)	(0.004)

Table 2.6 - The Effect of the Treatment and Rain shocks on the System of Demand Equations: SUR for Nonlinear Recursive Mixed Processes (cont.)

	Treatment	Adult man¥	Adult woman¥	Children¥	Meat /Protein	Dairy /Milk	Corn /Flour	Vegetables	Fats	Other food
Trash collection	-0.092**	-0.002	-0.000	0.005	0.003	0.011	0.007	-0.026**	0.001	0.000
	(0.038)	(0.008)	(0.003)	(0.006)	(0.007)	(0.012)	(0.019)	(0.011)	(0.005)	(0.003)
Male	0.014	-0.004	-0.002**	-0.000	-0.002	-0.005	0.004	0.004	-0.000	-0.000
	(0.011)	(0.004)	(0.001)	(0.003)	(0.002)	(0.004)	(0.005)	(0.004)	(0.002)	(0.001)
Minors	-0.001	-0.005***	0.001	0.000	-0.001	-0.004*	0.005**	0.007***	-0.000	-0.000
	(0.005)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
Adults	0.000	0.004	0.003***	-0.004**	0.001	-0.001	-0.002	-0.000	-0.004**	0.002**
	(0.008)	(0.003)	(0.001)	(0.002)	(0.002)	(0.004)	(0.004)	(0.003)	(0.002)	(0.001)
Married	0.041**	-0.007	0.000	0.009**	-0.009	0.016**	-0.015**	0.003	-0.001	0.002
	(0.020)	(0.006)	(0.002)	(0.004)	(0.006)	(0.007)	(0.007)	(0.007)	(0.003)	(0.002)
Constant	-0.067	-0.138***	-0.027***	-0.009	0.130***	0.047*	0.148***	0.297***	0.115***	0.050***
	(0.121)	(0.019)	(0.008)	(0.014)	(0.017)	(0.026)	(0.035)	(0.037)	(0.012)	(0.008)
Observations	10,285	10,285	10,285	10,285	10,285	10,285	10,285	10,285	10,285	10,285

The table shows the seemingly unrelated fully recursive mixed process regression results for the system of demand equations. Municipality clustered standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$. Other controls: department fixed effect.
¥ Correspond to IV-Tobit coefficient estimates.

Table 2.7 - The Effect of Treatment on the Anthropometric and Health Outcomes of Children – 2SLS

Controls	Treatment	Height-for-age	Weight-for-age	Under-weight	Normal-weight	Over-weight	Diarrhea	Flu
Bank	**0.685**							
	0.038							
Treated	-0.040	0.116	0.128**	-0.038*	0.043**	-0.004	0.018	-0.013
	0.031	(0.086)	(0.062)	(0.021)	(0.020)	(0.004)	(0.015)	(0.033)
Rain-shock	-0.213	0.020	-0.065**	0.020*	-0.018	-0.002	0.004	0.003
	0.108	(0.033)	(0.033)	(0.012)	(0.012)	(0.002)	(0.009)	(0.021)
Meat/Protein	-0.041	0.042	-0.188	0.057	-0.032	-0.025*	-0.133***	-0.269***
	0.082	(0.180)	(0.130)	(0.044)	(0.045)	(0.013)	(0.030)	(0.065)
Milk/Dairy	-0.241	-0.081	-0.089	0.015	-0.018	0.004	-0.089***	-0.199***
	0.102	(0.129)	(0.122)	(0.042)	(0.042)	(0.011)	(0.025)	(0.049)
Corn/Flour	-0.181	-0.187	-0.231**	0.083***	-0.077**	-0.006	-0.113***	-0.238***
	0.071	(0.118)	(0.093)	(0.031)	(0.032)	(0.010)	(0.021)	(0.048)
Vegetables	-0.342	-0.378**	-0.256**	0.064*	-0.059*	-0.005	-0.076***	-0.176***
	0.119	(0.161)	(0.115)	(0.035)	(0.035)	(0.011)	(0.025)	(0.046)
Fats	0.289	-0.188	-0.201	-0.016	0.037	-0.021	-0.018	0.073
	0.182	(0.187)	(0.137)	(0.043)	(0.044)	(0.013)	(0.048)	(0.084)
Other-foods	0.000	-0.477	-0.130	0.084	-0.075	-0.010	-0.127	-0.121
	0.000	(0.291)	(0.314)	(0.104)	(0.100)	(0.034)	(0.093)	(0.116)
Total household expenditures	0.006	0.000*	0.000*	-0.000	0.000	-0.000	0.000	0.000***
	0.005	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Mother-BMI	0.000	0.066***	0.118***	-0.034***	0.032***	0.002***	-0.000	-0.002
	0.000	(0.016)	(0.016)	(0.007)	(0.007)	(0.001)	(0.003)	(0.006)
Mother_MBI^2	-0.039	-0.001***	-0.001***	0.000***	-0.000***	-0.000	-0.000	0.000
	0.016	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Diarrhea	-0.035	-0.130***	-0.137***	0.044***	-0.042***	-0.002		
	0.015	(0.036)	(0.031)	(0.013)	(0.012)	(0.004)		
Flu	0.001	0.018	-0.029	0.004	-0.003	-0.001		
	0.000	(0.025)	(0.021)	(0.008)	(0.008)	(0.002)		
Age (in months)	0.026	0.001	-0.006***	0.001***	-0.001***	-0.000***	-0.002***	-0.002***
	0.036	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Electricity	-0.122	0.026	-0.008	0.002	0.009	-0.011***	-0.003	-0.019
	0.078	(0.050)	(0.042)	(0.013)	(0.013)	(0.003)	(0.013)	(0.025)

Table 2.7 - The Effect of Treatment on the Anthropometric and Health Outcomes of Children – 2SLS (cont.)

Controls	Treatment	Height-for-age	Weight-for-age	Under-weight	Normal-weight	Over-weight	Diarrhea	Flu
Gas	0.071	0.198***	0.237***	-0.025	0.006	0.019*	-0.003	-0.036
	0.031	(0.055)	(0.048)	(0.021)	(0.027)	(0.011)	(0.018)	(0.025)
Electricity	-0.036	-0.071	-0.024	0.020	-0.022*	0.003	-0.000	0.008
	0.047	(0.050)	(0.039)	(0.014)	(0.013)	(0.003)	(0.010)	(0.016)
Sewer	-0.093	0.061	0.058	-0.018	0.020	-0.002	-0.021*	-0.011
	0.036	(0.063)	(0.046)	(0.016)	(0.017)	(0.005)	(0.011)	(0.018)
Trash collection	0.011	0.089	0.028	-0.030*	0.029*	0.001	0.009	0.018
	0.043	(0.057)	(0.049)	(0.017)	(0.017)	(0.004)	(0.012)	(0.021)
Mother-High Education	-0.066	0.278***	0.250***	-0.051**	0.039*	0.012	-0.050***	-0.075***
	0.038	(0.074)	(0.069)	(0.021)	(0.022)	(0.008)	(0.017)	(0.028)
Father-High Education	-0.038	0.148*	0.131	-0.027	0.028	-0.001	-0.016	-0.023
	0.035	(0.080)	(0.091)	(0.023)	(0.025)	(0.010)	(0.020)	(0.031)
Mother-Wage Laborer	0.022	0.028	0.065	-0.016	0.010	0.005	-0.002	-0.033
	0.021	(0.059)	(0.051)	(0.018)	(0.018)	(0.007)	(0.013)	(0.020)
Father-Wage Laborer	-0.011	0.043	0.027	-0.018	0.018	0.000	-0.028***	-0.025**
	0.044	(0.042)	(0.036)	(0.013)	(0.014)	(0.003)	(0.008)	(0.013)
Cabecera	0.081	-0.089*	-0.040	0.006	0.001	-0.007	0.000	-0.034
	0.045	(0.053)	(0.056)	(0.022)	(0.024)	(0.006)	(0.015)	(0.022)
Centro Poblado	0.016	-0.091	0.009	-0.016	0.029	-0.013**	-0.031**	-0.038
	0.011	(0.061)	(0.054)	(0.020)	(0.023)	(0.006)	(0.015)	(0.023)
Male	0.001	-0.088***	-0.017	0.014	-0.013	-0.001	0.011	0.001
	0.005	(0.030)	(0.025)	(0.009)	(0.009)	(0.002)	(0.008)	(0.010)
Minors	-0.004	-0.117***	-0.093***	0.024***	-0.021***	-0.003***	0.002	-0.003
	0.008	(0.010)	(0.009)	(0.003)	(0.004)	(0.001)	(0.002)	(0.004)
Adults	0.031	0.022	0.008	-0.007	0.008	-0.001	-0.000	-0.007
	0.020	(0.016)	(0.016)	(0.006)	(0.006)	(0.001)	(0.005)	(0.007)
Married	0.685	0.085*	0.055	-0.012	0.009	0.003	-0.027***	-0.017
	0.038	(0.049)	(0.039)	(0.014)	(0.015)	(0.003)	(0.010)	(0.018)
Observations		10,260	10,273	10,285	10,285	10,285	10,285	10,285

The table shows the 2SLS regression results for the anthropometric outcomes of children. Municipality clustered standard errors in parentheses.
*** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$. Other controls: region fixed effect.

Table 2.8 - The Effect of Treatment on the Anthropometric Outcomes of Mothers – 2SLS

	Treated	BMI-Mother	BMI-Mother < 18.5	18.5< BMI-Mother <25	25< BMI-Mother <30	25< BMI-Mother
Bank	**0.685**					
	0.039					
Treated	-0.040	-0.393	0.003	0.040	-0.024	-0.018
	0.032	(0.376)	(0.014)	(0.035)	(0.033)	(0.020)
Rain shock	-0.202	-0.610***	0.026***	0.017	-0.019	-0.024***
	0.108	(0.145)	(0.007)	(0.014)	(0.013)	(0.008)
Meat/Protein	-0.041	-1.701***	0.055*	0.095	-0.126*	-0.025
	0.084	(0.637)	(0.033)	(0.067)	(0.065)	(0.039)
Milk/Dairy	-0.231	-1.630***	0.030	0.162***	-0.097*	-0.096***
	0.102	(0.490)	(0.024)	(0.056)	(0.052)	(0.033)
Corn/Flour	-0.174	-0.872*	-0.010	0.112**	-0.063	-0.040
	0.071	(0.509)	(0.019)	(0.052)	(0.044)	(0.039)
Vegetables	-0.373	-1.358**	0.030	0.121**	-0.094*	-0.057*
	0.121	(0.562)	(0.035)	(0.056)	(0.053)	(0.031)
Fats	0.304	-1.056	0.026	0.170*	-0.205**	0.009
	0.183	(0.867)	(0.035)	(0.093)	(0.086)	(0.044)
Other-foods	0.000	1.761	-0.104*	0.014	0.064	0.027
	0.000	(1.292)	(0.059)	(0.168)	(0.141)	(0.093)
Total Expenditures	-0.021	0.000**	-0.000	-0.000*	0.000	0.000
	0.021	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Sickness	0.027	-0.040	0.006	-0.022	0.016	0.000
	0.037	(0.177)	(0.009)	(0.022)	(0.022)	(0.012)
Gas	-0.122	0.111	-0.008	0.020	-0.012	0.001
	0.078	(0.252)	(0.013)	(0.025)	(0.021)	(0.015)
Electricity	0.071	-0.122	-0.018	0.050*	-0.028	-0.003
	0.031	(0.295)	(0.014)	(0.028)	(0.026)	(0.022)
Sewer	-0.036	-0.046	-0.008	0.028	-0.016	-0.003
	0.047	(0.203)	(0.010)	(0.021)	(0.021)	(0.013)
Water pipe	-0.092	0.584*	-0.022**	-0.020	-0.001	0.043**
	0.037	(0.303)	(0.010)	(0.029)	(0.029)	(0.022)
Trash collection	0.016	0.506*	-0.010	-0.072***	0.068***	0.014
	0.043	(0.261)	(0.011)	(0.023)	(0.025)	(0.017)
Mother-High Education	-0.068	-0.553*	0.006	0.031	0.027	-0.064***
	0.038	(0.311)	(0.018)	(0.038)	(0.039)	(0.018)
Father-High Education	-0.030	-0.011	-0.017	0.014	0.003	-0.001
	0.035	(0.356)	(0.013)	(0.038)	(0.037)	(0.023)
Mother-Wage Laborer	0.024	0.310	-0.011	-0.028	0.037	0.002

	0.021	(0.257)	(0.012)	(0.030)	(0.029)	(0.019)
Father-Wage Laborer	-0.009	-0.311*	0.008	0.026	-0.021	-0.012
	0.045	(0.161)	(0.007)	(0.019)	(0.018)	(0.011)
Cabecera	0.084	0.004	0.003	0.031	-0.063**	0.029
	0.045	(0.330)	(0.014)	(0.037)	(0.029)	(0.018)
Centro Poblado	0.015	0.036	-0.029**	0.034	-0.005	-0.001
	0.011	(0.305)	(0.013)	(0.038)	(0.030)	(0.016)
Male	0.001	-0.052	-0.004	0.003	0.008	-0.007
	0.005	(0.119)	(0.005)	(0.012)	(0.010)	(0.007)
Minors	-0.002	-0.046	0.003	0.004	-0.009*	0.002
	0.008	(0.047)	(0.002)	(0.006)	(0.006)	(0.003)
Adults	0.035	0.258***	-0.004	-0.017	0.001	0.020***
	0.020	(0.092)	(0.005)	(0.011)	(0.010)	(0.006)
Married	0.685	0.277	-0.018	-0.029	0.031	0.016
	0.039	(0.240)	(0.013)	(0.020)	(0.023)	(0.012)
Observations	10,285	10,285	10,285	10,285	10,285	10,285

The table shows the 2SLS-regression results for the anthropometric outcomes of mothers. Municipality clustered standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$. Other controls: region fixed effect.

Table 2.9 - The Effect of Treatment on the Anthropometric Outcomes of Mother/Child Pairs – 2SLS

	Treated	BMI-Mother <18.5, Under-weight child	Normal Pair	Over-weight Pair	BMI-Mother >25, Under-weight child (dual burden)	BMI-Mother >18.5, Under-weight child (single burden)
Bank	**0.685**					
	0.038					
Treated	-0.040	0.008	0.070**	0.001	-0.018*	-0.042**
	0.031	(0.007)	(0.031)	(0.003)	(0.010)	(0.020)
Rain-shock	-0.216	0.014***	0.005	-0.002	0.001	0.014
	0.109	(0.004)	(0.015)	(0.001)	(0.005)	(0.010)
Meat/Protein	-0.050	0.043**	0.045	-0.011	-0.020	0.044
	0.084	(0.019)	(0.063)	(0.010)	(0.027)	(0.045)
Milk/Dairy	-0.244	0.022	0.130**	0.004	-0.020	0.012
	0.101	(0.015)	(0.051)	(0.009)	(0.020)	(0.036)
Corn/Flour	-0.183	0.017	0.035	-0.008	0.000	0.079**
	0.071	(0.011)	(0.042)	(0.007)	(0.019)	(0.032)
Vegetables	-0.366	0.039**	0.055	-0.009	-0.020	0.046
	0.119	(0.019)	(0.050)	(0.008)	(0.015)	(0.032)
Fats	0.294	0.006	0.163*	-0.004	-0.044	-0.024
	0.184	(0.016)	(0.086)	(0.010)	(0.028)	(0.043)
Other-foods	0.000	-0.028	-0.084	-0.011	0.013	0.101
	0.000	(0.031)	(0.135)	(0.024)	(0.053)	(0.105)
Total HH expenditures	-0.045	-0.000	-0.000	-0.000	-0.000	-0.000*
	0.017	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Diarrhea	-0.037	0.006	0.005	0.003	0.013*	0.030**
	0.016	(0.005)	(0.017)	(0.003)	(0.007)	(0.012)
Flu	-0.015	-0.003	-0.001	-0.003	-0.002	0.003
	0.021	(0.003)	(0.011)	(0.002)	(0.005)	(0.008)
Sickness	0.026	0.007	-0.033	0.006*	0.005	0.012
	0.036	(0.005)	(0.020)	(0.003)	(0.008)	(0.011)
Electricity	-0.123	-0.005	0.016	-0.004*	-0.004	0.007
	0.078	(0.007)	(0.020)	(0.003)	(0.008)	(0.013)
Gas	0.071	-0.012**	0.058*	0.007	-0.003	-0.015
	0.031	(0.006)	(0.033)	(0.007)	(0.012)	(0.021)
Water pipe	-0.037	0.005	0.020	0.003	0.007	0.016
	0.047	(0.004)	(0.020)	(0.002)	(0.008)	(0.013)
Sewer	-0.091	-0.000	0.013	-0.000	0.005	-0.028*
	0.037	(0.006)	(0.027)	(0.005)	(0.010)	(0.017)
Trash collection	0.011	-0.010	-0.040*	0.003	0.003	-0.026
	0.044	(0.007)	(0.023)	(0.004)	(0.009)	(0.016)
Mother-High Education	-0.069	-0.012***	0.033	0.002	-0.024**	-0.036*
	0.039	(0.003)	(0.040)	(0.006)	(0.010)	(0.020)
Father-High Education	-0.033	0.000	0.033	0.008	-0.018	-0.031
	0.035	(0.006)	(0.037)	(0.010)	(0.013)	(0.023)
Mother-Wage Laborer	0.022	-0.007	-0.031	0.004	-0.015*	-0.010
	0.021	(0.006)	(0.025)	(0.005)	(0.009)	(0.018)

Father-Wage Laborer	-0.011	-0.000	0.034*	-0.002	-0.006	-0.015
	0.045	(0.004)	(0.018)	(0.002)	(0.007)	(0.012)
Cabecera	0.081	0.004	0.017	-0.001	-0.012	0.006
	0.045	(0.008)	(0.036)	(0.004)	(0.013)	(0.020)
Centro Poblado	0.016	-0.006	0.041	-0.004	-0.011	-0.010
	0.011	(0.007)	(0.036)	(0.004)	(0.014)	(0.019)
Male	0.001	-0.003	-0.008	-0.001	0.008	0.017**
	0.005	(0.003)	(0.012)	(0.002)	(0.005)	(0.008)
Minors	-0.003	0.002*	-0.009*	-0.001*	0.007***	0.021***
	0.008	(0.001)	(0.005)	(0.001)	(0.002)	(0.003)
Adults	0.033	-0.003*	-0.008	-0.001	0.004	-0.005
	0.020	(0.002)	(0.011)	(0.001)	(0.004)	(0.006)
Married	0.685	-0.009	-0.012	0.002	0.011	-0.006
	0.038	(0.008)	(0.019)	(0.002)	(0.007)	(0.013)
Observations	10,285	10,285	10,285	10,285	10,285	10,285

The table shows the 2SLS-regression results for the anthropometric outcomes of mothers and mothers and children. Municipality clustered standard errors in parentheses. HH = household.
*** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$. Other controls: region fixed effect.

Table 2.10 - Testing the Validity of the Instrument: The Presence of a Bank and the Rural Sex Ratio

First stage coefficient estimates: ***Bank:*** β = 0.66 (p-val 0.000), ***Rural sex ratio:*** β = -1.41 (p-val 0.020)

	Underidentification test - Kleibergen-Paap rk LM statistic	p-val	Weak identification test - Kleibergen-Paap rk Wald F statistic	Overidentification test of all instruments - Sargan statistic	$\chi^2(1)$ p-val	Endogeneity test of endogenous regressors	$\chi^2(1)$ p-val
Income	37.834	0.000	151.829	0.020	0.888	0.365	0.546
Expenditures	37.834	0.000	151.829	0.035	0.852	5.834	0.016
Food - Budget Shares							
Meat/Protein	37.834	0.000	151.829	4.448	0.035	6.865	0.009
Milk/Dairy	37.834	0.000	151.829	0.256	0.613	0.088	0.767
Corn/Flour	37.834	0.000	151.829	3.106	0.078	6.752	0.009
Vegetables	37.834	0.000	151.829	0.013	0.909	8.871	0.003
Fats	37.834	0.000	151.829	0.387	0.534	1.194	0.275
Other-foods	37.834	0.000	151.829	0.808	0.369	7.245	0.007
Food - Expenditures							
Meat/Protein	37.834	0.000	151.829	0.002	0.964	6.003	0.014
Dairy	37.834	0.000	151.829	0.467	0.494	0.745	0.388
Corn/Flour	37.834	0.000	151.829	0.383	0.536	8.725	0.003
Vegetables	37.834	0.000	151.829	0.364	0.547	2.473	0.116
Fats	37.834	0.000	151.829	0.237	0.627	3.498	0.061
Other-foods	37.834	0.000	151.829	0.016	0.900	1.138	0.286
Goods - Budget Shares							
Household-good	37.834	0.000	151.829	0.890	0.346	2.444	0.118
Goods - Expenditures							
Household-good	37.834	0.000	151.829	0.752	0.386	0.027	0.869

Appendix 2.1

Table R 2.3.C - The Effect of the Treatment on Total Expenditures: 2SLS (Bootstrapped-SEs)

	1st Stage	2nd Stage
Banks	0.682	168,118.092**
	0.041	(84,176.161)
Treated		-20,385.467
		(38,697.981)
Rain-shock	-0.034	-97,179.319**
	0.033	(46,819.601)
Electricity	0.045	36,532.381
	0.039	(94,297.282)
Gas	-0.100	-19,832.202
	0.083	(39,952.431)
Water pipe	0.076	99,441.886**
	0.033	(46,544.952)
Sewer	-0.044	43,786.518
	0.047	(47,060.557)
Trash collection	-0.093	91,947.279**
	0.039	(43,192.509)
Mother-High Education	0.013	33,729.824
	0.045	(46,516.033)
Father-High Education	-0.064	-48,867.684
	0.039	(32,484.362)
Mother-Wage Laborer	-0.028	-68,609.188**
	0.036	(32,984.886)
Father-Wage Laborer	0.029	71,619.502
	0.023	(45,493.876)
Cabecera	-0.015	89,996.675*
	0.048	(49,167.525)
Centro Poblado	0.075	-13,832.350
	0.048	(14,986.610)
Male	0.015	20,279.275***
	0.011	(7,213.978)
Minors	-0.003	21,437.209
	0.005	(16,652.898)
Adults	-0.001	-22,306.658
	0.008	(28,764.637)
Married	0.042	168,118.092**
	0.021	(84,176.161)
Observations		10,285

The table shows the IV regression results for the effect of the treatment on total household expenditures. Other controls: regional fixed effect. Municipality clustered bootstrapped std errors in par. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

Table R 2.4.C - Testing the Validity of the Instrument: Bank

	Underidentification test: Kleibergen-Paap rk LM statistic	p-val	Weak identification test: Kleibergen-Paap rk Wald F statistic	Endogeneity test of endogenous regressors	$\chi^2(1)$ p-val
Income (not reported)	39.562	0.000	280.706	0.583	0.445
Expenditures (Table 2.3 B)	39.562	0.000	280.706	5.219	0.022
Food - Budget Shares (Table 2.7 A)					
Meat/Protein	39.562	0.000	280.706	8.723	0.003
Milk/Dairy	39.562	0.000	280.706	0.071	0.790
Corn/Flour	39.562	0.000	280.706	6.433	0.011
Vegetables	39.562	0.000	280.706	9.051	0.003
Fats	39.562	0.000	280.706	1.755	0.185
Other-foods	39.562	0.000	280.706	6.287	0.012
Food – Expenditures (Table 2.7 B)					
Meat/Protein	39.562	0.000	280.706	0.780	0.377
Milk/Dairy	39.562	0.000	280.706	6.373	0.012
Corn/Flour	39.562	0.000	280.706	2.169	0.141
Vegetables	39.562	0.000	280.706	3.136	0.077
Fats	39.562	0.000	280.706	0.880	0.348
Other-foods	39.562	0.000	280.706	1.908	0.167
Goods - Budget Shares (Table 2.7 A)					
Household-good	39.562	0.000	280.706	6.410	0.011
Adult-woman	NA	NA	NA	0.000	0.982
Adult-man	NA	NA	NA	0.500	0.479
Children	NA	NA	NA	0.940	0.331
Goods - Budget Expenditures (Table 2.7 B)					
Household-good	39.562	0.000	280.706	0.024	0.876
Adult-woman	NA	NA	NA	0.000	0.978
Adult-man	NA	NA	NA	0.340	0.559
Children	NA	NA	NA	0.170	0.682
Mother Anthropometrics (Table 2.5)					
BMI	41.071	0.000	311.048	0.591	0.442
Under-weight	41.071	0.000	311.048	0.433	0.510
Normal-weight	41.071	0.000	311.048	0.337	0.561
Over-weight	41.071	0.000	311.048	0.393	0.531
Obese	41.071	0.000	311.048	0.250	0.617
Obese or overweight	41.071	0.000	311.048	0.675	0.411
Child Anthropometrics (Table 2.4)					
Height-for-age	41.226	0.000	317.346	2.693	0.101
Weight-for-age	41.279	0.000	317.362	2.056	0.152

Under-weight	41.324	0.000	318.078	1.186	0.276
Normal-weight	41.324	0.000	318.078	2.017	0.156
Over-weight	41.324	0.000	318.078	1.572	0.210
Diarrhea	41.203	0.000	313.254	6.314	0.012
Flu	41.203	0.000	313.254	1.353	0.245
Mother/Child Anthropometrics (Table 2.7)					
Under-weight	41.210	0.000	316.884	2.293	0.130
Normal-weight	41.210	0.000	316.884	1.676	0.195
Over-weight	41.210	0.000	316.884	0.002	0.964
Dual-burden	41.210	0.000	316.884	1.930	0.165
Single-burden	41.210	0.000	316.884	2.739	0.098

Appendix 2.2: Sample Selection & Construction of Main Variables

In 2002 (2003), the evaluation survey for the Familias en Acción Program collected the anthropometric information for all the children living in the household who were less than 7 (8) years of age at the time of the survey. There were 10,734 (10,873) such children interviewed in 2002 (2003). The following table summarizes the availability of the key anthropometric information for these children:

	2002 (N = 10,734)		**2003 (N = 10,873)**		**Both (N=9,615)**
		weight & height		weight & height	weight & height
Weight of the child	10,024	9,006	9,865	8,741	8,260
Height of the child	10,026		9,876		(children)
Weight of the mother	9,265		8,245		6,317
Height of the mother	9,279		8,263		(children & mothers)

Imputation

We imputed the anthropometric information of the mothers of children interviewed in both rounds by using 2002 measures to replace the missing 2003 measures and vice versa. This exercise gave us 14,446 child level observations (in both 2002 and 2003) with anthropometric information for both mother and child.

Calculation

The z-scores were computed using age and gender specific anthropometric measures using WHO's child growth standards. For children up to 5 years of age, we used the freely

available software "WHO Anthro for personal computers".[1] For children older than 5 years of age, we used the STATA macro for computing z-scores based on WHO Child Growth Standards. This macro is freely available from WHO.[2]

Consumption variables and Prices

Food consumption

The evaluation survey collected information on households' food consumption (7-day recall) for 94 different food items.[3] Respondents specified i) whether they have consumed the specific item in the last 7 days and if so, whether the item was (1) purchased or (2) obtained otherwise. In both cases, they also report i) the amount consumed, ii) the unit of measure, and when the item was purchased, iii) the amount paid. The survey also collected the municipality level market price per standard unit for each of the food items.

To construct the consumption expenditure measures we took the following steps:

1. (i.) The amount consumed, (ii.) the unit of measure, and (iii.) the amount paid were set to zero if missing or if negative, and were counted as zeros if no information was available. If some information was available and was valid, we replaced the missing values with the sample average.
2. Whenever the units of measure reported by the municipality for the "market price" and the "food obtained" were the same, the "market price" was used to price the food "obtained otherwise". If the units of measure differed, the "market price" was converted

[1] For more information, refer to: http://www.who.int/childgrowth/software/en/.
[2] For more information, refer to: http://www.who.int/childgrowth/software/readme_stata.pdf.
[3] These include: beef with bone, minced beef, pork no bone, pork with bone, goat sheep meat, other poultry, canned meat, cold cut, other parts meat, fish, sea food, tuna, sardine, milk, powder milk, cheese, dairy, orange, lemon, mandarin, banana, melon, mango, guava, blackberry, passion fruit, pineapple, coconut, other fruit, green bean, carrot, lima beans, tomato, green onion, onion, cob, peas, lettuce, bean-2, spinach, chard, cabbage, garlic, pepper, other vegetables, chickpeas, dried peas, dried beans, lentils, other grains, platano, harton, platano other, potato, potato creole, arracacia, yam; yucca; other vegetable-2, condiments, tomato sauce; soup concentrate; coffee, chocolate; aromatic herbs salt, sugar, cinnamon; vegetable oil; vegetable butter; butter; margarine; lard; soda, packed juice, powder juice, bottled water, other food.

into price per pound using standard conversions (e.g. 1 kilo = 2.2 pounds) and the "amount consumed" of the "food obtained" was converted to pounds. A few of the obtained purchases were reported in unusual units (e.g. "bundle", "package"). In such cases, the mean price and quantity were used to generate the total price paid. This procedure was used until all the valid "amount consumed" entries corresponding to the "obtained otherwise" food were assigned a reasonable value.

3. A "value" variable was generated by adding up values of the "purchased" and "obtained otherwise" foods.
4. After computing the value for each of the 94 food items, these were divided into six food expenditure groups (see the list below), and their respective budget shares were computed using total expenditures.

Group List	Total	Budget Share	Items Included
Meat/Protein	35,050	0.12	cow bone, chicken giblets, chicken, beef with bone, minced beef, pork no bone, pork with bone, goat sheep meat, other poultry, canned meat, cold cut, other parts meat, fish, sea, food, tuna, sardine.
Milk/Dairy	75,569	0.13	milk, powder milk, cheese, dairy
Corn/Flour	135,757	0.21	rice, bread, cookies, other bread, pasta, pearl barley, traditional barley, traditional corn, traditional wheat, corn flour, pre-cooked wheat flour, corn, wheat flour, cereals for children.
Vegetables	42,805	0.18	orange, lemon, mandarin, banana, melon, mango, guava, blackberry, passion fruit, pineapple, coconut, other fruit, green bean, carrot, lima beans, tomato, green onion, onion, cob, peas, lettuce, bean-2, spinach, chard, cabbage, garlic, pepper, other vegetables, chickpeas, dried peas, dried beans, lentils, other grains, platano, harton, platano other, potato, potato creole, arracacia, yam, yucca, other vegetable-2.
Fats	21,345	0.08	vegetable oil, vegetable butter, butter, margarine, lard.
Other-foods	10,675	0.05	condiments, tomato sauce, soup concentrate, coffee, chocolate, aromatic herbs salt, sugar, cinnamon, soda, packed juice, powder juice, bottled water, other food.

The same procedure described in steps 1-4 was followed for both the 2002 and the 2003 rounds. In 2003, however, some of the market prices were missing for 41 of the 94 items. To generate

market prices for these items, we used the market prices reported in 2002 adjusted for the 11-month inflation. The yearly inflation (excluding December) was 3.4 percent.[4]

Other consumption items

The computation of the non-food consumption was straightforward, as only total expenditures were reported in the survey.

Periodicity

Whenever the (food or non-food) items were not reported in terms of monthly expenditures, the expenditures for such items were converted to monthly expenditures. For example, 3-month expenditures were divided by 3; weekly expenditures were multiplied by 4.

Restricted sample

We restrict the sample to include children that belong to either the "treated with payment" group or the "control" group. In other words, the children that belonged to the treatment without payment in the first round are excluded from the sample (approx. 2,137 children). Similarly, children living in families with only one adult are also excluded from the sample (approx. 1,348 children). Related to this, we note that not all of the 7,723 observations having anthropometric outcomes for mothers and children are "complete", in the sense that only part of this sample is successfully merged to both mothers' and fathers' (or adult male) information.

Finally, children with missing or invalid consumption information are also excluded from the sample (approx. 1,794 children).

The final sample consists of 10,285 child level observations, of which 40.72 percent are from 2002.

[4] From January to December: J: 1.23; F: 0.65; M: 0.95; A: 2.14; M: 0.61; J: -1.06; J: -0.78; A: 0.00; S: -0.19; O: -0.14; N: 0.57; D: 1.25 = 3.41. Source: http://www.businesscol.com/economia/precios2.htm .

Chapter 3

Conflict, Access to Services and Wellbeing: The Afghan Experience

Abstract

The World Development Report (WDR 2011) reports that there are more than 1.5 billion people living in conflict countries. This chapter examines the existing links between wellbeing and both security and conflict in the context of Afghanistan. The analysis presented in this chapter combines data from the National Risk and Vulnerability Assessment (NRVA) 2007/08 household level survey, the first nationally representative dataset available in Afghanistan, with confidential geo-coded data on violent incidents from the United Nations Department of Safety and Security. The empirical evidence uncovers an important two-directional causal pathway between conflict and access to basic services. This two-directional pathway, in which conflict (or the ensuing destruction) fuels more conflict and woe, is found to represent a significant barrier to donor assistance delivery. The results from this chapter highlight the importance of helping conflict affected countries like Afghanistan develop their basic infrastructure while making its access more widespread. Such efforts are well known to have positive effects on wellbeing, but in conflict affected countries they are also likely to have positive spillovers on conflict prevention.

3.1 Introduction

The World Development Report (WDR 2011) reports that there are more than 1.5 billion people living in conflict countries. The conflict has far reaching consequences, as it affects individuals both directly – by disrupting their everyday activities, sources of livelihood, health and education, and indirectly, through the loss of physical capital and capacity of health and education systems to meet the needs of the population.[5] When high levels of conflict are frequent or become the norm, the effect of conflict is likely to have severe lifelong impacts on wellbeing[6] and to be particularly deleterious to the more vulnerable.[7] Finally, the conflict itself may lead – via destruction of capital and infrastructure - to future conflict and proliferation of conflict related activities.

In this study, we aim to examine how wellbeing links to both security and conflict in the context of Afghanistan. Our goal is to inform policy makers on the dimensions in which insecurity at the local level affects household wellbeing and the ability of households to access community services. First, using a multivariate regression approach, we examine the relationships between security and children's educational and health outcomes, as measured by literacy and school enrollment rates, immunization rates and the probability of receiving micronutrients supplementation. Next, we use both multivariate and instrumental variable

[5] Studies that find that conflict has significant long-term negative effect on educational outcomes include Rodríguez and Sánchez (2012), Justino et al. (2011), Shemyakina (2011), Akbulut-Yuksel (2009), Akresh and de Walque (2008), Dueñas and Sánchez (2007), Barrera and Ibañez (2004), and Ichino and Winter-Ebmer (2004), among others. All these studies are based on micro-level data. Similarly, studies that find that conflict has a significant effect on health include Akresh at al. (2012), Akresh et al. (2011), Akbulut-Yuksel (2009), Bundervoet et al. (2009), Guerrero-Serdán (2009), and Alderman et al. (2006), among others. Ibáñez and Moya (2009), Verwimp and Bundervoet (2008), and Justino and Verwimp (2006) provide further empirical evidence on the welfare of populations in conflict-affect areas in general.

[6] UNESCO (2011a) reports that conflict has had a significant negative impact on the national education systems of 25 conflict affected countries, resulting in significant declines in the proportion of the population with formal education, the average years of education attained, and the literacy rate.

[7] DFID (2009) estimates that the conflict-affected countries are home to about half of the children who die before they reach their fifth birthday and half of the children who are not in primary school.

frameworks to analyze the relationship between access to services and conflict. The aim of the latter analysis is to disentangle the link between regional conflict and community level access to basic services such as electricity, safe water, improved sanitation and basic health facilities. Our analysis makes use of a unique set of data that combines information from the National Risk and Vulnerability Assessment (NRVA) 2007/08 household level survey, the first nationally representative dataset available in Afghanistan with confidential geo-coded data on violent incidents from the United Nations Department of Safety and Security.

Overall, we find security and conflict to be important predictors of wellbeing. The results from the individual level empirical analysis reveal that higher levels of security are associated both with better educational outcomes and better health outcomes of children. In particular, we find that higher levels of security could help eliminate a significant part of the gap in educational outcomes that currently exists between boys and girls and across regions. With regard to health outcomes for children five years old and younger, our results show that independently of gender, higher levels of security are linked to higher levels of both immunization rates and access to micronutrients. The community level results suggest a more intricate relationship between conflict and access to basics services. In particular, higher levels of lagged conflict have a negative impact on access to electricity, sanitation, and health infrastructure. Similarly, current levels of access to services, particularly access to electricity, have a negative impact on conflict and a positive impact on security.

The empirical evidence presented in this chapter uncovers an important two-directional causal pathway between conflict and access to basic services. This two-directional pathway, in which conflict (or the ensuing destruction) fuels more conflict and woe, represents a significant barrier for donor assistance delivery. The results highlight the importance of helping conflict

affected countries like Afghanistan develop their basic infrastructure and make the access to such infrastructure more widespread. Such efforts are well known to have positive effects on wellbeing yet in conflict affected countries they are likely to also have positive spillovers on conflict prevention.

This chapter is organized as follows. In Section 3.2, we provide a general background to recent developments in Afghanistan and the challenges the country continues to face. We also discuss the issue of identification of the causal effect of conflict on wellbeing. In Section 3.3, we describe the data and the construction of the measures of access to services, conflict, and security. In Section 3.4, we describe the empirical framework. The empirical results are presented in Section 3.5. Section 3.6 concludes the chapter by summarizing the main findings.

3.2 The Context

Afghanistan has been undergoing large social and economic changes during an extended period of conflict and insecurity. The Afghan economy has grown strongly since 2002, with an average annual growth rate of more than 10 percent. Policy actions of the government of Islamic Republic of Afghanistan (GoIRA) have focused on the rebuilding of the infrastructure lost to war and conflict with an emphasis on basic schooling and institutions of higher education. Concurrent to this, there have been large inflows of donor funds. Since 2002, donors have contributed US$3 billion to USAID's Afghanistan Reconstruction Trust Fund (ARTF) which supports more than a fourth of GoIRA's development expenditure. USAID, which provides the largest bilateral civilian assistance to Afghanistan, has disbursed a total of 7.9 billion dollars since 2002; of this, USAID allocated $343 million to education, $422 million to health, $1,438 million to roads, $626 million to power, and $53 million in electricity.[8]

[8] USAID estimates can be found at http://afghanistan.usaid.gov/en/about/frequently_asked_questions, EU estimates at EUCS (2006), and the JICA estimates at MFA (2007).

Without a doubt, the large flow of resources directed to the reconstruction of the country helped Afghans experience improvements in their education and health outcomes following the fall of the Taliban in 2001. According to the WDI (2011) figures, in 2001 there were 773,623 students enrolled in primary school of which 70 percent were boys. In 2010, the number of enrolled children increased almost sevenfold to 5,279,326, of which 60 percent were boys. The same source reports similarly significant improvements in certain health outcomes, such as children immunization rates, which doubled for DPT and increased by more than 67 percent for measles (Figure 3.1).

Despite these successes, widespread poverty and non-decreasing levels of conflict continue to characterize the life of an ordinary Afghan. The North Atlantic Treaty Organization figures indicate that between 2007 and 2008 violence in Afghanistan increased by more than 30 percent.[9] Similarly, the number of security incidents as recorded by United Nations Department of Safety and Security increased from less than 200 per month in 2005, to more than 500 per month in 2007, to 900 per month during the first seven months of 2009.[10]

That is, while the signs of improvement must be underscored, the reality is that a combination of decades of conflict and discriminatory policies enacted by the Taliban regime (UNESCO 2011a) has had severe negative implications for the educational and health outcomes of all Afghans. Moreover, it must be emphasized that because the baseline levels[11] of enrollment, literacy, and immunizations were dismally low, the dramatic improvements observed may lead observers to overstate the *real* improvements and understate the potential challenges ahead.

One such challenge is the obliteration of infrastructure resulting from the past and ongoing

[9] See Burke (2009).
[10] See UN (2007) and HSRG (2010) for 2009 estimate.
[11] Here 2001 is taken as the baseline year.

conflict. Self-assessment evidence from the NRVA 2007/08 survey suggests that the lack of infrastructure is viewed as a central challenge to better outcomes. For instance, when families were asked to name the top reasons for not sending the children to school, the most frequent answer among the respondents (53 percent of 11,344 households) was that there was no school available in their community or that the school was too far. Dividing responses into 4 groups according to the district security levels,[12] there is a clear negative correlation between the district security level and the probability of citing the lack of educational infrastructure as the top reason for forgoing education: 72 percent of the respondents in low security districts (group 1) cited lack of infrastructure as the top reason behind their decision versus only 50 percent of the respondents in high security districts (group 4). Security concerns were also a top cited reason for forgoing children's education (13 percent at the national level, 32 percent among families living in high conflict areas). Similarly, when asked about reasons for not seeking medical care, 49 percent of the respondents said either that the health center was too far or that the care was of bad quality.

As the observed improvements took place parallel to both large inflows of donor funds and serious and ongoing security and conflict events, the appropriate inquiry to be made is: How much better would Afghans be in the absence of conflict? Answering this question, which rests on identifying the causal effect of conflict on wellbeing, is complicated for at least two reasons.

On the one hand, it is well known that conflict is likely to have both direct and indirect effects on individuals' wellbeing. The direct effect may be in the form of higher exposure to different forms of violence, such as displacement, forced recruitment, homicides and

[12] Household are placed in one of four bins according to the security level of their district, the four bins are simple equidistant cutoffs points corresponding to different security levels: less than or equal to 25, more than 25 (50) and less than or equal to 50 (75), and more than 75. Security is measured using the civil servant access score, constructed by United Nations Assistance Mission in Afghanistan (UNAMA). For more details on this measure, please see Section III.3.2.

kidnappings (UNAMI 2005), all of which are likely to prevent individual from performing their ordinary everyday activities. The indirect effect acts through the loss of both physical capital (UNESCO 2011b) and capacity of health and education systems to serve and respond to the needs of the population.[13] Similarly, the indirect effect also materializes via the deterioration of drinking water and sewage systems, unstable electricity supply, and/or lack of adequate food (UNAMI 2005).

Similarly, the literature shows that when high levels of conflict are frequent or become the norm, conflict is likely to have severe lifelong impacts on wellbeing and be particularly deleterious to children. For example, Rodríguez and Sánchez (2012) find that among Colombian children between the ages 6 and 17, conflict induces children older than 11 to drop out of school and enter the labor market too early. Similarly, studying the long-term effects of Allied bombing in Germany during the Second World War on the education, health and labor outcomes of individuals who were at school-age during the war, Akbulut-Yuksel (2009) finds that these individuals had on average fewer years of schooling in adulthood.[14]

On the other hand, there are several confounders which are likely to bias the effect of conflict on wellbeing when using contemporaneous measures of conflict. In particular, conflict itself may be the result of other detrimental factors, such as poverty, lack of access to services and infrastructure. For example, the destruction of infrastructure and capital resulting from years of war may lead to future conflict and the proliferation of conflict related activities. Supporting this hypothesis, Lind et al. (2009) find that the destruction of infrastructure brought about by conflict distorts farmers' incentives by making the cultivation and production of opium more

[13] In Afghanistan, the lack of access to services – a direct result of the decades of conflict and instability – has been the major factor behind the country's high maternal mortality, the second highest in the world (UNICEF 2008).

[14] See also Ichino and Winter-Ebner (2004) who show that Austrian and German children who were ten years old during the Second World War lost on average around 20 percent of a year of schooling.

profitable relative to other crops. In this case, referred to by Pugh et al. (2004) as "The Coping Economy", the destruction resulting from violent conflict fuels the cultivation of high-yield illicit crops (*war → destruction → conflict and illicit activities*). More importantly, however, under this scenario the effect of conflict is likely to be overestimated.

Alternatively, the negative relationship between conflict and wellbeing may be attenuated by the attendant high-reward economic opportunities.[15] An example scenario is given by what Pugh et al. (2004) refer to as "The Shadow Economy". In such economic arrangements, drug lords and drug cartels promote violent uprisings as a way to protect their activities and wealth (*high-reward illicit activities → conflict → wellbeing & infrastructure but also high rewards → wellbeing & infrastructure)*. Under this scenario, the effect of conflict is underestimated.

Furthermore, in the absence of alternative sources of sustainable income, farmers in "The Coping Economy" would choose to carry on the cultivations of opium leading perhaps to the rise of the "Shadow Economy". Once again, higher yields resulting from the sustainment of illicit activities allow farmers to avert poverty and to have more resources to allocate among the members of their family where the latter is, of course, likely to translate into better outcomes (*high-rewards → wellbeing*).[16] Here, the effect of conflict is underestimated.

Finally, a third scenario is given by the fact that insurgent groups often resort to high-rewards illicit activities, such as drug production, to finance their belligerent activities (Collier et al. 2003, Rubin 2000). This later scenario, in which the illicit activity is initiated as a way to finance violence (*insurgency → high reward illicit activities → wellbeing and infrastructure* as well as

[15] In support to this hypothesis, the latest poverty Assessment for Afghanistan finds that poverty is relatively lower in the Sothern part of Afghanistan (World Bank 2010), a region that is also known to host high levels of income, opium cultivation (UNODC 2007) as well as conflict (see figure 3.2).

[16] This scenario suggests that, in the absence of alternative sources of sustainable income, farmers would choose to carry on the cultivations of opium[16] and this is likely to lead to rise of the "shadow economy" (see next paragraph for an example of the "shadow economy").

high reward illicit activities → conflict), is described as "The Combat Economy" by Pugh et al. (2004). Under this scenario, the direction of the bias is unclear.

Hence, irrespectively of whether conflict was originally a cause or an effect of another unfavorable event, a common feature of the above described scenarios is a hypothesized tendency of conflict to generate a self-propelling vicious cycle. Consequently, using the first nationally representative household survey available in Afghanistan, this chapter aims both to understand the link between conflict and wellbeing as well as to test this hypothesis empirically.

3.3 The Data

3.3.1 Main Data Sources

The empirical analysis presented in this chapter combines the National Risk and Vulnerability Assessment (NRVA) 2007/08 household and individual level data with confidential geo-coded data on violent incidents from the United Nations Department of Safety and Security. The effective sample size for the household (primary sampling unit) level analysis is 20,543 households (2,568 PSUs) from 394 districts and 34 provinces. The effective sample size for the individual level analysis varies depending on the outcome under study (sample sizes are indicated at the end of the corresponding tables). In addition, our analysis makes use of two data sources on security in Afghanistan: (1) the security incidence database maintained by Security Information and Operation Centre (SIOC) of UNDSS and (2) the Civil Servants Accessibility at district level maintained by UNAMA (Figure 3.2).

The UNSIOC dataset is comprised of confidential data on multiple measures of security incidents at the district level for each month during the survey years. The unique feature of the NRVA data is its complete coverage—the data were collected from all provinces of Afghanistan, including areas where conflict incidents were frequently experienced. Thus, the merge of the

NRVA 2007/08 with the security data is well suited for gaining a better understanding of how conflict affects the national and sub-national level outcomes of the Afghan population.

3.3.2 Measure of Security and Conflict

Two indicators of security are used in the current analysis: the average civil servants accessibility score at the district level (henceforth refer to as average CSAS) and the grand total number of individuals killed per thousand people at the district level (henceforth refer to as killings or lagged killings, depending on whether they occurred before or after the period covered by the NRVA survey). The CSAS indicator constructed by the UNAMA provides an assessment of the outreach capacity of Afghan civilian government servants. This assessment can be used to evaluate impact of security conditions on development and governance outreach. In particular, in order to study and monitor violent conflict and insurgency, UNAMA assesses areas where the government can operate independently from military assistance by expressing the areas that can be accessed by government civil servants as a percentage of each administrative unit (district). The range of this assessment variable is between 1 and 100. The average CSAS is the average of three CSAS measurements corresponding to 2007 (for the month of June, September and December) and two CSAS measurements corresponding to 2008 (for the months of June and September). There are two different measures of killings: "lagged" killings and "current" killings. Lagged killings are those that took place between January 2006 and August 2007, whereas the current killings are those that took place between August 2007 and August 2008.

3.3.3 Measure of Access to Services

The analysis of the relationship between access to basic services and conflict exploits the tremendous amount of variation in access to services that exists across provinces (see Figure

3.3). Access to electricity refers to the percentage of households that have access to electricity at any time either from the government, community or private sources (e.g. electric grid, government generator, personal generator, community generator, solar, wind, or battery). Access to safe drinking water refers to the percentage of households whose main source of drinking water is one of the following: hand pump (in-compound, public); bored well (hand pump or motorized); protected spring; pipe scheme (gravity or motorized); and piped water provided by the municipality. Access to sanitary toilet refers to the percentage of households that use an improved sanitation facility – a flush latrine or any other improved latrine.

3.3.4 Controls

Variables included as controls in the analysis of educational outcomes include: indicators for the gender of the child, the child's age and age squared, district level infrastructure (whether there is a girls only, boys only and/or coed primary/middle/high school in community, and a continuous control for the distance to the closest girl school that is in a separate building), household level characteristics (whether the household head is literate, and whether the child belongs to a Kuchi family, household size, dependency ratio, the per-capita price adjusted monthly total consumption, household's head years of schooling, and the age of the household head), province level indicators (the province level literacy rate of the female and male youth – 20 to 40 year old individuals). All the regressions control for measures of cultural diversity using two variables, one that indicates whether the women always wear the burka outside compound and one for the number of days women spend outside of the compound. The regressions also include seven regional (South, East, Northeast, North, West, Southwest, West Central) and three seasonal indicators (second to fourth quarters). In the analysis of health outcomes, the variables related to education infrastructure are replaced with indicators for the presence of basic public

health services (BPHS) by donor (European Union, Ministry of Public Health, World Bank, and United States Agency for International Development). Descriptive statistics are reported in Tables 3.1 and 3.2.

Variables included as controls in the analysis of access to services include: an urban indicator, an indicator of whether the road is impassable all year long, district level density, 9 indicators for the type of terrain at the district level (baseline terrain is mid-altitude plains, controlled terrain types are: high-altitude plains, platforms, low plateaus, mid-altitude plateaus, high plateaus, low mountains, mid-altitude mountains, high mountains, very high mountains, see Meybeck et al. 2001), 8 regional indicators (South, East, Northeast, North, West, Southwest, and West Central; the baseline region is Central), and 3 indicators for the relief roughness category.

3.4 Methods

3.4.1 Empirical Model: Educational and Health Outcomes

To capture the relationship between security and conflict and different dimensions of wellbeing, the analysis exploits the existing variation in conflict across regions. To control for possible confounding factors the analysis resorts to a multivariate regression approach (probit regression). The focus is on two educational outcomes: literacy and school enrollment rates; and three health related outcomes: the probability of having a fully immunized child,[17] the probability of having a child lacking all required immunization, and the probability of receiving micronutrients supplementation. The regressions corresponding to educational outcomes are run separately for two age cohorts: children 7-12 years of age and children 13-18 years of age.

The model includes a base effect of security/conflict level in the district (Con) and an interaction term that allows the relationship between security/conflict level and the outcome to vary by the gender of the child. The specification is as follows:

[17] Fully immunize refers to children who have received complete vaccines for BCG, DPT3, OPV3, and measles.

$$O_i = \beta_0 + \beta_1 Con_d + \beta_2 Con_d \times Fem_i + \alpha Fem_i + \gamma Inf_d + \delta HH_i + \zeta Reg + \eta Q + \varepsilon_i, \quad (1)$$

where *i* denotes child, and *d* denotes district. O_i is the outcome of child *i* as described in the text; *Con* is district level security or conflict, where security is measured by the civil servant access score and conflict is measured by the numbers of killings per 1K of the population; *Inf* represents a vector of district level infrastructure; *HH* represents a vector of child *i's* household characteristics; *Reg* is a vector of regional controls; *Q* is a vector of seasonal controls; and ε is a child level idiosyncratic error term. The coefficients of interest are β_1 and β_2, where the latter represents the additional security/conflict correlation (in addition to β_1) that is related to the gender of the child.

3.4.2 Empirical Model: Conflict, Security and Access to Basic Services

We also investigate potential channels (or indirect effect) of conflict on wellbeing by analyzing how significant a barrier is conflict for individuals to access infrastructure that is crucial for the production of health and human capital. In terms of basic infrastructure, the analysis focuses on the effect of past and current conflict on access to electricity, safe drinking water, and improved sanitation facilities at the province level. In terms of health infrastructure, the analysis assesses the effect of past and current conflict on district level infrastructure related to basic public health services (BPHS) by provider. In order to control for the reverse causality that may exist between access to services and conflict (please see discussion above), we make use of lagged measures of conflict (to capture the effect of conflict on access to services) and the instrumental variable approach (to capture the effect of access to services on conflict).

The model for the effect of conflict on community level access to basic services includes a base effect of conflict at the district level. The specification is as follows:

$$A_p = \beta_0 + \beta_3 Con_d + \gamma Area_d + \eta Reg + \theta Q + \varepsilon_l \quad (2)$$

where *d* denotes district, and *p* denotes province. A_p is the basic service access level measured at the province level; Con is a district level measure of conflict, *Area* is a vector of district level controls; *Reg* is a vector of regional controls; Q is a vector of seasonal controls, and ε is a l-level idiosyncratic error term. The coefficient of interest, β_3, represents the effect of conflict on community level access to services. Regressions are run at the PSU (i.e. district) level.

The model for the effect of access on conflict and security at the district level is specified as follows:

$$Con_d = \beta_0 + \beta_4 A_p + \gamma Area_d + \eta Reg + \theta Q + \varepsilon_l \quad (3)$$

where Con_d is the level of security or conflict at the district-level; β_4 is the coefficient of interest, capturing the effect of community level access to services on security or conflict; and all the other variables are as specified above. Given the previous discussion on the possibility of reverse causality between conflict and access, a causal interpretation of a linear probability model may be problematic. In order to overcome the possible endogeneity of access to services, we instrument access to services with the 2006-rainfall deviation from a 4-year province-level average (2006-09) and two rain-shock indicators (+1 and +2 standard deviations, respectively).

The justification for the validity of the instrument is based on the fact that the economic activity of Afghanistan is primarily rain-fed agriculture that neither has an extensive irrigation system nor a developed industrialized sector; as a result, weather is an important determinant of the economic performance of households and regions.[18] The two rain-shock indicators are used to capture possible nonlinearities in the relationship between rain and regional economic activity.

[18] For example, Miguel et al. (2004) use rainfall variation as an instrumental variable for economic growth to assess the impact of growth on conflict in 41 African countries that rely on rain-fed agriculture for their subsistence.

3.5 Results

3.5.1 Educational Outcomes

The multivariate probit regression results for the educational outcomes are presented in Tables 3.3 to 3.8. Perhaps not surprisingly, for both cohorts (i.e. children 7-12 and children 13-18) the results show a positive and statistically significant correlation between the average civil servant access score (CSAS) and each of the educational outcomes used in the analysis. It is important to note, however, that this gradient is steeper for girls and, for the 13-18 cohort, it is primarily driven by the outcomes of girls. Figure 3.4a plots the simulated likelihood of being literate by gender and age cohort at 9 equidistant CSAS levels. This figure highlights how the educational outcomes of all children are significantly ameliorated at higher CSAS levels. The figure also shows a significant narrowing of the educational gap between boys and girls at higher levels of CSAS.

Figure 3.4b plots the simulated likelihood of being enrolled in either primary or secondary school by gender and age cohort at 9 equidistant CSAS levels. The patterns observed for the enrollment outcome are analogous to those for the literacy outcome. In particular, the primary school enrollment rates for all children and for girls in particular increase significantly at higher CSAS levels. Similarly, higher security levels are positively correlated with the secondary school enrolment rates of girls. This is not the case for boys, whose secondary school enrolment rates remain relatively unaffected by security. Finally, the figure also shows a significant narrowing of the educational gap between boys and girls at higher levels of CSAS, this being particularly striking for the younger cohort.

The same educational outcomes are regressed on the proxy of current conflict (i.e., current killings). Not surprisingly, the results show that there is a strong and statistically

significant negative relationship between current levels of conflict and both literacy and attendance. Similarly to security (as proxied by CSAS), the relationship between current conflict and outcomes is gender dependent. In particular, while conflict negatively correlates with the educational attainment of boys and girls, the gradient of this relationship is significantly augmented by gender. Unlike current conflict, lagged conflict is positively correlated with current levels of literacy and school enrolment. This gradient, however, is very small and often not statistically significant (Tables 3.7 and 3.8).

Overall, these findings suggest that conflict is an important barrier to children's educational attainment. The observed gender gradient between conflict and educational attainment suggests that the opportunity cost of girls, for whom the risk of violence-related harm is perceived as higher (Justino 2010), may increase disproportionately with conflict, leading households to invest relatively more in the education of boys. Similarly, faced with scarcity of resources (inputs in the production of human capital) or job opportunities (return to investments in human capital), families may decide to spend their resources on the investments that are more likely to yield higher returns (Chamarbagwala and Morán, 2011; Shemyakina 2011). Finally, it is important to note that, even if our results deal only with short term outcomes, the persistency of conflict in Afghanistan implies that the negative link is likely to translate into long-lasting implications for children's welfare.

3.5.2 Health Outcomes

The multivariate probit regression results for the selected health outcomes are presented in Table 3.9. The results show a statistically significant correlation between the average civil servant access score (CSAS) and all the health outcomes of children 5 years old or younger.

Unlike the educational outcomes, however, this gradient is not gender dependent.[19] Figure 3.5 plots the predicted likelihood of full vaccination for children between 2 and 5 years of age, of no vaccination for children between 6 months and 5 years of age, and of receiving vitamin A supplementation for all children up to five years old, by gender and at 9 different CSAS levels. This figure highlights significant improvements in the health outcomes of all children if they reside in low conflict areas (i.e. those areas with higher CSAS levels). Unlike the educational outcomes, there does not appear to be a significant gender gap for any of these three outcomes.

3.5.3 The Effect of Access to Basic Services on Security and Conflict

The results from the first stage regression corresponding to the analysis of the effect of community level access to services on security and conflict are presented in Table A 3.1. Note first that although the power of the instruments is not high enough for access to improved sanitation, and the under-identification test fails to reject the null hypothesis that the model is not identified for neither safe water nor improved sanitation, the p-value corresponding to the null hypothesis that community level access to electricity is exogenous to conflict cannot be rejected.

The linear probability regression (OLS) results (Table 3.10) suggest that there is a positive and statistically significant correlation between access to basic services and CSAS, with improved sanitation having a significantly larger estimated coefficient. The correlation between conflict (current killings) and access to services is not precisely estimated under either the IV or OLS models. Relative to the OLS results, the IV results suggest that the relationships between access to services and CASS are larger in magnitude.

[19] We note that the interaction term between PIR and the female dummy is negative, yet the estimated coefficient for this interaction is very small and not highly significant.

3.5.4 The Effect of Security and Conflict on Access to Basic Services

In this section, we summarize the results from the analysis of the effect of security and conflict on community level access to services. Given the results from the previous section (Table 3.10), it is not surprising to find a positive correlation between access to basic services and security (Table 3.11, top panel). The opposite relationship is found between conflict and access to electricity, whereas the relationship between the former and access to water and sanitation is not statistically significant (Table 3.11, middle panel). In this section, however, our interest is in the possible existence of a causal link between conflict and access to services. For instance, while killings and the CASS index may be contemporaneously correlated with access to services, the assumption is that the current level of access to services at the province level has no feedback effect on lagged levels of conflict. The results for the relationship between lagged conflict and access to basic services are presented in the third panel of Table 3.11. The occurrence of lagged conflict is negatively associated with all three types of access to basic services. These results suggest that conflict results in a significant decrease in the current level of community access to basic infrastructure.

Finally, we also investigate whether security and conflict affect a community's likelihood of having a basic public health services (BPHS) facility. The results, based on the regressions run separately for each health facility provider, are presented in Table 3.12. We observe that the current security level is negatively (positively) correlated with the presence of both EU and World Bank (MoPH and USAID) ran BPHSs. While current conflict does not have a statistically significant relationship with the likelihood of having a BPHS in the community, past conflict is found to significantly affect the probability of the presence of donor- and GoIRA- run facilities; in particular, past conflict decreases the probability of the presence of donor-run facilities and it

increases the probability of the presence of GoIRA-run facilities. These estimates present an interesting pattern which suggests that government run facilities are more likely to locate or to linger in conflict prone areas, whereas the opposite is true for donors run facilities. This also suggests that conflict is a significant barrier

3.6 Discussion

We examine the relationships between security, conflict and children's educational and health outcomes using a multivariate regression approach. The results suggest that conflict and security are significant predictors of children's educational outcomes. Higher (lower) levels of security (conflict) are positively (negatively) associated with literacy rates and school enrollment for all children (ages 7-12 and 13-18). While the effect is significant for all children, there is an important interaction between the female gender and both security and conflict. In particular, girls educational attainments are found to be disproportionally better (worse) in high security (conflict) areas. The results suggest that higher levels of security could help mitigate a significant share of the gap in educational outcomes that exists between boys and girls and across regions.

The second part of the analysis focuses on individual level health outcomes. In particular, the analysis examines the relationship between security and both immunization and vitamin A supplementation[20] (i.e. outcomes that are likely to both be affected by current level of conflict and to have long-lasting implications for individual's wellbeing). Regardless of gender, the results suggest that higher levels of security are linked with higher levels of full immunization

[20] The effects of vitamin A deficiency are well known. For example, Villamor and Wafaie (2005) find that, among children, vitamin A deficiency results in increased risks of mortality and morbidity from measles and diarrheal infections, blindness, and anemia, while among women it is likely to be associated with high mortality related to pregnancy.

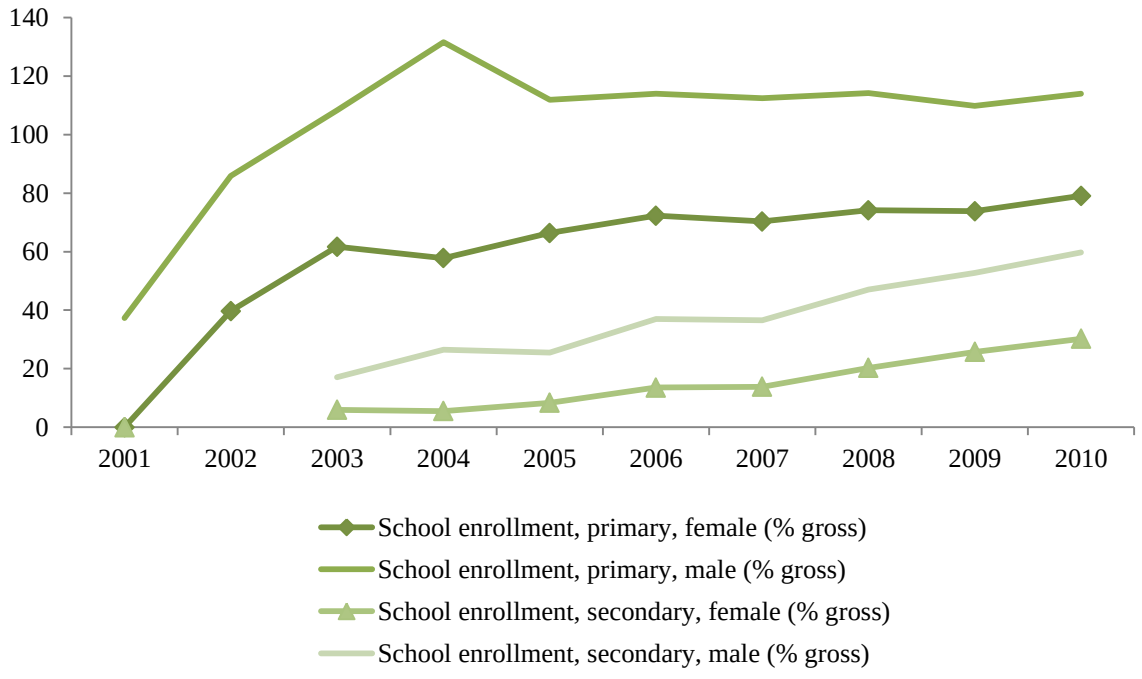
rates and lower (higher) likelihood of receiving no-immunization (micronutrients supplementation).

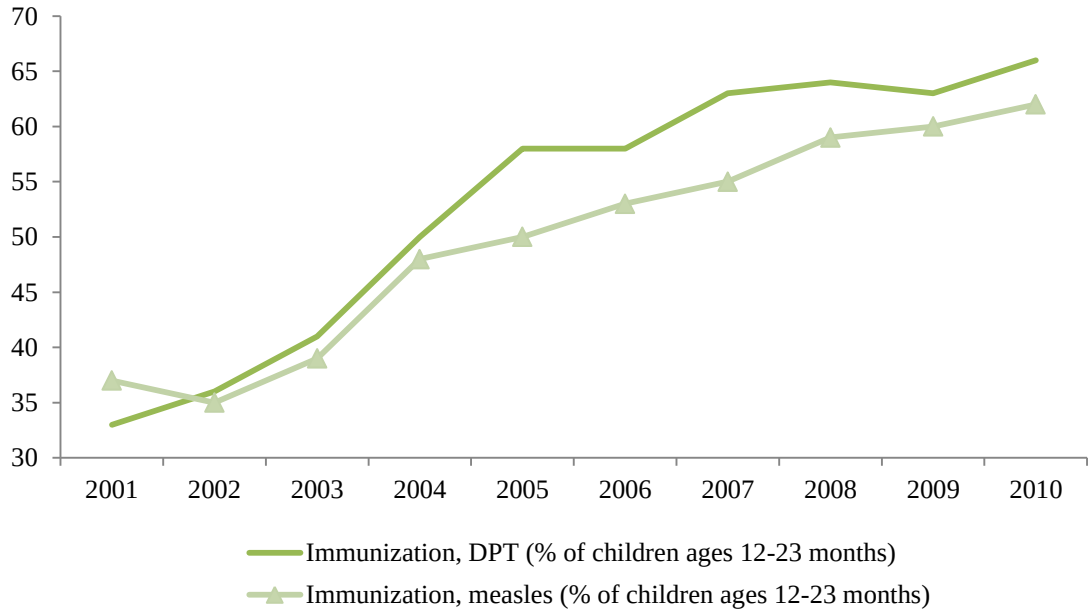
Finally, using both multivariate and instrumental variable approaches we analyze the relationships between access to services and conflict. The aim of the latter analysis is to disentangle the link between regional conflict and community level access to basic services such as electricity, safe water, improved sanitation, and the presence of basic health facilities. The community level results suggest an intricate relationship between conflict and access to basics services. In particular, higher levels of lagged conflict have a negative impact on access to electricity, improved sanitation, and health infrastructure. Similarly, current levels of access to electricity have a positive impact on security levels.

The analysis emphasizes the existing link between wellbeing and both security and conflict. The empirical evidence presented also uncovers an important two-directional causal pathway between conflict and access to basic services. This two-directional pathway, in which conflict (or the ensuing destruction) fuels more conflict and woe, represents a significant barrier for donor assistance delivery. The results highlight the importance of helping conflict affected countries like Afghanistan develop their basic infrastructure and make the access to such infrastructure more widespread. Such efforts are well known to have positive effects on wellbeing yet in conflict affected countries they are likely to also have positive spillovers on conflict prevention.

Figure 3.1

Trends in Selected Educational and Health Outcomes

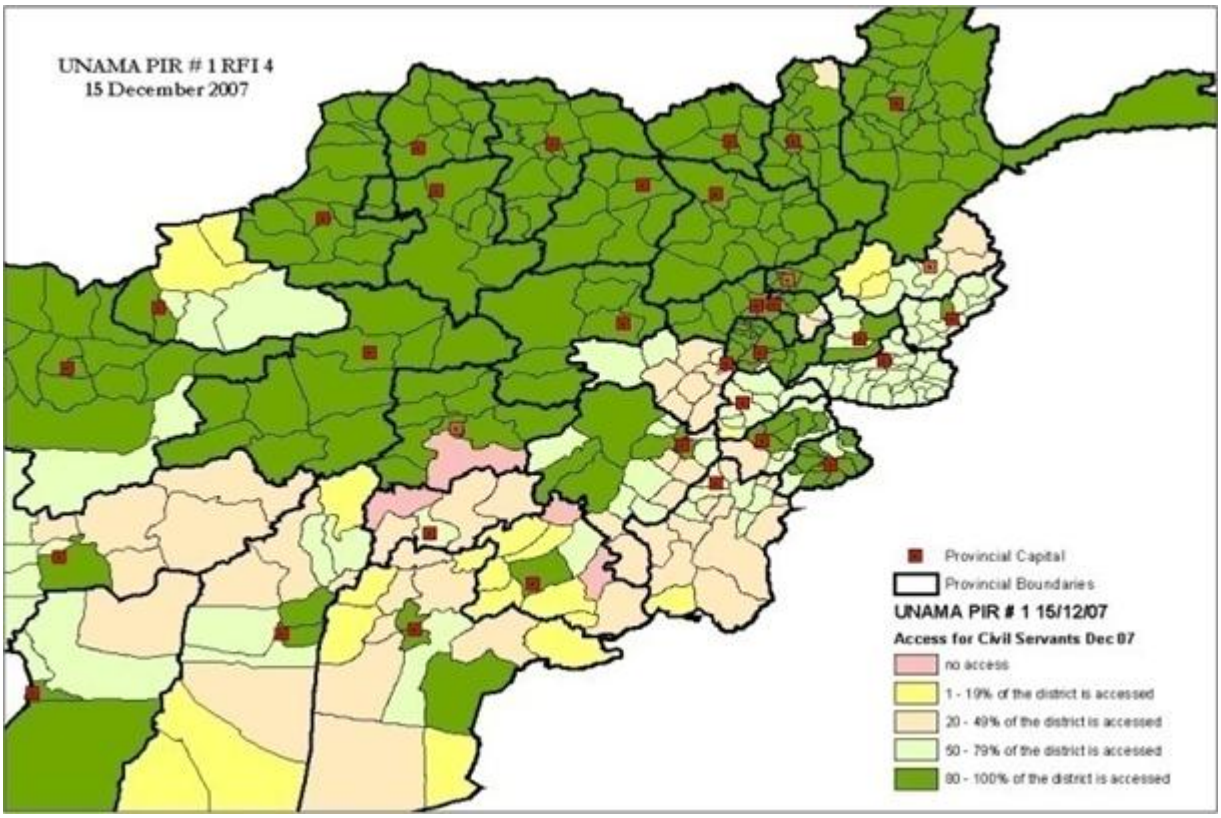




Source: WDI 2011

Figure 3.2

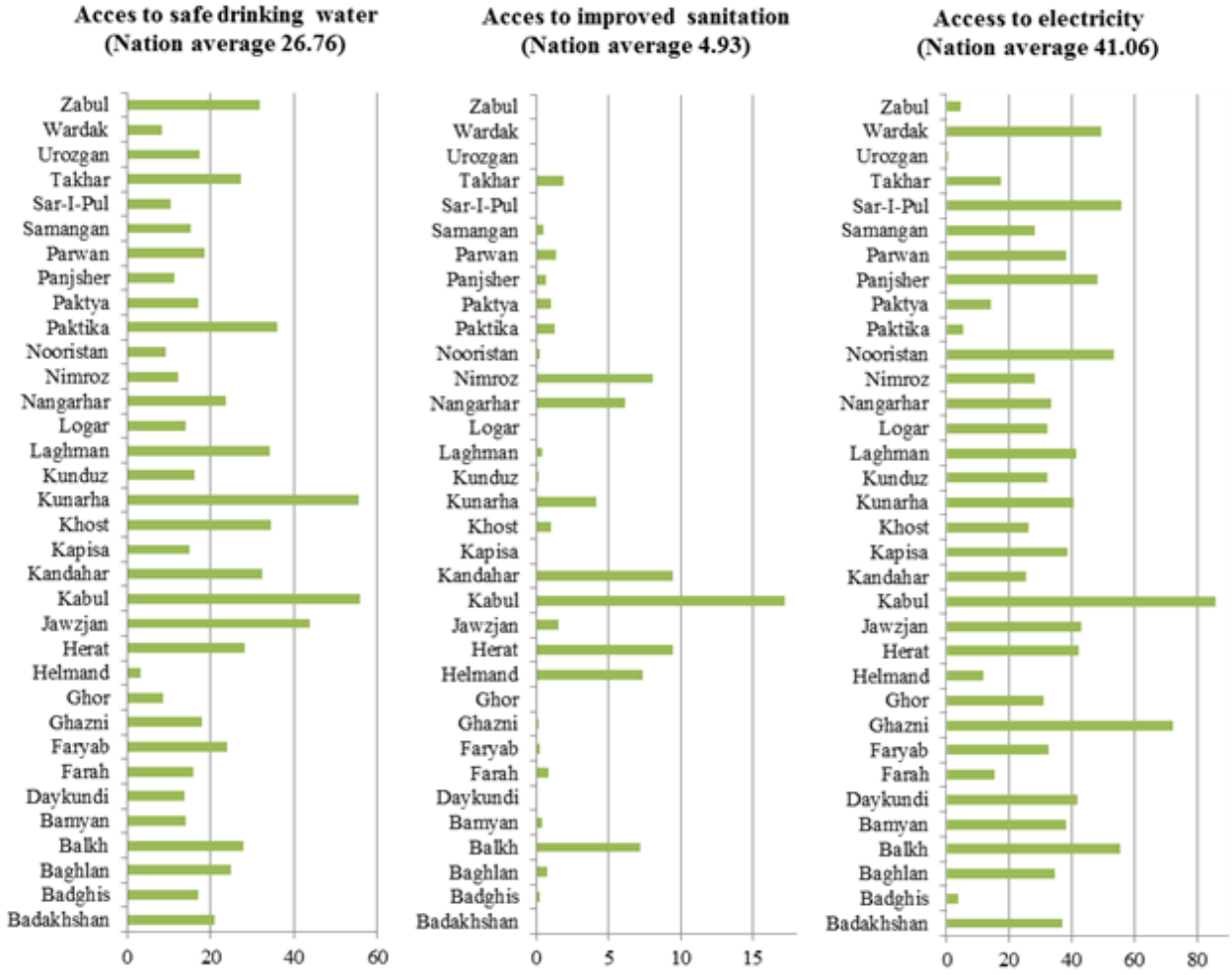
Map of Civil Servants Accessibility



Source: APU, UNAMA

Figure 3.3

Access to Basic Services by Province

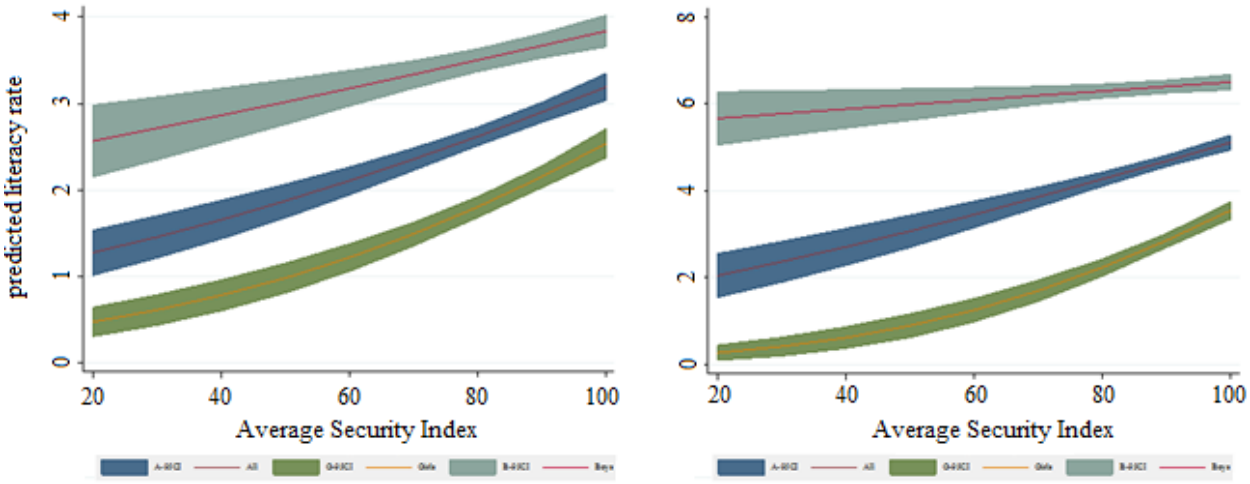


Source: NRVA 2007/08

Figure 3.4a

Educational Outcomes I

Literacy 7-12 *Literacy 13-18*

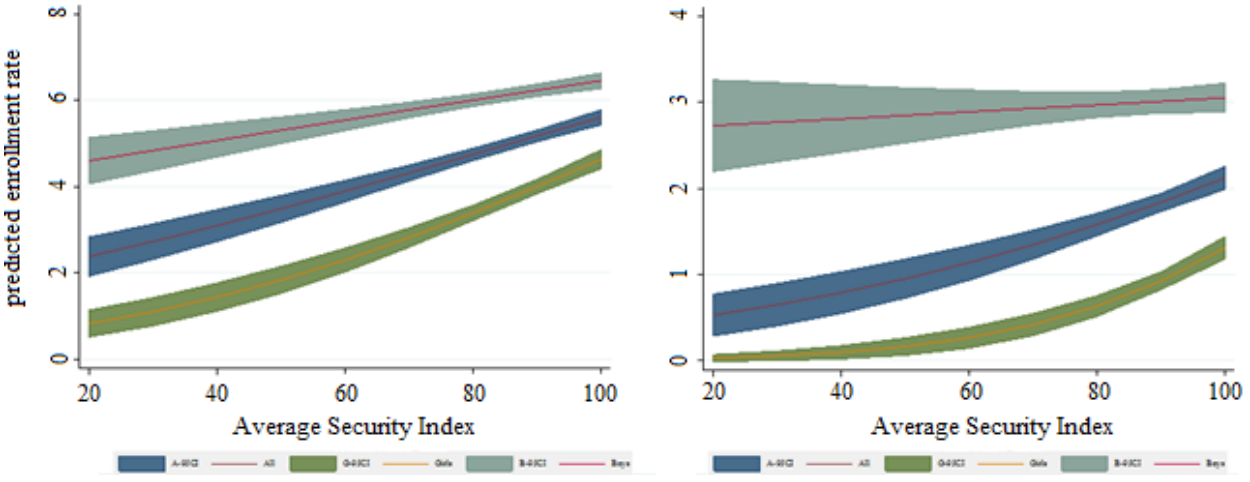


Source: Authors own calculations based on NRVA 2007/08 data.

Figure 3.4b

Educational Outcomes II

Enrollment-Primary *Enrollment-Secondary*

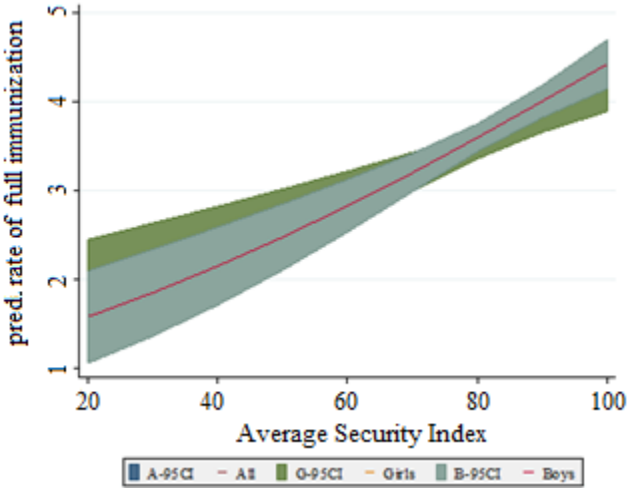


Source: Authors' own calculations based on NRVA 2007/08 data.

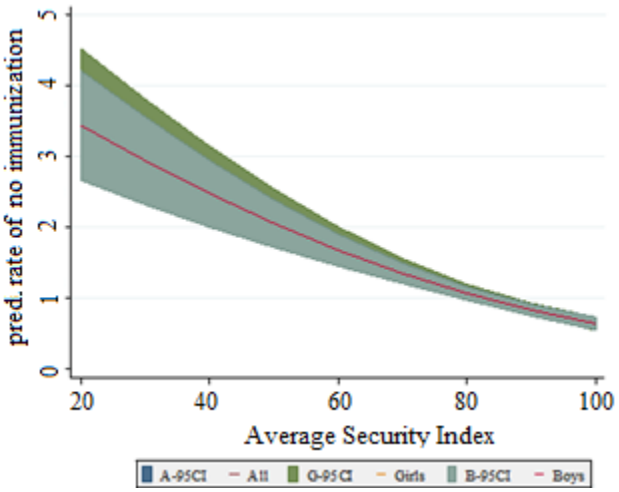
Figure 3.5

Health Outcomes

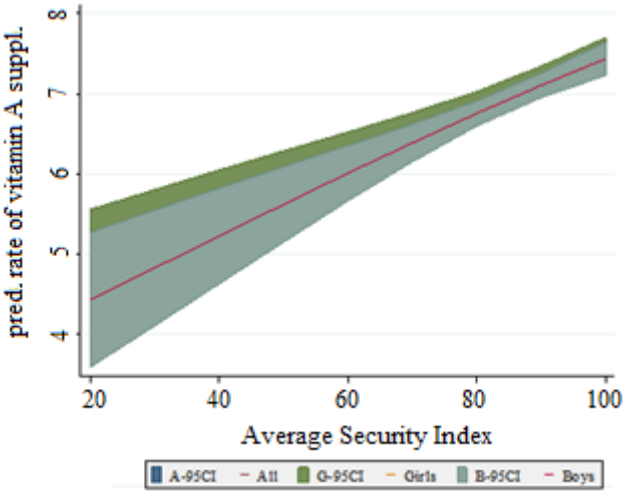
Full immunization rate



No-immunization rate



Vitamin A supplementation



Source: Authors' own calculations based on NRVA 2007/08 data.

Note: Underlying regressions control for NRVA survey desing.

Table 3.1

Descriptive Statistics - Educational Outcomes

	7-12 years old		*13-18 years old*	
Variable	Mean	Std. Dev.	Mean	Std. Dev.
Enrollment (primary school)	51.074	49.989		
Enrollment (secondary school)			0.250	0.433
Literacy rate	31.889	46.605	47.815	49.953
Average civil servant access score (CSAS)	83.185	25.425	86.802	23.160
Female	0.476	0.499	0.473	0.499
Girl primary school in village	0.249	0.432		
Closest girl school in separate bldg.	0.200	0.400		
Boy primary school in village	0.273	0.445		
Girl middle school available in the community			0.142	0.349
Boy middle school available in the community			0.205	0.403
Coed middle available in the community			0.082	0.274
Girl high school available in the community			0.136	0.343
Boy high school available in the community			0.237	0.425
Household size	8.894	3.276	9.019	3.262
Dependency ratio	0.614	0.506	0.390	0.399
Age	9.411	1.748	15.455	1.728
Age squared	91.614	33.416	241.846	53.857
Per-capita monthly total consumption	1,533	901	1,681	1,037
Household head is literate	0.312	0.463	0.347	0.476
Household head's years of schooling	2.466	4.471	2.931	4.885
Age of household head	44.302	12.164	47.874	13.055
Rural	0.776	0.417	0.707	0.455
Kuchi	0.056	0.230	0.053	0.225
Literacy rate: Female Youth	7.699	10.897	10.209	12.533
Literacy rate: Male Youth	35.405	20.101	38.341	20.126
Females always wearing burka (%)	49.596	25.111	50.311	23.503
Days spent outside compound (women)	9.266	5.081	9.177	4.742
South	0.116	0.320	0.093	0.290
East	0.110	0.313	0.099	0.299
Northeast	0.160	0.367	0.144	0.351
North	0.128	0.334	0.146	0.353
West	0.094	0.292	0.117	0.322
Southwest	0.110	0.313	0.074	0.261
West Central	0.063	0.243	0.054	0.227
Second quarter	0.270	0.444	0.261	0.439
Third quarter	0.245	0.430	0.238	0.426
Fourth quarter	0.271	0.445	0.285	0.452
Observations	27,343		20,080	

Source: NRVA 07/08 and UNAMA.
Note: the reported means are weighted by the household weight.

Table 3.2

Descriptive Statistics - Health Outcomes

	5 years old		6 months-5 years old		2-5 years old	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Full immunization	0.350	0.477	0.382	0.486	0.403	0.491
No immunization	0.153	0.360	0.128	0.334	0.121	0.327
Vitamin A intake	0.672	0.470	0.703	0.457	0.706	0.456
Average civil servant access score (CSAS)	84.85	24.84	84.30	25.33	83.59	25.78
Female	0.497	0.500	0.497	0.500	0.499	0.500
European Union	0.248	0.432	0.244	0.430	0.248	0.432
Ministry of Public Health	0.044	0.206	0.044	0.206	0.042	0.200
World Bank	0.180	0.384	0.188	0.390	0.196	0.397
USAID	0.528	0.499	0.524	0.499	0.514	0.500
Household size	8.674	3.753	8.612	3.734	8.604	3.743
Dependency ratio	0.905	0.502	0.896	0.496	0.896	0.494
Age	2.349	1.402	2.524	1.236	3.084	0.903
Age squared	7.484	6.613	7.901	6.184	10.324	5.815
Per-capita monthly total consumption	1,588	993	1,586	977	1,584	978
Household head is literate	0.309	0.462	0.306	0.461	0.307	0.461
Household head's years of schooling	2.372	4.410	2.332	4.376	2.335	4.389
Age of household head	41.375	13.245	41.290	13.114	41.238	12.957
Rural	0.767	0.423	0.770	0.421	0.771	0.420
Kuchi	0.064	0.245	0.063	0.243	0.065	0.247
Literacy rate: Female Youth	7.981	11.102	7.889	11.059	7.732	10.927
Literacy rate: Male Youth	35.019	19.664	34.786	19.725	34.667	19.724
Females always wearing burka (%)	49.640	25.061	49.895	25.172	49.805	25.181
Days spent outside compound (women)	9.144	4.952	9.089	4.973	9.100	5.013
South	0.113	0.316	0.113	0.316	0.117	0.321
East	0.128	0.334	0.123	0.329	0.129	0.335
Northeast	0.153	0.360	0.151	0.358	0.145	0.352
North	0.137	0.344	0.138	0.345	0.138	0.344
West	0.109	0.312	0.109	0.312	0.111	0.314
Southwest	0.101	0.301	0.107	0.309	0.109	0.312
West Central	0.071	0.258	0.070	0.255	0.068	0.251
Second quarter	0.271	0.445	0.271	0.445	0.268	0.443
Third quarter	0.239	0.427	0.239	0.426	0.236	0.425
Fourth quarter	0.263	0.441	0.260	0.439	0.265	0.441
Full immunization	0.350	0.477	0.382	0.486	0.403	0.491
No immunization	0.153	0.360	0.128	0.334	0.121	0.327
Observations	24,064		21,440		17,205	

Source: NRVA 07/08 and UNAMA.

Note: the reported means are weighted by the household weight.

Table 3.3

Educational Outcome 1 - Literacy and CSAS

	Literacy Age 7-12			***Literacy*** Age 13-18		
Explanatory variables	dy/dx	SE	P>z	dy/dx	SE	P>z
Average civil servant access score (CSAS)	**0.002**	**0.000**	**0.000**	**0.003**	**0.000**	**0.000**
Female	-0.136	0.006	0.000	-0.281	0.007	0.000
Girl primary school in village	0.006	0.016	0.714			
Closest girl school in separate bldg.	0.066	0.013	0.000			
Boy primary school in village	0.042	0.015	0.005			
Girl middle school available in the community				-0.024	0.019	0.195
Boy middle school available in the community				0.013	0.016	0.396
Coed middle available in the community				0.014	0.017	0.416
Girl high school available in the community				-0.006	0.018	0.756
Boy high school available in the community				0.016	0.015	0.258
Household size	-0.001	0.001	0.522	0.004	0.001	0.007
Dependency ratio	-0.006	0.007	0.368	-0.019	0.010	0.056
Age	0.237	0.019	0.000	0.121	0.036	0.001
Age squared	-0.009	0.001	0.000	-0.005	0.001	0.000
Per-capita monthly total consumption	0.000	0.000	0.000	0.000	0.000	0.000
Household head is literate	0.090	0.011	0.000	0.127	0.013	0.000
Household head's years of schooling	0.000	0.001	0.928	0.010	0.001	0.000
Age of household head	0.000	0.000	0.329	0.001	0.000	0.047
Rural	0.030	0.018	0.104	-0.060	0.018	0.001
Kuchi	-0.179	0.032	0.000	-0.322	0.032	0.000
Literacy rate: Female Youth	-0.004	0.001	0.000	-0.001	0.001	0.459
Literacy rate: Male Youth	0.005	0.000	0.000	0.005	0.000	0.000
Females always wearing burka (%)	0.000	0.000	0.369	0.000	0.000	0.734
Days spent outside compound (women)	0.002	0.001	0.135	0.003	0.001	0.015
South	0.057	0.019	0.003	0.120	0.022	0.000
East	-0.063	0.017	0.000	-0.022	0.018	0.221
Northeast	-0.019	0.017	0.262	0.054	0.018	0.002
North	0.147	0.022	0.000	0.084	0.021	0.000
West	0.021	0.021	0.316	0.063	0.020	0.001
Southwest	-0.084	0.026	0.001	-0.149	0.030	0.000
West Central	0.102	0.024	0.000	0.097	0.026	0.000
Second quarter	-0.019	0.015	0.180	-0.007	0.015	0.646
Third quarter	-0.020	0.014	0.152	-0.007	0.014	0.631
Fourth quarter	-0.014	0.014	0.303	0.026	0.013	0.054
Observations	27,343			20,080		

Note*:* This tables presents the marginal effect obtained using the delta method.
Note: Regressions control for the NRVA survey design. PSU clustered standard errors.

Table 3.4

Educational Outcome 2 - Enrollment and CSAS

	Primary School Age 7-12			*Secondary School* Age 13-18		
Explanatory variables	dy/dx	SE	P>z	dy/dx	SE	P>z
Average civil servant access score (CSAS)	**0.003**	**0.000**	**0.000**	**0.002**	**0.000**	**0.000**
Female	-0.192	0.007	0.000	-0.180	0.006	0.000
Girl primary school in village	0.049	0.016	0.002			
Closest girl school in separate bldg.	0.068	0.014	0.000			
Boy primary school in village	0.014	0.015	0.362			
Girl middle school available in the community				-0.007	0.017	0.659
Boy middle school available in the community				0.008	0.015	0.583
Coed middle available in the community				0.008	0.015	0.599
Girl high school available in the community				0.000	0.016	0.988
Boy high school available in the community				-0.003	0.012	0.795
Household size	0.001	0.001	0.592	0.001	0.001	0.320
Dependency ratio	-0.003	0.007	0.705	-0.019	0.009	0.033
Age	0.384	0.019	0.000	0.468	0.034	0.000
Age squared	-0.019	0.001	0.000	-0.015	0.001	0.000
Per-capita monthly total consumption	0.000	0.000	0.008	0.000	0.000	0.000
Household head is literate	0.026	0.012	0.032	0.050	0.012	0.000
Household head's years of schooling	0.008	0.001	0.000	0.012	0.001	0.000
Age of household head	0.000	0.000	0.601	0.001	0.000	0.007
Rural	-0.048	0.018	0.008	-0.052	0.016	0.001
Kuchi	-0.327	0.036	0.000	-0.204	0.034	0.000
Literacy rate: Female Youth	0.000	0.001	0.769	-0.002	0.001	0.016
Literacy rate: Male Youth	0.003	0.000	0.000	0.004	0.000	0.000
Females always wearing burka (%)	-0.001	0.000	0.050	0.001	0.000	0.043
Days spent outside compound (women)	0.002	0.001	0.070	0.005	0.001	0.000
South	0.017	0.021	0.412	0.062	0.019	0.001
East	0.026	0.019	0.171	-0.047	0.015	0.001
Northeast	0.097	0.019	0.000	0.007	0.015	0.618
North	0.024	0.023	0.299	0.000	0.018	0.992
West	0.022	0.021	0.284	-0.063	0.015	0.000
Southwest	-0.294	0.031	0.000	-0.132	0.024	0.000
West Central	0.058	0.029	0.049	0.004	0.026	0.861
Second quarter	0.025	0.015	0.109	0.021	0.013	0.113
Third quarter	0.052	0.015	0.000	0.041	0.012	0.001
Fourth quarter	0.073	0.014	0.000	0.061	0.011	0.000
Observations	27,343			20,080		

Note: This tables presents the marginal effect obtained using the delta method.
Note: Regressions control for the NRVA survey design. PSU clustered standard errors.

Table 3.5

Outcome 1 - Literacy and Current Conflict

	Literacy Age 7-12			*Literacy* Age 13-18		
Explanatory variables	dy/dx	SE	P>z	dy/dx	SE	P>z
Current conflict (Killings per 1K population)	**-0.023**	**0.006**	**0.000**	**-0.036**	**0.005**	**0.000**
Female	-0.136	0.006	0.000	-0.279	0.008	0.000
Girl primary school in village	0.007	0.016	0.647			
Closest girl school in separate bldg.	0.064	0.013	0.000			
Boy primary school in village	0.030	0.015	0.041			
Girl middle school available in the community				-0.020	0.019	0.294
Boy middle school available in the community				0.012	0.016	0.437
Coed middle available in the community				0.019	0.017	0.264
Girl high school available in the community				-0.005	0.019	0.776
Boy high school available in the community				0.016	0.015	0.284
Household size	0.000	0.001	0.983	0.004	0.001	0.002
Dependency ratio	-0.002	0.007	0.746	-0.013	0.010	0.191
Age	0.236	0.020	0.000	0.121	0.036	0.001
Age squared	-0.009	0.001	0.000	-0.005	0.001	0.000
Per-capita monthly total consumption	0.000	0.000	0.000	0.000	0.000	0.000
Household head is literate	0.087	0.011	0.000	0.126	0.013	0.000
Household head's years of schooling	0.000	0.001	0.998	0.010	0.001	0.000
Age of household head	0.000	0.000	0.197	0.001	0.000	0.044
Rural	0.040	0.019	0.032	-0.051	0.018	0.006
Kuchi	-0.175	0.031	0.000	-0.311	0.032	0.000
Literacy rate: Female Youth	-0.002	0.001	0.017	0.002	0.001	0.081
Literacy rate: Male Youth	0.004	0.000	0.000	0.004	0.000	0.000
Females always wearing burka (%)	0.001	0.000	0.081	0.000	0.000	0.351
Days spent outside compound (women)	0.002	0.001	0.042	0.003	0.001	0.003
South	0.067	0.019	0.001	0.120	0.022	0.000
East	-0.034	0.016	0.037	0.001	0.018	0.953
Northeast	0.014	0.016	0.391	0.085	0.017	0.000
North	0.182	0.021	0.000	0.111	0.021	0.000
West	0.021	0.021	0.312	0.062	0.020	0.002
Southwest	-0.046	0.029	0.115	-0.111	0.031	0.000
West Central	0.148	0.023	0.000	0.133	0.026	0.000
Second quarter	-0.021	0.014	0.147	-0.005	0.016	0.725
Third quarter	-0.023	0.014	0.097	-0.004	0.014	0.765
Fourth quarter	-0.016	0.014	0.247	0.027	0.014	0.048
Observations	27,343			20,080		

Note: Regressions control for the NRVA survey design. PSU clustered standard errors.

Table 3.6

Outcome 2 - Enrollment and Current Conflict

	Primary School Age 7-12			***Secondary School*** Age 13-18		
Explanatory variables	dy/dx	SE	P>z	dy/dx	SE	P>z
Current conflict (Killings per 1K population)	**-0.044**	**0.006**	**0.000**	**-0.041**	**0.007**	**0.000**
Female	-0.192	0.007	0.000	-0.179	0.006	0.000
Girl primary school in village	0.052	0.015	0.001			
Closest girl school in separate bldg.	0.064	0.014	0.000			
Boy primary school in village	-0.002	0.015	0.866			
Girl middle school available in the community				-0.004	0.017	0.826
Boy middle school available in the community				0.008	0.015	0.605
Coed middle available in the community				0.011	0.015	0.476
Girl high school available in the community				0.000	0.016	0.982
Boy high school available in the community				-0.004	0.012	0.716
Household size	0.002	0.001	0.152	0.001	0.001	0.228
Dependency ratio	0.003	0.007	0.702	-0.016	0.009	0.072
Age	0.386	0.019	0.000	0.467	0.034	0.000
Age squared	-0.019	0.001	0.000	-0.015	0.001	0.000
Per-capita monthly total consumption	0.000	0.000	0.001	0.000	0.000	0.000
Household head is literate	0.022	0.012	0.074	0.050	0.012	0.000
Household head's years of schooling	0.008	0.001	0.000	0.012	0.001	0.000
Age of household head	0.000	0.000	0.829	0.001	0.000	0.009
Rural	-0.031	0.018	0.090	-0.045	0.016	0.006
Kuchi	-0.315	0.035	0.000	-0.195	0.035	0.000
Literacy rate: Female Youth	0.003	0.001	0.000	-0.001	0.001	0.383
Literacy rate: Male Youth	0.003	0.000	0.000	0.004	0.000	0.000
Females always wearing burka (%)	0.000	0.000	0.510	0.001	0.000	0.023
Days spent outside compound (women)	0.003	0.001	0.011	0.006	0.001	0.000
South	0.042	0.021	0.050	0.073	0.019	0.000
East	0.072	0.018	0.000	-0.030	0.015	0.044
Northeast	0.146	0.018	0.000	0.022	0.015	0.126
North	0.074	0.023	0.001	0.011	0.018	0.543
West	0.026	0.021	0.219	-0.061	0.015	0.000
Southwest	-0.221	0.035	0.000	-0.088	0.026	0.001
West Central	0.126	0.027	0.000	0.019	0.025	0.437
Second quarter	0.024	0.015	0.116	0.022	0.013	0.099
Third quarter	0.049	0.015	0.001	0.042	0.012	0.001
Fourth quarter	0.070	0.014	0.000	0.061	0.011	0.000
Observations	27,343			20,080		

Note: This tables presents the marginal effect obtained using the delta method. Regressions control for the NRVA survey design. PSU clustered standard errors.

Table 3.7

Outcome 1 - Literacy and Past Conflict

	Primary School Age 7-12			***Secondary School*** Age 13-18		
Explanatory variables	dy/dx	SE	P > z	dy/dx	SE	P > z
Lagged conflict (Killings per 10K population)	**0.000**	**0.000**	**0.042**	**0.000**	**0.000**	**0.653**
Female	-0.136	0.006	0.000	-0.278	0.008	0.000
Girl primary school in village	0.011	0.016	0.471			
Closest girl school in separate bldg.	0.065	0.013	0.000			
Boy primary school in village	0.028	0.015	0.054			
Girl middle school available in the community				-0.023	0.019	0.232
Boy middle school available in the community				0.011	0.016	0.503
Coed middle available in the community				0.018	0.017	0.291
Girl high school available in the community				-0.006	0.019	0.750
Boy high school available in the community				0.016	0.015	0.277
Household size	0.000	0.001	0.922	0.004	0.001	0.001
Dependency ratio	-0.002	0.007	0.782	-0.011	0.010	0.268
Age	0.233	0.020	0.000	0.127	0.036	0.000
Age squared	-0.008	0.001	0.000	-0.005	0.001	0.000
Per-capita monthly total consumption	0.000	0.000	0.000	0.000	0.000	0.000
Household head is literate	0.083	0.011	0.000	0.121	0.013	0.000
Household head's years of schooling	0.000	0.001	0.738	0.010	0.001	0.000
Age of household head	0.000	0.000	0.156	0.001	0.000	0.039
Rural	0.028	0.019	0.149	-0.057	0.019	0.002
Kuchi	-0.187	0.032	0.000	-0.317	0.033	0.000
Literacy rate: Female Youth	-0.002	0.001	0.015	0.002	0.001	0.046
Literacy rate: Male Youth	0.004	0.000	0.000	0.004	0.000	0.000
Females always wearing burka (%)	0.000	0.000	0.116	0.000	0.000	0.243
Days spent outside compound (women)	0.002	0.001	0.062	0.004	0.001	0.002
South	0.045	0.019	0.018	0.090	0.021	0.000
East	-0.039	0.017	0.019	-0.014	0.018	0.430
Northeast	0.025	0.016	0.132	0.092	0.018	0.000
North	0.194	0.021	0.000	0.117	0.021	0.000
West	0.018	0.021	0.402	0.058	0.020	0.004
Southwest	-0.110	0.026	0.000	-0.177	0.028	0.000
West Central	0.158	0.023	0.000	0.145	0.026	0.000
Second quarter	-0.022	0.015	0.135	-0.005	0.016	0.747
Third quarter	-0.023	0.014	0.104	-0.003	0.015	0.815
Fourth quarter	-0.017	0.014	0.224	0.027	0.014	0.049
Observations	27,343			20,080		

Note: This tables presents the marginal effect obtained using the delta method.
Regressions control for the NRVA survey design. PSU clustered standard errors.

Table 3.8

Outcome 2 - Enrollment and Past Conflict

	Primary School Age 7-12			***Secondary School*** Age 13-18		
Explanatory variables	dy/dx	SE	P > z	dy/dx	SE	P > z
Lagged conflict (Killings per 10K population)	**0.000**	**0.000**	**0.956**	**0.000**	**0.000**	**0.012**
Female	-0.192	0.007	0.000	-0.179	0.007	0.000
Girl primary school in village	0.060	0.016	0.000			
Closest girl school in separate bldg.	0.063	0.014	0.000			
Boy primary school in village	-0.008	0.015	0.595			
Girl middle school available in the community				-0.005	0.017	0.748
Boy middle school available in the community				0.007	0.015	0.654
Coed middle available in the community				0.010	0.015	0.494
Girl high school available in the community				-0.001	0.016	0.964
Boy high school available in the community				-0.004	0.012	0.715
Household size	0.002	0.001	0.158	0.001	0.001	0.174
Dependency ratio	0.004	0.007	0.573	-0.014	0.009	0.109
Age	0.381	0.020	0.000	0.470	0.034	0.000
Age squared	-0.019	0.001	0.000	-0.015	0.001	0.000
Per-capita monthly total consumption	0.000	0.000	0.001	0.000	0.000	0.000
Household head is literate	0.017	0.012	0.164	0.048	0.012	0.000
Household head's years of schooling	0.009	0.001	0.000	0.012	0.001	0.000
Age of household head	0.000	0.000	0.961	0.001	0.000	0.006
Rural	-0.048	0.019	0.012	-0.050	0.016	0.002
Kuchi	-0.332	0.036	0.000	-0.201	0.035	0.000
Literacy rate: Female Youth	0.003	0.001	0.000	0.000	0.001	0.506
Literacy rate: Male Youth	0.003	0.000	0.000	0.004	0.000	0.000
Females always wearing burka (%)	0.000	0.000	0.501	0.001	0.000	0.015
Days spent outside compound (women)	0.003	0.001	0.016	0.006	0.001	0.000
South	0.001	0.021	0.960	0.042	0.018	0.018
East	0.056	0.018	0.002	-0.046	0.015	0.002
Northeast	0.161	0.018	0.000	0.024	0.015	0.104
North	0.089	0.023	0.000	0.013	0.018	0.449
West	0.012	0.022	0.577	-0.068	0.015	0.000
Southwest	-0.323	0.031	0.000	-0.143	0.023	0.000
West Central	0.140	0.027	0.000	0.023	0.025	0.358
Second quarter	0.021	0.016	0.178	0.023	0.013	0.094
Third quarter	0.048	0.015	0.001	0.043	0.012	0.001
Fourth quarter	0.069	0.014	0.000	0.062	0.011	0.000
Observations	27,343			20,080		

Note: This tables presents the marginal effect obtained using the delta method.
Regressions control for the NRVA survey design. PSU clustered standard errors.

Table 3.9

Health Outcomes - Access to Immunization and Vitamin A Supplementation

	Fully Immunized			***Not immunized***			***Vitamin A***		
	2Y ≤ Age ≤ 5Y			6M ≤ Age ≤ 5Y			Age ≤ 5Y		
Explanatory variables	dy/dx	SE	P>z	dy/dx	SE	P>z	dy/dx	SE	P>z
Avg civil servant access score (CSAS)	**0.003**	**0.001**	**0.000**	**-0.003**	**0.000**	**0.000**	**0.003**	**0.000**	**0.000**
Female	-0.012	0.007	0.095	0.004	0.005	0.402	0.009	0.006	0.132
European Union	-0.001	0.001	0.126	0.000	0.000	0.232	0.083	0.054	0.121
MPH	0.004	0.002	0.094	0.002	0.001	0.101	-0.778	0.179	0.000
USAID	0.002	0.001	0.001	0.002	0.000	0.000			
World Bank	0.392	0.070	0.000	0.108	0.032	0.001	-0.140	0.052	0.007
European Union*CSAS	-0.460	0.230	0.045	-0.088	0.136	0.518	-0.003	0.001	0.000
MPH*CSAS	0.316	0.062	0.000	0.116	0.032	0.000	0.003	0.002	0.063
USAID*CSAS							-0.003	0.001	0.000
Household size	0.000	0.002	0.793	-0.001	0.001	0.435	0.003	0.001	0.022
Dependency ratio	-0.011	0.009	0.250	0.022	0.007	0.002	-0.012	0.008	0.150
Age	0.142	0.028	0.000	-0.044	0.006	0.000	0.169	0.006	0.000
Age squared	-0.022	0.004	0.000	0.006	0.001	0.000	-0.028	0.001	0.000
Per-capita MTC	0.000	0.000	0.000	0.000	0.000	0.041	0.000	0.000	0.578
HH head is literate	-0.017	0.015	0.270	-0.014	0.010	0.137	-0.040	0.013	0.002
HH head's years of schooling	0.010	0.002	0.000	-0.003	0.001	0.060	0.008	0.001	0.000
Age of household head	0.000	0.000	0.356	0.000	0.000	0.257	0.000	0.000	0.525
Rural	-0.013	0.024	0.583	0.040	0.014	0.004	0.008	0.022	0.711
Kuchi	-0.290	0.041	0.000	0.161	0.019	0.000	-0.060	0.036	0.093
Literacy rate: Female Youth	0.001	0.001	0.414	0.000	0.001	0.964	0.000	0.001	0.905
Literacy rate: Male Youth	0.000	0.001	0.680	0.000	0.000	0.637	0.000	0.000	0.524
Females always wearing burka	0.001	0.000	0.005	-0.001	0.000	0.029	0.000	0.000	0.627
Days spent out. com. (women)	-0.003	0.002	0.039	0.002	0.001	0.042	0.003	0.001	0.028
Observations		21,440			17,205			24,064	

Notes: This tables presents the marginal effect obtained using the delta method.
Other controls: regional and seasonal fixed effects.
Regressions control for the NRVA survey design. PSU clustered standard errors.
MPH = Ministry of Public Health, MTC = monthly total consumption, HH = household.

Table 3.10

The Effect of Access to Basic Services on Security and Conflict

Dependent variables	*Average CSAS*		*Killings*	
Independent variable	IV	OLS	IV	OLS
Access to Electricity	0.424**	0.369***	-0.002	-0.019
Std. Err.	(0.173)	(0.095)	(0.014)	(0.014)
R^2		0.522		0.246
Safe Water	0.761**	0.209	0.018	0.015
Std. Err.	(0.378)	(0.173)	(0.019)	(0.017)
R^2		0.490		0.243
Improved Sanitation	2.925**	1.843***	0.098	-0.009
Std. Err.	(1.321)	(0.506)	(0.123)	(0.030)
R^2		0.532		0.241
Observations (PSU-level)	2,568	2,568	2,568	2,568

Notes*:* Regressions are run at the primary sampling unit (PSU) level. The measure of access to service is the mean at the province level. Each cell represents a separate regression. Controls: urban indicator, an indicator for whether the road is impassable all year long, district level density, 9 indicators for the type of terrain (baseline terrain is Mid-altitude plains, controlled terrain types are: High-altitude plains, Platforms, Low plateaus, Mid-altitude plateaus, High plateaus, Low mountains, Mid-altitude mountains, High mountains, Very high mountains, see Meybeck et al. 2001), 8 regional indicators (baseline region is Central), and 3 indicators for the relief roughness category. Province clustered standard errors in parentheses.

Table 3.11

Conflict on Access to Basic Services

Dependent variables	*Access to electricity*	*Access to water*	*Access to sanitation*
Average CSAS	0.220***	0.103***	0.055***
Std. Err.	[0.016]	[0.011]	[0.003]
R^2	0.684	0.591	0.748
Killings	-0.299***	0.118	0.005
Std. Err.	[0.114]	[0.108]	[0.016]
R^2	0.659	0.578	0.723
Lagged Killings	-0.045***	-0.058***	-0.015***
Std. Err.	[0.010]	[0.008]	[0.002]
R^2	0.658	0.580	0.724
Observations	2,568	2,568	2,568

Notes: Regressions are run at the PSU level. The measure of access to service is the mean at the province level. Each cell represents a separate regression. Controls: urban indicator, an indicator for whether the road is impassable all year long, district level density, 9 indicators for the type of terrain (baseline terrain is Mid-altitude plains, controlled terrain types are: High-altitude plains, Platforms, Low plateaus, Mid-altitude plateaus, High plateaus, Low mountains, Mid-altitude mountains, High mountains, Very high mountains, see Meybeck et al. 2001), 8 regional indicators (baseline region is Central), and 3 indicators for the relief roughness category. Regressions control for the NRVA survey design. Robust standard errors in brackets.

Table 3.12

Conflict and the Presence of Health Facilities, by Donor

Dependent variables	Health Facilities by Donor			
	EU	***MoPH***	***World Bank***	***USAID***
Average CSAS	-0.001***	0.002***	-0.006***	0.006***
Std. Err.	[0.000]	[0.000]	[0.000]	[0.000]
R^2	0.654	0.427	0.457	0.515
Killings	-0.003**	-0.001**	0.004	-0.000
Std. Err.	[0.001]	[0.000]	[0.003]	[0.003]
R^2	0.651	0.408	0.384	0.473
Lagged Killings[1]	-0.001***	0.003***	-0.001***	-0.002***
Std. Err.	[0.000]	[0.000]	[0.000]	[0.000]
R^2	0.651	0.442	0.384	0.475
Observations	2,568	2,568	2,568	2,568

Notes: Regressions are run at the PSU. The measure of access to service is the mean at the district level. Each cell represents a separate regression. Controls: urban indicator, an indicator for whether the road is impassable all year long, district level density, 9 indicators for the type of terrain (baseline terrain is Mid-altitude plains, controlled terrain types are: High-altitude plains, Platforms, Low plateaus, Mid-altitude plateaus, High plateaus, Low mountains, Mid-altitude mountains, High mountains, Very high mountains, see Meybeck et al. 2001), 8 regional indicators (baseline region is Central), and 3 indicators for the relief roughness category. Robust standard errors in brackets.

Appendix 3.1

Table A 3.1

Testing the Endogeneity of Access to Services and the Validity of The Instrument

IV–2006 Average Yearly Rainfall Deviation from 4-Year Average at the Province Level and two rain-shock indicators (+1 and +2 standard deviations).

	Underidentification test - Kleibergen-Paap rk LM statistic	p-val.	Weak identification test - Kleibergen-Paap rk Wald F-statistic	Overidentification test of all instruments - Sargan statistic	χ^2 p-val	Endogeneity test of endogenous regressors	χ^2 p-val
			CASS				
Access to Electricity	10.971	0.012	20.035	3.363	0.186	0.271	0.603
Safe Water	5.894	0.117	10.420	4.354	0.113	1.206	0.272
Improved Sanitation	4.594	0.204	3.560	4.764	0.092	1.427	0.232
			Lagged Killings				
Access to Electricity	10.971	0.012	20.035	1.146	0.564	0.164	0.686
Safe Water	5.894	0.117	10.420	1.153	0.562	0.090	0.764
Improved Sanitation	4.594	0.204	3.560	1.264	0.532	0.093	0.760
			Killings				
Access to Electricity	10.971	0.012	20.035	4.294	0.117	0.755	0.385
Safe Water	5.894	0.117	10.420	4.263	0.119	1.503	0.220
Improved Sanitation	4.594	0.204	3.560	4.190	0.123	0.906	0.341

Notes: First stage regressions run at the PSU level. The measure of access to service is the mean at the province level. Controls: urban indicator, an indicator for whether the road is impassable all year long, district level density, 9 indicators for the type of terrain (baseline terrain is Mid-altitude plains, controlled terrain types are: High-altitude plains, Platforms, Low plateaus, Mid-altitude plateaus, High plateaus, Low mountains, Mid-altitude mountains, High mountains, Very high mountains; see Meybeck et al. 2001), 8 regional indicators (baseline region is Central), and 3 indicators for the relief roughness category. Regressions control for the NRVA survey design. Province level clustered standard errors.

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