An Evaluation of the Impact of Mexico's *Oportunidades* CCT Program on Children's Health

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Abstract

In this paper, we investigate the impact of the conditional cash transfer program in Mexico - *Oportunidades* on children's anthropometric outcomes, including the z scores for height-for-age, weight-for-age, and weight-for-height. The analysis is based on a survey data collected in 2002 and 2004 in Mexican urban areas. We obtain that the *Oportunidades* intervention had a significant positive impact on z scores for height-for-age and weight-for-age for children aged 0-3 years old. The program intervention increased z score for height-for-age and weight-for-age by 0.54 and 0.32, respectively. However, we do not find significant impact of the *Oportunidades* on the z score for weight-for-height. One of the reasons might be that before the intervention in 2002, z scores for height-for-age and weight-for-age were below the WHO Child Growth Standards, but z score for weight-for-height was above the WHO Standards.

Key word: *Oportunidades*, conditional cash transfer, Mexico, health, human capital.

1. Introduction

Children's development is affected by different factors, such as genetic inheritance, socioeconomic, physical, and psychological factors. The first 5 years of life is a crucial period for a child's development. In this period, children experience rapid physical and intellectual development, which has been shown to affect their grown-up life (Nelson (2000)). However, there are many serious barriers to children's development including poverty and its accompanying problems, such as inadequate and low-quality food, poor sanitation conditions, deficient care, and inadequate schooling. In developing countries, more than 6 million children die every year of preventable diseases (Gareth, et al. (2003)), and more than 200 million children under 5 years old do not have sufficient resource for their growth (Grantham-McGregor, et al. (2007)).

To improve children development and break the intergenerational poverty transmission, some developing countries in Latin America have adopted Conditional Cash Transfer (CCT) programs (e.g. Schady (2006)).[1] Unlike traditional cash transfer programs that transfer money directly to people or households in poverty without any requirement, CCT programs make money transfers to households in poverty conditional on some requirements, such as visiting health clinics for immunization and check-ups, attending health and nutrition sessions, or sending their children to school. In this way, the money transfers stimulate parents to invest in their children's health and wellbeing. With the money, households can purchase more and high-

[1] For example: *Oportunidades* in Mexico, *Bolsa Alimentação* in Brazil, *Red de Protección Social* in Nicaragua, *Programa de Asignación Familial* in Honduras, *Familias en Acción* in Columbia, *Subsidio Unico Familiar* in Chile, and the Program of Advancement through Health and Education in Jamaica.

quality food or improve housing environment.

The implementation of CCT programs is often accompanied by national-wide surveys held by the program evaluation groups to follow up the intervention effect every year. The surveys collect data on a wide range of outcomes such as consumption behavior, how much property they have, education of the households, children's health outcomes, and women health outcomes. The survey data are the base of most assessments of CCT programs.

Oportunidades in Mexico is the largest CCT program in the world. Starting from 1997 in Mexican rural areas, *Oportunidades* gradually expanded to more areas and covered more households nationwide. The purpose of the program is to improve the socioeconomic conditions of families in poverty and stimulate human development. The program provides cash transfer to the households and nutrition supplement to children if the parents qualify specific requirements such as participating nutrition sessions and sending their children to school. In 2010, the program covers 100,000 localities and assists 5.8 million families throughout the country. For 2010, the Mexican government authorized 63 thousand million pesos (approx. 5 billion US dollars) for the program. Evidences from many evaluations of *Oportunidades* have shown that in the short term, this program improves health and nutritional outcomes for young children (e.g. Gertler (2000), Barber and Gertler (2008)), increases school enrollment rates (e.g. Schultz (2000), Valdés (2008)) and improves life quality of households (e.g. Hoddinott (2004)).[2]

When *Oportunidades* was implemented in rural areas of Mexico in 1997, it was

[2] A detailed review of the literature is provided in Section 3.

designed as random assignment; when it was expanded to urban areas in 2002, *Oportunidades* was non-randomized due to financial, ethics, and practical reasons.

In this paper, we focus on the impact of *Oportunidades* on the health of children aged 0-3 years old, based on two survey datasets from Mexican urban areas in 2002 and 2004: ENCELURB 2002 and ENCELURB 2004. These two datasets contains information of health outcomes, socioeconomic characteristics and food intake frequencies for children participated in the surveys in both 2002 and 2004.

We analyze the impact of the program in terms of health outcomes such as z scores for height-for-age, weight-for-age, and weight-for-height. These three indicators are commonly used as proxy of young children's health status.[3] Since we observe the same individuals in both years, we are able to control for unobserved time-invariant factors that impact the outcomes of interest. Because we have information of health outcomes, socioeconomic characteristics and food intake frequencies on the control group and treatment group in two years, we adopt a difference-in-differences estimation strategy. Our results indicate significant positive effects of *Oportunidades* intervention on children health in terms of z scores for height-for-age and weight-for-age. Because of the program intervention, the z scores for height-for-age and weight-for-age increased by 0.54 and 0.32, respectively. However, we did not obtain a significant result of the program intervention on z score for weight-for-height.

The results in this paper are in accord with other examinations of Oportunidades on children's health, such as Behrman and Hoddinott (2001). However, the difference is

[3] See examples in Behrman and Hoddinott (2001), Fernald et al (2008), Leroy et al (2008).

that the examination in this paper is based on survey data of non-randomized design in urban areas, while Behrman and Hoddinott (2001) used survey data of randomized design from rural areas. The difference between randomized design and non-randomized design is that, individuals are assigned to control and treatment groups randomly for the randomized design, while each individual make their own decision whether to be in control or treatment groups for the non-randomized design.[4]

This paper is organized as follows. In Section 2 we describe the *Oportunidades* intervention and program design. In Section 3 we discuss the literature related to different CCT programs, especially the *Oportunidades* in Mexico. In Section 4 we present some descriptive statistics of the basic facts. In Section 5 we describe the empirical model of the analysis. We present our main estimation results in Section 6 and the conclusions in Section 7.

2. *Oportunidades* Intervention and Program Design

2.1 Intervention

Oportunidades was firstly implemented in Mexico in 1997.[5] It is the largest scale and longest lasting conditional cash transfer program in the world. In 2010, the program covers 100,000 localities throughout the country and assists 5.8 million families nationwide. The purpose of *Oportunidades* is to promote and strengthen the capacities and potential of families living in extreme poverty, so that they can achieve

[4] The details of the program design of *Oportunidades* is discussed in Section 2.
[5] Previously called *Progresa* (*Programa de Educación, Salud y Alimentación*) when fist implemented in rural areas of Mexico in 1997, the name changed to *Oportunidades* (English: *Opportunities*) in 2002 when expanded to urban areas.

a higher standard of living. The size of cash transfer corresponds to over 20% average increase in income of households living in extreme poverty.

The households incorporated in the program can receive the following benefits:[6]

Nutrition and Health:

To make sure parents indeed visit health clinics, the record of visiting health clinic for check-ups is one of the conditionality to receive the bi-monthly cash transfers. Mothers' attendance record at training sessions on nutrition and health care is also required to obtain the cash payments. Young children aged 6 to 24 months old, undernourished children 2 to 5 years old and pregnant women can receive daily nutritional supplements. The supplements constitute 20% of caloric requirements and 100% necessary micronutrients. Additionally, in the treatment areas, the supplies of medicines and health services has been increased and doctors and nurses have received more training to provide better health services.

Education:

The households with a child aged 7 to 18 years old receive a bi-monthly payment during the school year, if the children's school attendance rate reaches 85% of school days. Households with children in elementary school can also obtain grants for school materials at the beginning of each semester. Moreover, to encourage parents to send their daughters to school, the grants for girls are higher than those for boys at the

[6] The statements regarding the specific components of *Oportunidades* are based on the document from *Oportunidades* Register and Transfer Office, 2010.

secondary school level. Additionally, as the money transfer stimulates more parents to send their children to school, the program also makes efforts to improve the quality of schools, to prevent a drop in educational quality caused by increased enrollment.

As *Oportunidades* provides multidimensional support for households in poverty, it could improve human capital through different channels (Guo and Harris (2000)). In particular, there are at least two mechanisms that can explain the impact of *Oportunidades* on children's health outcomes.

First, households have greater purchasing power due to the cash transfer. The money can be spent on more food of different varieties preventing malnutrition and improving children health status (Hoddinott and Skoufias (2004)). Also, the money can be spent on household materials, such as improved flooring, better sanitation, and refrigerator or other kitchen appliance, which reduce the risk of being sick or injured.

The second channel to affect children health outcomes is the provision of necessary health clinic service, nutritional supplement, and dissemination of correct baby care knowledge. With health service provided by the program, children in poverty are able to do regular check-ups or be treated when they are ill, without worrying about the cost of these services. The nutritional supplement can prevent malnutrition caused by poverty and insufficient and low-quality food intake. As people in extreme poverty seldomly obtain education, many parents in poverty do not know about how to feed their children properly. This also leads to poor health outcomes of young children.

2.2 Program Design

Oportunidades was implemented in some rural areas in 1997, and gradually expanded to more communities since then. In 2002, *Oportunidades* expanded to poor urban areas with 50,000 to 1 million residents. The main difference of program design in urban areas with respect to the initial implementation in rural areas is that, non-randomized design was adopted in urban areas. The process of allocating people into control or treatment groups in the urban areas is the following.

First, the Government has identified households poverty level based on the information from the National Income and Expenditure of Households Survey 2000 (ENIGH 2000, for its initials in Spanish), and classified them as eligible (poor) or non-eligible (not poor). Using the distribution information of poor households in all urban areas, the program executors selected the potential incorporation areas. In these areas, the information of the *Oportunidades*, eligibility rules, and the procedure to apply for incorporation were disseminated through different media. Then the households could submit the applications to the local registration office. After reassessing their eligibility status, the non-eligible (not poor) households were excluded; only eligible (poor) households were included in the program. The control group included households that were eligible (poor) according to ENIGH 2000 but did not apply to incorporate into the program voluntarily.

A problem of the non-randomized design is that the characteristics of participants in control and treatment groups are not exactly the same. Moreover, even if the observed characteristics of households in the two groups are similar, whether to be included in the program depends not only on whether the households are poor but also on their own decisions. This is the so-called self-selection problem (Wooldridge (2002)). For example, parents registering to become beneficiaries may possibly care more about their children's health and further development or they receive more information than other parents. If the fact that individuals selected themselves into the program were ignored, the estimates would be biased. One of the methods to solve this problem is the fixed effect estimate, which controls for unobserved factors that impact the dependent variables of interest. Through the fixed effect estimate, we can obtain the impact of observed explanatory factors.

3. Review of the Literature

The impact of the CCT program intervention on children's health has been investigated for different health outcomes.The major part of the literature has focused on the *Oportunidades* in Mexico, but we also review the literature on CCT programs in other countries. Most of the papers evaluating *Oportunidades* have used anthropometric outcomes to assess the short-term impact of the program intervention on children health. They take advantage of the organized surveys and the existence of control and treatment groups. The overall results show that the program improves children's health for some age groups. Because the CCT programs in other Latin American countries were implemented 3 or 4 years later than the *Oportunidades* in Mexico, so the literature on the CCT programs in other countries are all short-term evaluations.

Barber and Gertler (2008) investigate the impact of *Oportunidades* on birth-weight in grams and low birth-weight.[7] They use the retrospective data collected from women in low-income households in rural area who participated in the program from 1997 to 2003.[8] The analysis focuses on a subsample derived from the original sample of control and treatment groups. The treatment group includes children who were born after the households received their first cash transfer, while the children in control group did not receive any intervention. They use both random effects and fixed effects estimations to control the unobserved factors that impact the birth-weight in the analysis and obtain similar results. Their analysis shows that *Oportunidades* has significant positive impact on birth-weight. The program increased birth weight by 127.3g and reduced the probability of low birth weight by 4.6%.

Based on the survey data of young children aged 12-36 months in the rural area between 1998 and 1999, Behrman and Hoddinott (2001) investigate the impact of *Oportunidades* on preschool children's height. Their regressions include food prices, resources, household characteristics, and community constraints in order to account for the parents' decisions related to resource allocation. Using individual child fixed effects, they obtain that the program significantly increased infants and young children's height and reduced the probability of being stunted.

Fernald et al. (2008) investigate the impact of *Oportunidades* on z score for height-for-age and body-mass index for age percentile for young children from rural areas. They use linear and logistic regression to analyze the data and control for a wide

[7] Low birth-weight is defined as less than 2500g when the baby is born.
[8] The sample is a subset of the women who were randomly assigned to the treatment group in 1998 or 1999 across seven Mexican states, and a third group of women from communities that were not eligible for the intervention (CONAPO 2003).

range of covariates, such as household socioeconomic status.[9] They find that the program contributed to the increase of children height, to the decrease in the probability of stunting and to the decrease in the prevalence of being overweight.

Leroy et al. (2008) investigate the impact of *Oportunidades* on growth of children in urban areas. Based on the survey data of children aged 0 to 24 months in 2002 and 2004: ENCELURB_2002 and ENCELURB_2004. They use difference-in-differences model and control for unobserved fixed characteristics over time. They analyzed the impact of *Oportunidades* on several subdivided age groups. Their findings show that there is no relation between the program participation and growth for children aged between 6 and 24 months. However, because of the program participation, children younger than 6 months in treatment group grew 1.5 cm and 0.76 kg more than their counterparts in the control group.

Maluccio and Flores (2004) investigated the impact of the CCT program *Red de Protección Social* in Nicaragua on z scores for height-for-age and weight-for-height for young children of the rural areas. Their analysis was based on two years survey data in 2000 and 2002, which contains the health status for over 1,300 children aged 0-3 years old. Through the difference-in-differences model, they find that because of the two-year intervention, the percentage of stunting decreased by 3.4% while it increased by 2.2% for the children in the control areas. For the z score for weight-for-height, as wasting was not a major problem of children's growth, so there was no significant change because of the program intervention.

[9] They include the children aged 24-68 months old when they started this assessment in September 2003. This is a subsample of the children incorporated into the program since 1999.

The short-term impact of the CCT program *Familias en Acción* in Colombia was analyzed by Attanasio et al. (2005). Their examination was based on the survey data of children younger than 7 years old from 2001 to 2002. They focus on the impact of the program intervention on the z score for height-for-age and the newborns' weight. They find that the children under 2 years old improved their health status, as the average z score for height-for-age increase by 0.161. However, children older than 2 years did not benefited from the intervention in terms of this health indicator. They also find that, newborns that live in the urban areas increased their weight by 0.578 kilograms because of the program intervention.

A second health outcome that can be used to infer the impact of the program is the utilization of health clinics. The record of visiting the health clinics for prenatal care and regular check-ups is one of the conditions of the cash transfer in *Oportunidades*.

Using the survey data between 1998 and 2000 of the Mexican rural area, Gertler (2000) estimated the impact of *Oportunidades* on visits to public facilities for prenatal care and child nutrition monitoring.[10] Gertler (2000) finds that *Oportunidades* increases the utilization of public health clinics for preventive care, and lowers the number of inpatient hospitalizations. He also finds that there is no decrease in the visits to private health clinics. This confirms that the increase in utilization at public health clinics is not due to a substitution effect between different types of health clinics.

Morris et al. (2004) investigated the impact of the CCT program *Programa de*

[10] The survey data includes a pre-intervention baseline survey in 1998 ENCEL_1998_Match, and four follow-up surveys at six-month interval.

Asignación Familial in Honduras on the use of preventive health care. Based on the two years survey data in 1998 and 2000, which contains health information of about 5,600 households from 70 municipalities, they used the difference-in-differences strategy. They find that the program intervention had a significant positive impact on the use of preventive health care. Because of the intervention, the coverage of antenatal care and children's check-ups increased by 15% and 20%, respectively.

A third way of assessing the impact of the program on health is by analyzing immunization coverage for children. Barham et al. (2007) evaluated the impact of *Oportunidades* in Mexico and *Red de Protección Social* in Nicaragua on vaccination coverage against tuberculosis, dephtheria-pertussis-tetanus, oral polio, and measles in children less than 3 years of age. For the *Oportunidades* in Mexico, they showed that the vaccination against measles for young children increased after the *Oportunidades* intervention, especially for those children living in localities far from a health clinic and whose mother did not complete primary school. [11] However, as the turberculosis vaccination rate was already high[12] before *Oportunidades* operated, the analysis does not show the significant effect on tuberculosis coverage. She finds that although *Oportunidades* increases the tuberculosis coverage among children 0-11 months old by 5%, this effect is mainly due to a reduction in vaccination rates in the control group rather than an increase in the treatment group. Moreover, after 12 months, there is no longer a significant impact of *Oportunidades*, because the control group recovered from the drop in vaccination coverage. For the *Red de Protección Social* in Nicaragua, the program intervention leads to a significantly increase in coverage of

[11] The data source is based on three rounds of survey in 1998 and 1999: ENCEL_1998 AND ENCEL_1999 at six-month interval.
[12] By 1992, the coverage rages for tuberculosis was95%.

the third dose of diphtheria-pertussis-tetanus vaccine and fully vaccinated children.[13] This increase was also experienced among the children far from the health clinics and those with less educated mothers. The author suggests possible modifications on the program design, such as targeting towards people who have limited access to health services or are less educated so that the program intervention can be more effective.

Another commonly used indicator of children health status is health outcomes such as morbidity, anemia and mortality. Gertler (2004) obtains strong evidence of a significant reduction of young children illness rate due to the *Oportunidades* intervention.[14] His findings also show that for children younger than 3 years and infants born during the intervention period, the longer they stay in the program, the larger the program effects.

The impact of *Oportunidades* on anemia reduction for children has been investigated by Gertler (2004) and Rivera et al. (2004). Using the survey data between 1998 and 2000 from Mexican rural area,[15] they obtain that children participating in the program are less likely to be anemic than their counterpart in the control group.

Barham (2010) uses neonatal and infant mortality as health outcomes to investigate the effect of *Oportunidades* on children health. She uses data collected from 1997 to 2001 and includes municipality and time fixed-effects in the model.[16] Her findings

[13] The survey data includes a baseline household survey in September 2000, and two follow-up surveys implemented in October 2001 and October 2002.
[14] The data comes from five rounds of surveys from 1998 to 2000: ENCEL_1998, ENCEL_1999, and ENCEL_2000 at six-month interval.
[15] The dataset is the same as that used in Gertler (2004): ENCEL_1998, ENCEL_1999, and ENCEL_2000 at six-month interval.
[16] The mortality data are from a nation-wide database containing information on every certified death in Mexico and were provided by the Mexican Ministry of Public Health. The data about *Oportunidades* was collected between 1997 and 2001.

show that an 8% reduction in average infant mortality can be attributed to *Oportunidades* starting in 1997. This contrasts with a decrease in infant mortality rate in rural areas of less than 1% between 1992 and 1996, before the program was implemented.

Other papers focus on indicators measuring intellectual and behavioral outcomes of young children. Therefore, they measure the medium- and long-term impact of *Oportunidades*. Gertler and Fernald (2004) use survey data from 1998 to 2003 in Mexican rural areas [17] to investigate the 3-6-year impact of *Oportunidades* on cognitive, motor, and socio-emotional development of young children. They select three different groups, the first is for the children receive intervention from the very beginning of the program in 1998, the second is for the children incorporated one and half years later than the first group, the third one is for the children never incorporated in the program. After controlling for the observed differences in the three groups, they obtain a significant positive impact of the program on children's motor and behavioral development, especially on girls' motor skills. Children who have better motor skills are healthier and can participate in school activities better. However, they do not find a significant impact of the program on children's cognitive development. They point out that the program should improve household environment in order to provide more stimulation for the improvement of young children's cognitive abilities.

Ozer et al. (2009) investigated the impact of *Oportunidades* on symptoms of anxiety/depression and symptoms of aggression/oppositional of 4- and 5-year-old children in rural areas.[18] The outcome measure for their analysis was mothers' report

[17] The datasets are the baseline survey data ENCEL_1998 and the follow-up survey data each year until 2003. Some new participants were incorporated into the program, but the authors excluded the households incorporated after 2000 in order to focus on the households that had more than 3 years exposure to the program.

[18] In 2003, they applied a household-level survey to a subsample of original treatment group since 1998 and a

of behavior problems.[19] Since there is no explicit component in the program that addresses children's behavior, their analysis is based on the idea that the program could exert effects on children behavior by improving nutrition condition or by remission of severe economic stress. They obtained that, although the program did not address children's behavior problems directly, it had positive effect on young children's behaviors.

4. Data

4.1 Sample Definition

The data comes from two rounds of surveys, which were carried out by the Evaluation Group of *Oportunidades* in September – December 2002 and June – November 2004 in Mexican urban areas. These two rounds of surveys collected information on socioeconomic characteristics, such as demographic information, household property, consumption behavior; and health outcomes, including children height, weight, hemoglobin, and food intake frequency for both control and treatment groups.

As mentioned in Section 2, unlike in rural areas, the design of *Oportunidades* in urban areas is non-randomized allocation. In the projected urban areas with population of 50,000 to 1,000,000 residents, the households were categorized as

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subsample of new participants of the program. The treatment group had been receiving *Oportunidades* benefits for 3.5 to 5 years. The control group was newly created households before the survey applied.

[19] The behavior problems include: argues a lot, complains of being alone, cries a lot, acts mean/cruel with others, demands attention, destroys own thing, destroys things of family, disobedient at home, afraid of thinking/doing something wrong, feels as though he/she to be perfect, feels as though nobody loves her/him, feels worthless or inferior, fights a lot, spends time with people who get in trouble, prefers being alone instead of with others, tells lies, cheats, being nervous/tense, being too anxious/afraid, and feels guilty for everything.

eligible (poor) and non-eligible (not poor) according to ENIGH 2000. The households who apply to incorporate into the program would be allocated into the potential treatment group. If the eligible households did not apply for the benefit, they would be allocated into the control group. For the potential treatment group, a screening questionnaire was carried out to verify their socio-demographic data. Non-eligible (not poor) households would be excluded from the treatment group. After this selection, the control and treatment groups were set up, and both groups would answer a set of questionnaires called ENCELURB[20] in each year. In this paper, we use data from the ENCELURB 2002 and ENCELURB 2004.

The baseline survey, ENCELURB 2002, has two large components, a socioeconomic survey and a biological survey. The socioeconomic survey contains information on 17,201 households. The information collected included socio-demographic characteristics, occupation, consumption, expenditure, and incomes. In the biological survey, the anthropometric measurement questionnaire was applied to 5,762 children aged less than 47 months; the food intake frequency questionnaire was applied to 3,351 children aged less than 36 months. The anthropometric measurement questionnaire collected information on age, gender, height, weight, hemoglobin level and anemia for the children.[21] However, information on the hemoglobin level and anemia was only collected for a very small proportion of the children. Hence, we cannot use the data on hemoglobin level and anemia. The questionnaire of food intake frequency contains information on frequency and quantity of 50 kinds of food they eat/drink. Unfortunately, for many food species the information is missing for more

[20] ENCELURB: abbreviation of its Spanish name *Encuesta de Evaluación de los Hogares Urbanos* (Assessment Survey of Urban Household in English).
[21] Children's height was measured using a PVC infant meter, made of a 2-meter long flexible metallic measuring tap and a movable right angle structure. Children's weight was determined using a Tanita ® electronic weighting scale with accuracy to ±20 grams.

than half of the sample. So we include the nine more frequent kinds of food reported as controls in the main analysis.

The follow-up survey ENCELURB 2004 collected information on socioeconomic and biological characteristics. There were 17,023 households included in the socioeconomic survey. Because the upper age limit of children who participate in the survey is 60 months, so the anthropometric questionnaire[22] and food intake frequency questionnaire were applied to 3,315 children aged 24-60 months.

The subsample of children used in this analysis has been obtained through three steps. Firstly, the dependent variable in our analysis will consist of children health status, such as height for age and sex, weight for age and sex, and weight for height. Since our estimation strategy will be the use of fixed effect, it is necessary to have the children's anthropometric measurement in both 2002 and 2004. Combining the children's anthropometric measurement datasets of 2002 and 2004 based on the unique individual ID, there is information on 1,788 children both in 2002 and in 2004. Because the upper age limits of the children in the program in 2002 and 2004 are 60 months, so the children appearing in both 2002 and 2004 are aged between 0 to 36 months in 2002. After computing the z scores for height-for-age, weight-for-age, and weight-for-height, we obtain the subsample 1 in the analysis.[23] For these children, we have their anthropometric information and whether they are in control or treatment

[22] Relative to the anthropometric survey in 2002, there are some changes in the anthropometric measurement instruments. Children's height was measured with a portable wooden infant meter with a 198 cm limit and accuracy to 1 mm. Children's weight was taken using a single electronic weighting scale with a 135 kg for older than 24 months. These adjustments were made according to children's growth. For infants who cannot stand or walk, it is proper to measure their height using a flexible PVC infant meter, and it is better to use wooden meter when the children can stand and walk. Similarly, for children older than 2 years, a larger weighting scale is better than the weighting scale only for newborn babies and infants.

[23] The details of computation of z scores for height-for-age, weight-for-age, and weight-for-height are present in the following subsection.

groups, but we do not have information on food intake frequency and socioeconomic characteristics of the households for all the children, because not every individual child in this subsample participate in all three surveys.

The second step is to clean the datasets taking the socioeconomic characteristics and food intake frequencies into consideration. The reason of doing so is that, besides the program, there are some other factors that may explain a change of the children's health status, such as their household environment and their food intake behavior. For the socioeconomic characteristics survey, 14,787 households appear both in 2002 and in 2004; for the food intake frequency survey, 1,026 children that participate in the 2002 survey are included in the 2004 survey. After matching the two data sets for the same survey in 2002 and 2004, we get two datasets for matched participants with information on socioeconomic characteristics and food intake frequency, respectively.

The third step to get the subsample 2 is combining the subsample 1 with the two datasets of matched participants in both years. Flowchart 1 in the Appendix describes the process of data filtering, from the data source to the two subsamples that would be used in the following analysis. In subsample 2, the control group contains 303 children, and the treatment group contains 643 children.

4.2 Variables Definition

The dependent variables are children health indicators. Although we have information on children's age, sex, height, and weight, we cannot use these indicators directly. The reason is straightforward: it is meaningless to compare the height or weight of children with different ages since they have different growth standards according to different ages. In order to control for that, we calculate the commonly used anthropometric indices: z scores for height-for-age, z score for weight-for-age, and z score for weight-for-height to assess children growth status.

The z score is widely recognized as the adequate system for analysis of anthropometric data. It expresses the anthropometric value as a number of standard deviations below or above the reference mean (World Health Organization (WHO) Global Database on Child Growth and Malnutrition). Here, we use the WHO Child Growth Standards released in 2006 as the reference. The standard is based on the growth data of healthy breastfed infants and young children aged less than 5 years old in Brazil, Ghana, India, Norway, Oman and USA. The z score is calculated according to the following formula:

$$\text{z score} = \frac{\text{observed value} - \text{mean value of reference population}}{\text{standard deviation of reference population}}$$

According to the WHO Child Growth Standards, low height-for-age, low weight-for-age, and low weight-for-height are defined as less than -2 z score. A z score for height-for-age smaller than -2 is defined as stunted, and a z score for weight-for-height less than -2 is defined as wasted. The criteria to judge whether a population is healthy is not that the percentage of stunting or wasting is zero. According to the WHO definition, even in a general health population, about 2.3% of children have a z score for health outcomes lower than -2. Hence, a proportion that equal to or below 2.3% is regarded as the expected prevalence of malnutrition for any population. In this analysis, we follow these definitions about z scores for height-for-age, weight-for-age and weight-for-height. Also we use the 2.3% as the benchmark of measuring whether the population is healthy.

We compute the z scores for height-for-age, weight-for-age, and weight-for-height according to the WHO growth standard for child aged 0-5 years old. For all children in the subsample 1, we get z scores for height-for-age, weight-for-age, and weight-for-height for 1,781 children.[24] This process produced the subsample 1 in the analysis.[25]

The explanatory variables used in the analysis can be classified in three categories: children characteristics, household characteristics (housing situation and consumption), and calories from main food intake. These variables are list in the end of the Appendix.

4.3 Descriptive Statistics

In this section, we present some descriptive statistics based on the survey data in 2002 and 2004, which correspond to the year of the program intervention and two years after. We first describe some basic facts about the health status of children aged 0 to 3 years old, who appear in the anthropometric survey both in 2002 and 2004 (subsample 1 shown in the flowchart 1). Then we analyze the subsample 2, considering some food intake frequency and socioeconomic characteristics, to investigate the impact of *Oportunidades* intervention. As shown in the program intervention in Section 2, young children aged 6 to 24 months old, undernourished

[24] The height and weight value are missing for 2 children in 2002, and 3 children exceed 60-month-limitation in 2004, so we cannot calculate their z score for height-for-age and weight-for-age. Also, 2 children's heights were below 45 cm, which is the minimum height in the weight-for-height WHO standards, so that we cannot calculate the z score for weight-for-height. After excluding the 7 children from our sample, we have 1,781 children in the subsample of z scores.

[25] See, Flowchart 1 in the Appendix.

children 2 to 5 years old and pregnant women can receive daily nutritional supplements. In our sample, children are aged between 0 to 3 years old, children who were younger than 2 years old account for more than 90% of all children. Hence, our analysis is based on the sample, which includes all children aged 0 to 3 years old.

Table 1 shows the health status for children in 2002 and 2004. The first three rows for 2002 and 2004 give information on z scores for height-for-age, weight-for-age, and weight-for-height for all children in subsample 1, control and treatment groups, respectively. The last two rows for 2002 and 2004 show the proportion of being stunted, and wasted, defined as being more than two standard deviations below the mean for the standards, for all children in the sample, control and treatment groups, respectively.

At the beginning of the *Oportunidades* intervention in 2002, on average, the children are 0.94 standard deviations below the standard in terms of height-for-age, and 0.12 standard deviations below the standard in terms of weight-for-age. For these two indicators, children in control group have worse health status than those in the treatment group. The average z score for weight-for-height is 0.51 above the WHO standard. It is higher for children in the treatment group than that for the children in the control group. Two years after the implementation of the program, in 2004, the children are 1.57 standard deviations below the standard in terms of height-for-age, and 0.58 standard deviations below the standard in terms of weight-for-age. Comparing these two indicators for the control and treatment groups, children in treatment group have better health status than those in the control group. It seems that children's average health status in terms of height-for-age and weight-for-age deteriorated two years after the program was implemented. However, this does not necessarily mean that *Oportunidades* had no impact on health outcomes. We need to analyze the changes of control and treatment groups separately to see if children's health outcomes in the two groups deteriorated at the same rate.

In terms of the growth problems, as we mentioned in the previous section, the expected proportion of low z score for health outcome in a population is 2.3%. In 2002, for the children in poverty in urban areas, comparing with 22% of the children being stunted, only 1% of them are wasted. In 2004, the proportion of stunted children is 33%, while the proportion of wasted children is only 0.28%. The percentage of being stunted and wasted for children in the control group is higher than that in the treatment group. The above numbers indicate that children seem to be more affected by stunting than by wasting in urban Mexico. This is similar to the finding of Behrman and Hoddinott (2001) that stunting is more serious than wasting, based on the data of rural areas in 1998. Other papers also report that there is a substantial incidence of stunting with its damaging long-run effects, but not much wasting (e.g. Martorel (1999), Johnston et al. (1987)).

Table 2 shows the allocation of children of subsample 2 into control and treatment groups of different age group. Over 90% children were younger than 24 months during the survey in 2002. This corresponds to the intervention rule that children aged 6 to 24 months receive daily nutrition supplement. The ratio of children in control and treatment groups is around 3:7. The children aged between 12 to 24 months are split to control and treatment groups at this ratio. And children in this age group account for 50% of all children in control group and treatment group respectively. One of the reasons is that during the period that the households chose whether to incorporate before the program intervention, potential treatment households acknowledged all the intervention rules, so the households with younger children (less than 2 years old) would more likely to incorporate into the program.

Table 3a and Table 3b summarize the health status of children in 2002 and 2004 in control and treatment groups of each age group. We notice that for z scores for height-for-age and weight-for-age, children younger than 6 months have the best health status in both control groups and treatment group in 2002. However, in 2004, the health status for these children deteriorated the most in terms of z scores for height-for-age and weight-for-age, which decreased by 1.5 standard deviation. Both in control and treatment groups, the z scores for height-for-age and weight-for-age of children aged 12 to 24 months are lower than those in other age groups in 2002. In 2004, these two indicators for the children in this age group are still the lowest among others. For the z scores for weight-for-height, although it varies in each age group, they are all positive and above the WHO standard both in 2002 and in 2004.

Next we consider some basic characteristics of variables used in the analysis. Table 4a and Table 4b give the means and standard deviations for children in the control group and treatment group in 2002 and 2004 for groups of factors related to child characteristics, household characteristics, and calories from food. Although these children live in the urban areas, their household resources are very limited: in 2002, in both the control and treatment groups, on average 6 people live in very crowed houses (only about 0.3 rooms per person), and the majority do not have water connection; nearly half of the households in the treatment group have dirt floors. In 2004, the household characteristics in the treatment group improved, such as fewer households had dirt floor and more households had water connections. For the calories from food intake per week, in the control group, the calories from tomato, milk, sugar and oil decreased from 2002 to 2004, while the calories from the other food increased. Comparatively, only the calories from sugar and oil decreased in 2004, while the calories from the other food increased.

5. Empirical Model

We now briefly discuss the difference-in-differences method that will be used in the analysis.

The basic requirement is that outcomes be observed for two groups (control and treatment) for two time periods. The treatment group is the one that is exposed to the intervention in the second period but not in the first period; control group is not exposed to the intervention in each period. The effects of the intervention can be obtained by subtracting the average change of outcomes in the control group from the average change of outcomes in the treatment group. The difference-in-difference model makes the assumption that the outcomes in treatment group would change at the same rate as in the control group if the intervention does not exist.

Since we have a two-period panel data, we need to use the fixed effects estimates to control for the unobserved factors of individual child. The model can be formalized as:

$$y_{it} = \beta_0 + \beta_1 dA + \beta_2 d2004 + \beta_3 dA \bullet dT + \beta_4 C + \beta_5 H + \beta_6 K + f_i + u_{it} \qquad (5.1)$$

where y_{it} is the health outcomes, such as z scores for height-for-age, weight-for-age and weight-for-height, of individual i in period t. d2004 is a dummy variable for the time period (equals to 1 in 2004) and it captures aggregate factors that would cause changes in y even in the absence of the intervention. Another dummy variable dTREAT captures the difference between the control and treatment groups that do not change over time. The interaction term, dTREAT•d2004 is the same as a dummy variable equal to one for those observations in the treatment group in the second period. C is a set of children characteristics, such as sex and age. H is a set of household characteristics, such as housing status and monthly expenditure. K is a set of calories from food intake per person every week. F_i is the individual-level unobserved factors. The main assumption in this estimation procedure is that f_i is constant over time. We also assume that

$$E\,(u_{it} \mid dA, dT, dA \bullet dT, C, H, K) = 0 \qquad t = 1, 2 \qquad (5.2)$$

This assumption indicates that, conditional on the independent variables, the expected value of the error term is zero. The covariance of the error term does not affect the change of the dependent variable. So the factors that impact the health outcomes of children are the independent variables and the fixed effect. As the fixed effects f_i control for all unobserved factors, we can estimate the partial effects of the observed factors in the model. Additionally, we do not include any observed time-constant factor in the estimation, as we would not be able to distinguish the effects of observed time-constant factors from unobserved time-constant factors. We only estimate the effects of observed time-variant factors.

In this model, the difference-indifferences estimate is the estimate the coefficient of the interaction term, dA•dT, β_3:

$$\beta_3 = (y_{treat,\, t=2} - y_{treat,\, t=1}) - (y_{control,\, t=2} - y_{control,\, t=1}) \qquad (5.3)$$

It measures the effect of the *Oportunidades* intervention two years after the implementation comparing the changes between treatment and control groups. The coefficient β_3 indicates the impact of the program intervention on health outcomes of young children. Section 6 presents these estimates.

6. Main Results

Our estimate of the impact of *Oportunidades* intervention is based on the theoretical framework in Section 5. We use the difference-in-differences estimate to compare the change (before and after *Oportunidades*) in children health status of treatment group with the corresponding change in control group. Since we have panel data, the differences are calculated for the same individuals of the two years. We also report the regression results for pooled OLS. Both pooled OLS regressions and fixed effect regressions are based on the subsample2.

6.1 Pooled OLS Regression

Table 5 shows three OLS estimates on the z score for height-for-age for children in the sample. The first regression does not include any control variables apart from the effect of the program, a time dummy, and a treatment dummy. The second regression adds the logarithm of children's age in the explanatory variables. The third regression adds children's sex and factors of household characteristics and calories from food intake summarized in the explanatory variable list in the Appendix. The coefficient of dTREAT•d2004 is not statistically significant at 90% level in the first regression, but is significant at 95% level in the second and third regression. Without any control variables but the effect of the program, a time dummy, and a treatment dummy, the program intervention does not have significant impact on z score for height-for-age for the children. However, adding more control variables into the regression, the program intervention has significant positive impact on z score for height-for-age for the children. Participating in the program increase the z score for height-for-age by 0.41. In the last two regressions, the logarithm of child's age is one of the independent variables. As the age increases, it leads the z score for height-for-age drop by 0.73 and 0.76, respectively. Among the variables included in the estimates in the third column, the group of calories from food intake is not significant at the 10% level. As we adding more control variables into the regression, the fraction of variance due to the residual term increases.

Table 6 shows three pooled OLS regressions on the z score for weight-for-age for the children in the sample. The coefficient of dTREAT•d2004 is not statistically significant at 10% level in the first regression, but is significant at 5% level in the second and third regression. The first regression result indicates that, without any control variables but apart from the effect of the program, a time dummy, and a treatment dummy, the program intervention does not have significant impact on z score for height-for-age for the children. Adding more control variables in the regression, the program intervention has significant positive impact on z score for weight-for-age. Participating in the program increases the z score for weight-for-age by 0.31 and 0.36 respectively in the two estimates. In the last two regressions, the logarithm of child's age is one of the independent variables. As the age increases, it leads the z score for height-for-age drop by 0.38 and 0.32, respectively. Among the variables included in the estimates in the third column, the groups of the household coefficient and the calories from food intake are not significant at the 10% level. As we adding more control variables into the regression, the fraction of variance due to the residual term increases.

Similar to the two tables above, Table 7 shows three OLS estimates on the z score for weight-for-height. The results show that in all three regressions on z score for weight-for-height, the coefficient of dTREAT•d2004 is not statistically significant in any regression. Only in the second regression, the coefficient of the logarithm of child's age is significant at the 10% level. Among the variables in the third column, none of the coefficient of the variables is significant at the 10% level. We need to see if the program intervention is still insignificant in the following regression with fixed effect.

As the above OLS regressions ignore the unobserved factors that impact the health outcomes, so the regressions might overestimate the effect of the program intervention. The biased estimation is caused by the self-selection into the treatment group of control group. We need to do the fixed effect regression to control for the unobserved explanatory factors to get the unbiased estimate of the coefficient of the independent variables of interest.

6.2 Fixed Effect Regression

In this section, we estimate the overall program intervention on z scores for height-for-age, weight-for-age, and weight-for-height respectively using fixed effect estimation. As the fixed effect controls for unobserved and observed time-invariant factors, so the variables indicating whether the children are in treatment group dTREAT, and children sex are dropped.

Table 8 gives two fixed effect estimates of the program intervention on z score for height-for-age for the children. The first column shows that the coefficient of dTREAT•d2004 is not statistically significantly different from 0 at the 10% level, when no other controls are added. There is no significant relationship between this defined program intervention and z score for height-for-age. In the second regression we add variables related to household characteristics and calories from food intake summarized in the explanatory variable list in the Appendix. The results show that the coefficients of d2004 and Program are in 90% confidence intervals. There exists a significant relationship between the program intervention and z score for height-for-age. In the post-intervention period, z score for height-for-age is 0.53 lower than that in 2002, which means on average children health status in terms of height-for-age deteriorated after the program intervention. However, the program intervention leads z score for height-for-age to increase by 0.45. In other words, the z score for height-for-age for children who received program intervention decreased less than that for children who did not receive the intervention. The estimates suggest that *Oportunidades* intervention had a significant positive impact on children health in terms of z score for height-for-age. Among the factors in the second column, the coefficient of the logarithm of child's age is not significant at the 10% level. The groups of household coefficients and the calories coefficients are not significant at the 10% level.

Table 9 shows two fixed effect estimates of the program intervention on z score for weight-for-age. The first column shows that there is no significant relationship between the program intervention and z score for weight-for-age. The second regression adds household characteristics and calories from food intake. The results show that the coefficients for the time period and the program intervention are significantly different from zero. Similar to the results in Table 8, two years after the baseline survey in 2002, on average children health status in terms of weight-for-age deteriorated. However, the program intervention increased the z score for weight-for-age by 0.32. Z score for weight-for-age for children did not receive the intervention decreased more than that for those did. The program intervention had a positive impact on z score for weight-for-age overall. Among the factors in the second column, the coefficient of the logarithm of child's age, the groups of household coefficients and the calories coefficients are not significant at the 10% level.

As we discussed in Section 4, the problem of stunting is more serious than wasting. Similar to most government intervention programs that focus on health, the main goal of *Oportunidades* is to improve the health status of the malnourished children. For the children in the sample we have, z score for weight-for-height and the proportion of wasting are above the WHO standards, which means the children health status in terms of weight-for-height is above the expected level. There are no specific interventions that aim to improve children health for those who had already been healthy. Hence, under the general intervention, there is no significant impact of the program intervention on z score for weight-for-height. Table 10 shows two fixed effect estimates of *Oportunidades* intervention on z score for weight-for-height. The results show that, in both specifications, the program intervention is not significantly different from 0 in 90% confidence intervals. There is no significant impact of the program intervention on z score for weight-for-height. We fail to reject the assumption that all coefficients equal to zero.

Through the three tables above, we obtain the following results: on average the z scores for height-for-age and weight-for-age both decreased in 2004, which means the health status in terms of height-for-age and weight-for-age deteriorated. However, children who received *Oportunidades* intervention had better health status than those did not receive any treatment during the two years. For z score for weight-for-height, we did not obtain evidence that the program had a significant impact on this health outcome. One of the reasons for the result is that before the *Oportunidades* intervention in 2002, the average z score for weight-for-height of the sample was already above the WHO standards, so it is difficult for any intervention to improve the health status for healthy children under the general interventions that focus to improve health for those malnourished.

7. Conclusion

The first few year of life is a crucial period for children's physical and intellectual growth. However, poverty and its accompanying problems cause several children growth problems, such as malnutrition, stunting, wasting, anemia, malaria, and other diseases. To improve children's development and break the poverty transmission between generations, some developing countries in Latin America, such as Mexico, Brazil, adopted conditional cash transfer programs. The CCT program in Mexico, *Oportunidades*, has two types of program design in its implementation. When it was operated in rural areas in 1997, the program was designed as randomized allocation. It was non-randomized design when it expanded to urban areas in 2002.

In this paper we attempt to evaluate the impact of *Oportunidades* in Mexico on children's health. The analysis is based on the survey data from Mexican urban areas in 2002 and 2004. We use z scores for height-for-age, weight-for-age, and weight-for-height as the proxy of children health status. We find that the program contributed to improved z scores for height-for-age, and weight-for-age. Although from 2002 to 2004, these two indicators both decreased for all children on average, because of the program intervention, the z score for height-for-age and z score for weight-for-age for the children in treatment group increased by 0.54 and 0.32, respectively. For the third health outcome, z score for weight-for-height, we did not obtain significant result of the program intervention. Before the program intervention in 2002, the children in the sample had poor health status in terms of z scores for height-for-age and weight-for-age, but not z score for weight-for-height. Their health statuses in terms of weight-for-height and wasting were better than the expected status. Also because there were no specific interventions in *Oportunidades* that aim to improve health outcomes for healthy children, so it was difficult to obtain good intervention effect on all health outcomes that below-standards and above-standards.

It is a long-run task to reverse poor health status for all children in a large population. Through our analysis based on the two-year data, we did not see that *Oportunidades* turn children health status from below-standards to above. However, it is not deniable that the program intervention did prevent children health deterioration in the short term.

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Appendix

Flowchart 1: The procedure of data filtering from the original datasets to subsamples

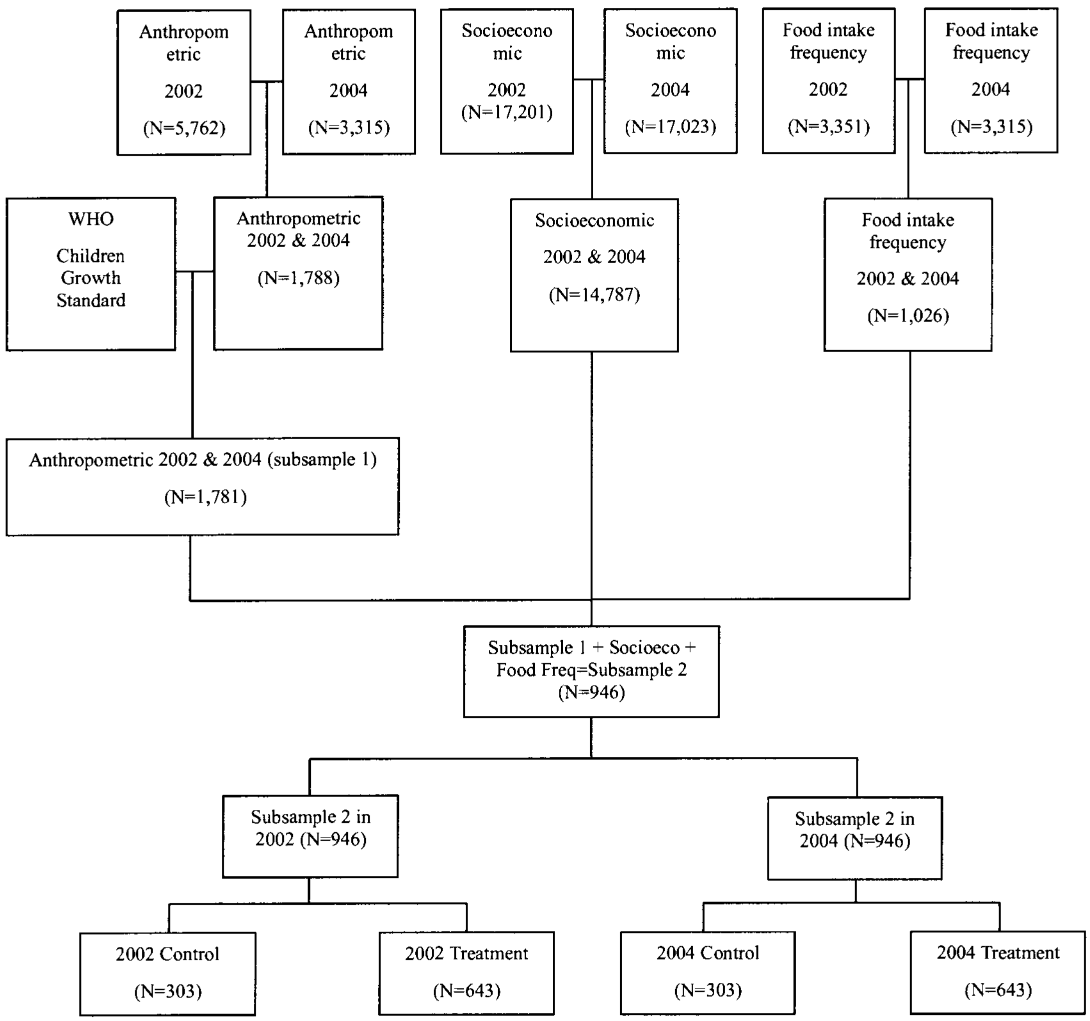

Table 1: Health Status for Children in 2002 and 2004

Health Status Indicator	Overall		Control		Treatment	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
2002						
Z score for height-for-age	-0.94	0.04	-1.05	0.04	-0.81	0.07
Z score for weight-for-age	-0.12	0.03	-0.12	0.03	-0.11	0.05
Z score for weight-for-height	0.51	0.03	0.62	0.04	0.38	0.04
Proportion stunted	0.22	0.01	0.22	0.01	0.22	0.01
Proportion wasted	0.01	0.00	0.01	0.00	0.01	0.00
2004						
Z score for height-for-age	-1.57	0.03	-1.69	0.04	-1.43	0.04
Z score for weight-for-age	-0.58	0.02	-0.66	0.03	-0.49	0.03
Z score for weight-for-height	0.53	0.03	0.51	0.03	0.55	0.05
Proportion stunted	0.33	0.01	0.37	0.02	0.29	0.02
Proportion wasted	0.00	0.00	0.00	0.00	0.00	0.00

Notes: the sample size is 1781 in 2002 and 2004.
Source: Calculated by the author.

Table 2: Number and percentage of children in control and treatment groups by age group

Age group (2002)	Control	Treatment	Total
0-6 months	39	136	175
Row percentage	22.29%	77.71%	100%
Column percentage	12.87%	21.15%	18.50%
6-12 months	58	167	225
Row percentage	25.78%	74.22%	100%
Column percentage	19.14%	25.97%	23.78%
12-18 months	88	178	266
Row percentage	33.08%	66.92%	100%
Column percentage	29.04%	27.68%	28.12%
18-24 months	67	144	211
Row percentage	31.75%	68.25%	100%
Column percentage	22.11%	22.40%	22.30%
24-36 months	51	18	69
Row percentage	73.91%	26.09%	100%
Column percentage	16.83%	2.8%	7.29%
Total	303	643	946
Row percentage	32.03%	67.97%	100%
Column percentage	100%	100%	100%

Source: Calculated by the author.

Table 3a: Mean z scores for height-for-age, weight-for-age, and weight-for-height of children in the control group in 2002 and 2004, by age group

Age group (2002)	z score for height-for-age			
	2002		2004	
	Mean	Standard deviation	Mean	Standard deviation
0-6 months	-0.17	0.22	-1.72	0.42
6-12 months	-0.62	0.13	-1.78	0.13
12-18 months	-1.21	0.14	-1.79	0.11
18-24 months	-1.48	0.15	-1.84	0.13
24-36 months	-1.36	0.15	-1.56	0.17
	z score for weight-for-age			
	2002		**2004**	
	Mean	**Standard deviation**	**Mean**	**Standard deviation**
0-6 months	0.13	0.17	-0.89	0.28
6-12 months	-0.16	0.10	-0.65	0.12
12-18 months	-0.37	0.11	-0.74	0.09
18-24 months	-0.30	0.12	-0.77	0.10
24-36 months	-0.24	0.12	-0.71	0.11
	z score for weight-for-height			
	2002		**2004**	
	Mean	**Standard deviation**	**Mean**	**Standard deviation**
0-6 months	0.43	0.17	0.00	0.15
6-12 months	0.30	0.11	0.57	0.14
12-18 months	0.29	0.13	0.46	0.10
18-24 months	0.54	0.13	0.50	0.10
24-36 months	0.78	0.13	0.38	0.10

Source: Calculated by the author.

Table 3b: Mean z scores for height-for-age, weight-for-age, and weight-for-height of children in the treatment group in 2002 and 2004, by age group

Age group (2002)	z score for height-for-age			
	2002		2004	
	Mean	Standard deviation	Mean	Standard deviation
0-6 months	0.75	0.32	-1.43	0.10
6-12 months	-0.76	0.10	-1.36	0.08
12-18 months	-1.40	0.09	-1.57	0.09
18-24 months	-1.66	0.11	-1.55	0.08
24-36 months	-1.38	0.33	-1.15	0.29
	z score for weight-for-age			
	2002		2004	
	Mean	Standard deviation	Mean	Standard deviation
0-6 months	0.74	0.20	-0.47	0.08
6-12 months	-0.02	0.08	-0.41	0.07
12-18 months	-0.51	0.06	-0.59	0.07
18-24 months	-0.61	0.08	-0.65	0.06
24-36 months	0.02	0.24	-0.15	0.26
	z score for weight-for-height			
	2002		2004	
	Mean	Standard deviation	Mean	Standard deviation
0-6 months	0.40	0.16	0.46	0.09
6-12 months	0.64	0.12	0.57	0.08
12-18 months	0.20	0.07	0.60	0.18
18-24 months	0.24	0.09	0.44	0.08
24-36 months	1.17	0.25	0.87	0.21

Source: Calculated by the author.

Table 4a: Means and Standard Deviations of basic characteristics for children in the control group in 2002 and 2004

	Mean and Standard Deviations			
	2002		2004	
Health outcomes	**Mean**	**Standard deviation**	**Mean**	**Standard deviation**
Height (cm)	74.59	0.46	90.57	0.37
Weight (kg)	9.55	0.12	13.25	0.12
Z score for height-for-age	-1.05	0.07	-1.75	0.08
Z score for weight-for-age	-0.23	0.05	-0.74	0.06
Z score for weight-for-height	0.45	0.06	0.42	0.05
Stunted	0.23	0.02	0.40	0.03
Wasted	0.02	0.01	0.01	0.00
Child characteristics				
Age (months)	15.19	0.55	39.30	0.48
Sex (male)	0.51	0.04	0.51	0.03
Household characteristics				
Household size	6.16	0.16	6.25	0.16
Dirt floors (%)	0.33	0.04	0.31	0.03
Water connection (%)	0.14	0.03	0.15	0.02
Rooms per household member	0.32	0.02	0.32	0.02
No. of children younger than 6 years	1.73	0.06	1.79	0.06
Ln consumption per capita per month	5.45	0.05	5.63	0.04
Calories from food intake per week				
Tomato	119.98	8.33	97.10	11.33
Onion	46.43	2.47	49.08	3.82
Banana	1413.16	150.53	1694.10	239.11
Rice	1904.31	168.48	3096.80	404.39
Bean	500.91	45.99	665.84	86.70
Egg	849.46	75.66	1033.76	146.18
Milk	2245.89	183.40	1871.75	161.03
Sugar	843.70	72.00	692.16	62.97
Oil	1716.08	76.52	1667.85	82.09

Source: Calculated by the author.

Table 4b: Means and Standard Deviations of basic characteristics for children in the treatment group in 2002 and 2004

	Mean and Standard Deviations			
	2002		2004	
Health outcomes	**Mean**	**Standard deviation**	**Mean**	**Standard deviation**
Height (cm)	71.15	0.33	89.91	0.24
Weight (kg)	8.67	0.08	13.17	0.08
Z score for height-for-age	-0.84	0.09	-1.47	0.04
Z score for weight-for-age	-0.13	0.06	-0.52	0.04
Z score for weight-for-height	0.39	0.05	0.54	0.06
Stunted	0.23	0.02	0.31	0.02
Wasted	0.02	0.01	0.00	0.00
Child characteristics				
Age (months)	12.05	0.36	36.24	0.32
Sex (male)	0.50	0.03	0.50	0.02
Household characteristics				
Household size	5.72	0.11	6.17	0.13
Dirt floors (%)	0.45	0.03	0.37	0.02
Water connection (%)	0.11	0.02	0.19	0.02
Rooms per household member	0.28	0.01	0.31	0.01
No. of children younger than 6 years	1.71	0.04	1.74	0.04
Ln consumption per capita per month	5.36	0.04	5.58	0.03
Calories from food intake per week				
Tomato	100.05	4.60	102.98	8.95
Onion	44.64	1.72	46.03	2.34
Banana	1230.78	75.30	1540.64	159.19
Rice	1970.09	114.91	3141.31	247.33
Bean	546.96	37.29	750.01	71.45
Egg	814.17	63.33	904.51	94.42
Milk	2079.49	97.80	2264.58	326.36
Sugar	669.52	28.53	554.14	38.39
Oil	1513.34	44.09	1428.64	55.98

Source: Calculated by the author.

Table 5: Pooled OLS estimates of impact of *Oportunidades* intervention on z score for height-for-age

	z score for height-for-age		
dTREAT•d2004	0.07 (0.13)	0.41 (0.09)**	0.41 (0.19)**
dTREAT	0.21 (0.11)*	-0.19 (0.09)**	-0.09 (0.12)
d2004	-0.70 (0.11)**	0.09 (0.10)	0.12 (0.18)
Constant	-1.05 (0.09)**	0.81**	0.16
Ln child age		-0.73**	-0.76**
Joint test for ln age and sex			Chi2(2)=99.33 Prob>chi2=0.0000
Joint test for household coefficients			Chi2(6)=17.51 Prob>chi2=0.0076
Joint test for calories coefficients			Chi2(9)=5.54 Prob>chi2=0.7845
Joint test for all coefficients	Wald chi2(3)=118.03 Prob>chi2=0.0000	Wald chi2(4)=339.32 Prob>chi2=0.0000	Wald chi2(20)=162.49 Prob>chi2=0.0000
Number of groups	946	946	605
Number of observations	1892	1876	727
R squared: within	0.1054	0.2446	0.1962
between	0.0071	0.0479	0.1945
overall	0.0425	0.1031	0.1731
sigma_u	0.94	0.91	1.02
sigma_e	1.35	0.92	0.86
rho (fraction of variance due to u_i)	0.33	0.49	0.58

Notes: * indicates significance at 10% level, ** indicates significance at 5% level. The difference of sample size is due to the missing observations as more control variables are added.

Table 6: Pooled OLS estimates of impact of *Oportunidades* intervention on z score for weight-for-age

	z score for weight-for-age		
dTREAT•d2004	0.12 (0.86)	0.31 (0.07)**	0.36 (0.12)**
dTREAT	0.10 (0.08)	-0.12 (0.07)	-0.37 (0.09)
d2004	-0.52 (0.07)**	-0.11 (0.07)	-0.23 (0.11)**
Constant	-0.23 (0.07)**	0.73 (0.12)**	-0.056 (0.36)
Ln child age		-0.38 (0.04)**	-0.32 (0.05)**
Joint test for ln age and sex			Wald chi2(2)=40.72 Prob>chi2=0.0000
Joint test for household coefficients			Wald chi2(6)=16.36 Prob>chi2=0.0120
Joint test for calories coefficients			Wald chi2(9)=4.07 Prob>chi2=0.9065
Joint test for all coefficients	Wald chi2(3)=123.66 Prob>chi2=0.0000	Wald chi2(4)=232.25 Prob>chi2=0.0000	Wald chi2(20)=106.85 Prob>chi2=0.0000
Number of groups	946	946	605
Number of observations	1892	1876	727
R squared: within	0.1113	0.1886	0.2091
between	0.0057	0.0210	0.1194
overall	0.0375	0.0615	0.1166
sigma_u	0.78	0.75	0.77
sigma_e	0.87	0.67	0.51
rho (fraction of variance due to u_i)	0.44	0.56	0.69

Notes: * indicates significance at 10% level, ** indicates significance at 5% level. The difference of sample size is due to the missing observations as more control variables are added.

Table 7: Pooled OLS estimates of impact of *Oportunidades* intervention on z score for weight-for-height

	z score for weight-for-height		
dTREAT•d2004	0.17 (0.11)	0.15 (0.10)	0.08 (0.17)
dTREAT	-0.06 (0.09)	-0.05 (0.09)	0.01 (0.10)
d2004	-0.03 (0.09)	0.08 (0.11)	-0.81 (0.16)
Constant	0.45 (0.08)**	0.72 (0.16)**	0.01 (0.45)
Ln child age		-0.11 (0.06)*	-0.01 (0.06)
Joint test for ln age and sex			Wald chi2(2)=0.29 Prob>chi2=0.8665
Joint test for household coefficients			Wald chi2(6)=2.31 Prob>chi2=0.8889
Joint test for calories coefficients			Wald chi2(9)=6.86 Prob>chi2=0.6522
Joint test for all coefficients	Wald chi2(3)=5.34 Prob>chi2=0.1483	Wald chi2(4)=6.91 Prob>chi2=0.1407	Wald chi2(20)=9.72 Prob>chi2=0.9729
Number of groups	946	946	605
Number of observations	1892	1876	727
R squared: within	0.0055	0.0096	0.0003
between	0.0002	0.0002	0.0202
overall	0.0021	0.0024	0.0145
sigma_u	0.70	0.70	0.69
sigma_e	1.12	1.09	0.82
rho (fraction of variance due to u_i)	0.28	0.29	0.42

Notes: * indicates significance at 10% level, ** indicates significance at 5% level. The difference of sample size is due to the missing observations as more control variables are added.

Table 8: Fixed effect estimates of the program intervention on z score for height-for-age

	z score for height-for-age	
dTREAT•d2004	0.07 (0.13)	0.45 (0.27)*
d2004	-0.70 (0.11)**	-0.53 (0.31)*
Constant	-0.91 (0.04)**	-1.16 (1.24)
Ln child age		-0.25 (0.20)
Joint test for household coefficients		F(6,104)=0.82 Prob>F=0.5536
Joint test for calories coefficients		F(9,104)=1.07 Prob>F=0.3909
Joint test for all coefficients	F(2,944)=55.64 Prob>F=0.0000	F(18,104)=2.25 Prob>F=0.0056
Number of groups	946	605
Number of observations	1892	727
R squared: within	0.1054	0.2805
between	0.0071	0.0617
overall	00392	0.0694
sigma_u	1.34	1.39
sigma_e	1.35	0.86
rho (fraction of variance due to u_i)	0.50	0.72
F test that all u_i=0	F(945,944)=1.97 Prob>F=0.0000	F(604,104)=2.54 Prob>F=0.0000

Notes: * indicates significance at 10% level, ** indicates significance at 5% level. The difference of sample size is due to the missing observations as more control variables are added.

Table 9: Fixed effect estimates of the program intervention on z score for weight-for-age

	z score for weight-for-age	
dTREAT•d2004	0.12 (0.09)	0.32 (0.16)**
d2004	-0.52 (0.07)**	-0.46 (0.18)**
Constant	-0.16 (0.03)**	-0.34 (0.73)
Ln child age		-0.10 (0.12)
Joint test for household coefficients		F(6,104)=0.71 Prob>F=0.6400
Joint test for calories coefficients		F(9,104)=0.55 Prob>F=0.8344
Joint test for all coefficients	F(2,944)=59.13 Prob>F=0.0000	F(18,104)=2.24 Prob>F=0.0059
Number of groups	946	605
Number of observations	1892	727
R squared: within	0.1113	0.2796
between	0.0057	0.0278
overall	0.0360	0.0440
sigma_u	0.99	0.95
sigma_e	0.87	0.50
rho (fraction of variance due to u_i)	0.57	0.78
F test that all u_i=0	F(945,944)=2.60 Prob>F=0.0000	F(604,104)=3.66 Prob>F=0.0000

Notes: * indicates significance at 10% level, ** indicates significance at 5% level. The difference of sample size is due to the missing observations as more control variables are added.

Table 10: Fixed effect estimates of the program intervention on z score for weight-for-height

	z score for weight-for-height	
dTREAT•d2004	0.17 (0.11)	0.08(0.26)
d2004	-0.03 (0.09)	0.12 (0.30)
Constant	0.41 (0.04)**	0.47 (1.18)
Ln child age		-0.17 (0.19)
Joint test for household coefficients		F(6,104)=0.75 Prob>F=0.6108
Joint test for calories coefficients		F(9,104)=1.28 Prob>F=0.2587
Joint test for all coefficients	F(2,944)=2.59 Prob>F=0.0758	F(18,104)=0.92 Prob>F=0.5573
Number of groups	946	605
Number of observations	1892	727
R squared: within	0.0055	0.1373
between	0.0002	0.0089
overall	0.0018	0.0014
sigma_u	1.06	1.14
sigma_e	1.12	0.82
rho (fraction of variance due to u_i)	0.47	0.66
F test that all u_i=0	F(945,944)=1.79 Prob>F=0.0000	F(604,104)=1.83 Prob>F=0.0001

Notes: * indicates significance at 10% level, ** indicates significance at 5% level. The difference of sample size is due to the missing observations as more control variables are added.

Explanatory Variable List

Time Period and Household Type	d2004
	dTREAT
	d2004• dTREAT
Children Characteristics	Age (months)
	Sex (male)
Household Characteristics	Household Size
	Dirt Floors
	Water connection
	Rooms per household member
	Number of children younger than 6 years
	Ln consumption per capita per month
Calories from Food Intake per Week	Tomato
	Onion
	Banana
	Rice
	Bean
	Egg
	Milk
	Sugar
	Oil