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The Impact of Conditional Cash Transfers on Nutrition: Evidence from Mexico

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Abstract

In this paper, I study the effect of *Oportunidades*, a conditional cash transfer program in Mexico, on the micronutrient and macronutrient levels of program recipients. Overall, I find that *Oportunidades* has a positive, significant impact on micronutrient acquisition for *Oportunidades* beneficiaries. Program participants consume 20.5% more vitamins and 10.1% more minerals than individuals living in non-treatment households. This change could be critical for reducing rates of micronutrient deficiencies in low- and middle-income countries. Furthermore, I conclude that although *Oportunidades* induces higher micronutrient consumption, program recipients also consume higher levels of calories, fat, and sodium, all of which could be harmful to health. Together, these two conclusions illustrate how *Oportunidades* contributes to both positive and negative nutritional outcomes.

Key Words

Oportunidades, conditional cash transfer, Mexico, macronutrients, micronutrients, nutrition transition, Western diet

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I. Introduction

Several decades ago, before the advent of the globalized “Western diet,” policy-makers assumed that hunger and malnutrition were, and would continue to be, the primary nutritional threats in low- and middle-income countries. In recent years, experts in food policy and international development have been surprised to find that this is not entirely accurate. Although hunger remains a key concern today, a secondary problem has emerged: poor nutritional health and high rates of obesity as a result of the “Western diet.” Now, countries face a double disease burden wherein they must address problems of malnutrition caused by nutritional deficits and, simultaneously, handle steep increases in nutrition-related chronic disease (Uauy and Monteiro, 2004). This two-pronged attack on the health of millions of individuals has, and will continue to have, staggering effects on health care costs, individual quality of life, and productivity in low- and middle-income nations (Popkin et al., 2012).

One method to address these nutrition and health concerns is conditional cash transfer programs. Conditional cash transfer programs (CCTs) are a type of public assistance program which offer regular cash transfers to beneficiary households in exchange for those parties adopting a set of outlined behaviors. CCT programs are designed to improve standard of living through adoption of the positive behaviors that are required of the program (be they health, nutrition, education, or work related), as well as through the direct cash transfer. In theory, the incentive-based programs seek to provide income assistance for participants, while also contributing to the human capital of those individuals. In this paper, I will study how Oportunidades, a conditional cash transfer program in Mexico, has affected the nutrition of individuals living in Mexico, specifically changes in micronutrient and macronutrient consumption. Oportunidades is often touted as one of the most successful public assistance programs of the 2000s, and has been used as a model for similar programs in more than 52 other countries around the world (The World Bank, 2014). For these reasons, it is a particularly important CCT program to study, as its effects have played out on both a domestic and global scale.

This paper's analysis is rooted in the phenomena of the "Western diet" and the "nutrition transition." The "Western diet" is an overarching term that encapsulates the rapid shift in diet composition that has occurred in many low- and middle-income countries (LMICs), most notably in areas of Latin America, Asia, Northern and Sub-Saharan Africa, and the Middle East. In affected areas, the Western diet has come to replace traditional food sources and methods of preparing meals with more modernized ones. With this transition, LMICs adapt their traditional diets, typically comprised of minimally-processed foods deriving from vegetables and cereals, to the higher-calorie Western diet (Baker and Friel, 2014). Adoption of the Western diet results in a sharp increase in the consumption of vegetable oils, animal source foods, sweeteners (both natural and artificial), and packaged/processed foods, along with a decrease in the consumption of cereals, coarse grains, and legumes (Popkin, 2001; Bermudez and Tucker, 2003; Popkin et al., 2012; Popkin et al., 2013; Popkin, 2014). In simple terms, global proliferation of the Western diet has resulted in diets higher in fat, sugar, and salt and lower in whole grains and fiber.

The "nutrition transition" describes the general movement towards the Western diet. In recent years, the nutrition transition has chronicled a significant increase in individuals that are either overweight or obese (Popkin, 2001; Popkin et al., 2012; Rivera et al., 2006, Vio et al, 2007). In 2014, 39% of the world's adult population was considered overweight and 13% of the adult population obese. Even more alarming is that fact that these conditions are not going away; since 1980, the prevalence of obesity has more than doubled worldwide (WHO, 2016). Higher rates of overweight and obesity are directly related to increased instances of non-communicable diseases (NCDs) such as diabetes, heart disease, and cancer, which come with lifestyle-impacting health problems and can be fatal (Popkin, 2001). The systemic changes that have occurred as a result of the nutrition transition will critically shape the health and nutrition frontiers in LMICs, as well as how conditional cash transfer programs are able to work in these new food environments.

There is a robust, but often conflicting, body of research concerning the nutrition effects of conditional cash transfer programs. First, CCTs have been shown to increase height and weight for both infants and children who are CCT program participants (Gertler, 2004; Lomelí, 2008). In one study, children (aged 1-3) who lived in Oportunidades households were found to be, on average, 0.96 centimeters taller than children not treated with the CCT transfer (Gertler, 2004). Using height-for-age z-scores (HAZ), which measure how many standard deviations a given child's height is from the population mean, Basset (2008) and Anderson et al. (2015) confirm this effect for Oportunidades, and for CCT programs in Peru, Colombia, and Nicaragua. Additionally, CCT programs have in some cases reduced stunting in treated children (Sanchez et al., 2016; Gertler, 2004; Basset, 2008; Andersen et al., 2015; Ramos and Van de Gaer, 2012). Basset (2008) finds that Oportunidades had a significant, negative impact on stunting, causing a reduction of 18% in the overall probability of children being stunted, although

García-Parra et al. (2016) finds that there is no effect on stunting in the rural region of Chiapas, Mexico. With regards to the Juntos program in Peru, Sanchez et al. (2016) find that a CCTs ability to reduce stunting in children depends heavily on the year of exposure for those children. They find that when children are first treated at age 0-3, severe stunting falls by 15%, but when children are first treated at age 5-7, there is no change in stunting.

There is not a clear relationship between CCT implementation and participant BMI, and the differences depend primarily on whether the participants are adults or children. Fernald et al. (2008), through a study of Oportunidades, find that CCT treatment causes an increase in adult BMI, as well as an increase in the prevalence of overweight and obesity.[1] Conversely, when looking at children in the Juntos program in Peru, Anderson et al. (2015), find that body mass index-for-age z score (BAZ) and prevalence of overweight fall for females, although there is no change in males. Lastly, a study of CCT programs in Bangladesh finds that CCTs cause an increase in weight-for-height z-scores (WHZ) for treated children (Ferré and Sharif, 2014), although the time of treatment is critical for finding a positive, significant effect. Children first treated at age 10-22 months experienced positive weight increase, while the program had no effect on children aged 22-46 months at the time of enrollment (Ferré and Sharif, 2014).

Another way to evaluate nutritional changes is to directly observe changes in consumption patterns from CCT implementation, as Hoddinott and Skoufias (2004) do

[1] The World Health Organization defines overweight as a BMI (body mass index) of 25 or higher and defines obesity as a BMI of 30 or higher.

[2] The adequacy dimension refers to a sufficient intake of vitamins and minerals (micronutrients), which are critical to adequate diet quality. The moderation dimension

with Oportunidades. This method of study is the most similar to the investigation that I will conduct in this paper. Hoddinott and Skoufias (2004) find that approximately 1½ years after Oportunidades' first treatment, the median beneficiary households obtained 6.4% more calories than did comparable control households. Furthermore, they find that consumption impact is greatest on the acquisition of calories coming from fruits/vegetables and animal proteins. On average, treatment households consumed 17.5% more from calories from these sources than did control households. García-Parra et al. (2016) study Oportunidades in rural Mexico and both support and refute this conclusion. They find that Oportunidades households exhibit a significant increase in meat consumption, but they also add that Oportunidades-affected children eat diets that are higher in industrialized foods and lower in fruits/vegetables. Ferré and Sharif (2014), in studying a similar CCT program in Bangladesh, conclude that individuals increase consumption of high-protein animal source foods with program treatment, supporting the claims of both Hoddinott and Skoufias (2004) and García-Parra et al. (2016).

My paper will improve upon existing research by studying not only changes in food group consumption and calorie acquisition, but also changes in macronutrient and micronutrient consumption. This is a key addition to the literature because Hoddinott and Skoufias (2004) study only how calorie acquisition changed. I will evaluate changes in calorie consumption, as well as changes in consumption of 25 different macronutrients and micronutrients. A nutritional framework including micronutrient analysis is critical for measuring the effects of the nutrition transition because it addresses both the adequacy and moderation dimensions of dietary quality (Basiotis et al., 1995; Burggraf et al., 2015).[2] This allows for the nutritional complexity of many foods common in modern diets.[3] Micronutrients are a critical dimension of nutrition because of their importance in physical and cognitive development, and each micronutrient serves a specific purpose in the body. The absence of any given micronutrient can cause serious, often irreparable effects. For example, Vitamin A deficiency is the leading cause of preventable blindness in children, and iron deficiency leads to poor pregnancy outcomes, increased risk of morbidity in children, and reduced work productivity in adults (WHO, 2017). Furthermore, this issue is intimately related to the nutrition transition. The majority of the more than 2 billion people in the world with micronutrient deficiencies live in LMICs, where the nutrition transition has had the greatest impact on diets (WHO, 2007). A survey of micronutrient deficiency in Mexico found that nearly 1.8 million children under five years old are stunted, approximately 800,000 children are underweight and 213,000 children are wasted (Food and Agriculture Organization, 2010).

This paper will be presented in 7 sections. First, I offer background information on Oportunidades including its history, goals, and program design. Second, I will cover this paper's theory, based in utility maximization and Gary Becker's household models, before moving on to a summary statistics of the data. Finally, I will offer empirical analysis, discussion, and final conclusions of Oportunidades' impact on the nutrition status of individuals living in Mexico, while also highlighting robustness checks and estimation challenges. Overall, I find that Oportunidades has had a significant, positive

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[2] The adequacy dimension refers to a sufficient intake of vitamins and minerals (micronutrients), which are critical to adequate diet quality. The moderation dimension covers consumption of nutrients that may negatively impact health when over-consumed (such as fat, salt, and sugar), and therefore should be eaten in moderation.

[3] Eggs, for example, contain critical micronutrients (important for the adequacy dimension), as well as fat and cholesterol (part of the moderation dimension).

impact on the micronutrient levels of individuals living in Mexico. These benefits come with certain challenges, such as higher levels of total fat, saturated fat, and sodium that are likely the result of diets higher in animal source foods, processed carbohydrates, and processed sugar.

III. Background on Oportunidades

Oportunidades (rebranded as Prospera in 2014) was first implemented in 1998 for a select group of rural localities and was subsequently expanded to additional rural localities and urban areas in 2002. Today, the program operates nationwide, and it is estimated than more than 20% of Mexican households receive benefits from the program. In lower-income regions such as Chiapas and Oaxaca, this figure can be more than 50% (Consejo Nacional de Evaluación de la Política de Desarrollo, 2015). Oportunidades offers low-income families monthly cash benefits based on the number of children in the home in exchange for those children maintaining regular primary and secondary school attendance and for family members attending regular preventative care doctor appointments. With the CCT, Oportunidades hopes to improve the three pillars of the Oportunidades program: nutrition, health, and educational attainment.

The nominal value of Oportunidades' cash transfer is broken down into three forms of payment. The first is a monthly fixed payment conditional on family members using preventative health services. Family members are assigned specific health care services based on their age and health condition (for example, malnutrition or pregnancy) (Fernald et al., 2008). During clinic appointments, emphasis is placed on illness prevention, maternal and child health, and family planning initiatives (Hoddinott et al., 2000). Female heads of household are also required to attend health and nutrition talks (called *pláticas*), which cover topics such as prenatal care, breastfeeding practices, and how to identify and react to common illnesses (Hoddinott et al., 2000).

The second portion of the cash transfer is an additional payment allocated per child, conditional on that child attending school a minimum of 85% of the time and not repeating a grade more than twice (Fernald et al., 2008). The exact payment of the per child educational transfer depends on the age and sex of the child, with increasing payments as children get older, and higher payments for girls over boys (Fernald et al., 2008). This payment is first available in third grade and continues through the ninth grade. Sex differentiation begins in seventh grade. This system is designed to offer appropriate compensation based on the opportunity costs for the family of having a certain age and sex child stop schooling. For example, the opportunity cost of having an older female child quit schooling is higher than that of an older male child. The third payment is an additional allocation (paid on a per child basis) for children's school supply costs. Table 1 below outlines the fixed monthly payment, educational payments, and school supply payments based on age and sex (when applicable) for the years 1998-1999. There are two payment rounds per year.

Table 1: Monthly Payments to Oportunidades Beneficiaries (real USD in 1998 taking into account purchasing power parity)

Grant	January-June 1998	July-December 1998	January-June 1999	July-December 1999
Third grade	13.27	14.29	15.31	16.33
Fourth grade	15.31	16.33	18.37	19.39
Fifth grade	19.39	20.41	23.47	25.51
Sixth grade	26.53	27.55	30.62	33.68
Seventh grade (male)	38.78	40.82	44.90	48.99
Seventh grade (female)	40.82	42.86	47.96	51.03

Eighth grade (male)	40.82	42.86	47.96	51.03
Eighth grade (female)	44.90	47.96	53.07	57.15
Ninth grade (male)	42.86	44.90	50.00	54.09
Ninth grade (female)	48.98	52.05	58.17	62.25
Family cash transfer (conditional on health service usage)	19.39	20.41	23.47	25.51
Primary school (Sept.)	--	In-kind	--	22.45
Primary school (Jan.)	8.16	--	9.18	--
Secondary school (Sept.)	--	34.70	--	41.84
Maximum grant per household	119.40	127.56	141.85	153.08

Source: *Progresa and its Impacts on the Welfare of Rural Households in Mexico* by Emmanuel Skoufias

In addition to providing monthly transfer payments, Oportunidades also provides a fortified food supplement to pregnant and lactating women and to children between the ages of four months and two years (Hoddinott et al., 2000). Children two years to five years old with low weight-for-age scores also qualify for a nutritional supplement. The supplements contain 20% of daily caloric needs and 100% of daily micronutrient requirements and are tailored to the health and age needs of individual beneficiaries (Basset, 2008). The supplements are provided in one-month supplies, and are available for pick up when a family member goes to the health clinic for their or their children's preventative health services.

IV. Theory

In this paper, I will employ a theory based in utility maximization. My objective is to show how demand for two categories of food, "traditional food" and "manufactured food" are affected by conditional cash transfer programs. After discerning this change in demand and applying average micronutrient values, I will be able to conclude how CCT programs impact nutrition levels. The simple form of this utility function will be:

$U(T, M)$, where T stands for traditional food and M stands for manufactured food. Households maximize this function subject to the following constraints:

$$C = I(w, CCT), \text{ where } C \geq 0 \quad (1)$$

$$C = Q_T * P_T + Q_M * P_M \quad (2)$$

Above, C represents consumption (comprised of traditional food and manufactured food), I represents income (which is a function of w, wage, and CCT, conditional cash transfer payment), Q represents quantity consumed, and P represents price. In this model, I am assuming that consumption from the CCT can take two forms, traditional food and manufactured food. This assumes that beneficiary households spend the entire payment on food consumption. This follows empirical observation, as research finds that with Oportunidades treatment, households increase food expenditure by the value of, or more than the value of, the cash transfer (Angelucci et al., 2012).[4] Empirically and in this model, the CCT will result in a positive income shock for participating families. Through this increased income, the household decision maker will change the quantities of traditional food and manufactured food that she buys due to the new budget constraint.

[4] It is important to note that this trend may not apply to every family. It is possible that the household could spend the CCT payment on non-food products.

If I assign a functional form to the utility function such that $U(T, M) = T^{1/2} M^{1/2}$, I can derive the demand for traditional food (T) and manufactured food (M). Using a Lagrangian multiplier, the Lagrangian system and first order conditions are as follows:

$$\mathcal{L} = T^{1/2} M^{1/2} - \lambda (TP_T + MP_M - I) \quad (3)$$

$$\frac{\partial \mathcal{L}}{\partial \mathrm{T}} = \frac{1}{2} T^{-1/2} M^{1/2} - \lambda (P_T) = 0 \quad (4)$$

$$\frac{\partial \mathcal{L}}{\partial \mathrm{M}} = \frac{1}{2} T^{1/2} M^{-1/2} - \lambda (P_M) = 0 \quad (5)$$

$$\frac{\partial \mathcal{L}}{\partial \lambda} = -(TP_T + MP_M - I) = 0 \quad (6)$$

Using this system, I can derive the demand for T and M, whose demand equations are:

$$T^* = \frac{I(w,CCT)}{2P_T} \quad (7)$$

$$M^* = \frac{I(w,CCT)}{2P_M} \quad (8)$$

These specific demand equations help relate the CCT transfer to the nutrition transition and the consumption of micronutrients. Above, $I(w, CCT)$ is increasing in both w and CCT. Thus, with these demand equations, one can see how an increase in I due to a CCT payment will increase the demand for both traditional foods and manufactured foods. These increases could have both positive and negative impacts on nutrition and micronutrient levels. The increase in demand for traditional foods (which includes fruits/vegetables and legumes) would likely have a positive impact on micronutrient levels, while the increase in demand for manufactured food (including chips, soda, and other packaged products) would likely have little positive impact on micronutrient levels, and could increase levels of fat, sodium, and sugar that are harmful to nutrition.

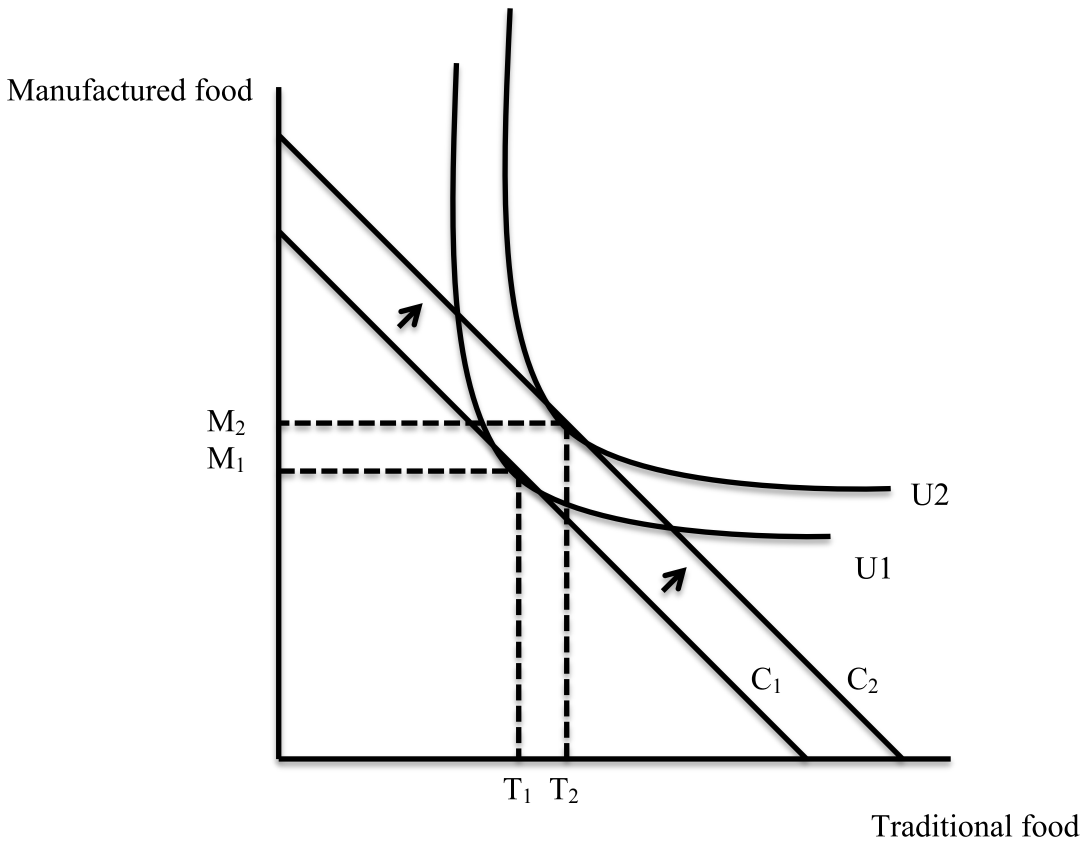
Rather than looking at single-person households or using an individualistic approach with respect to utility functions, I will use a household (family) utility function in which one member of the family is the sole household decision maker. This assumption fits with the structure of the CCT program; Oportunidades is designed such that the female head of household is the sole recipient of the cash transfer payments. The theoretical concept behind having one family decision maker lies in Gary Becker's discussion of specialization in the household (Becker, 1981). The drawback to making this assumption is that this model will not account for co-decision making, and therefore, the influence of the male head of household on consumption decisions. In the model, the household decision maker is responsible for the duties of choosing what food to consume, purchasing that food from a market or grocery store, and preparing the food for other family members. It is important to include meal planning and preparation in the duties of the household decision maker because she incurs the time costs of consumption decisions. In other words, the implications from choosing to buy/prepare food that is more time intensive or less time intensive (perhaps, in part, because of a difference in price) will directly affect the domestic work of individuals making those choices.[5]

Figure 1 below shows the income shock that Oportunidades' conditional cash transfer has on the household budget constraint. Graphically, this is the shift from C_1 to C_2. For this particular household, the household decision maker maximizes utility by increasing consumption of both traditional food and manufactured food. This decision is the change from T_1 to T_2 and M_1 to M_2 where $T_2 > T_1$ and $M_2 > M_1$. This is only one possibility of how a conditional cash transfer could affect household consumption. It is

[5] Although household consumption decisions are determined solely by the female household decision maker, she chooses quantities of consumption that maximize *total* family utility.

possible that the quantity purchased of traditional food could rise or fall with the CCT shock, and, similarly, that the quantity purchased of manufactured food could rise or fall.

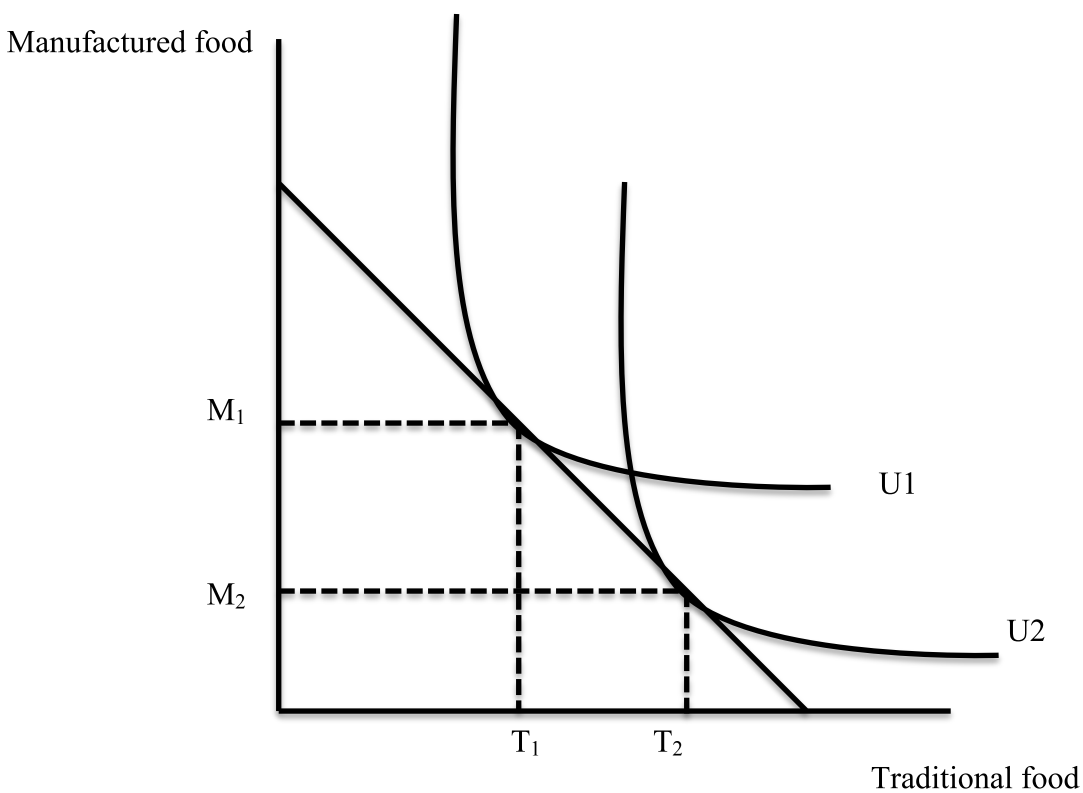
Figure 1: Household Budget Constraint and Indifference Curve with CCT Shock



If traditional food is an inferior good (with a negative income elasticity of demand), a positive income shock will result in a reduction in the quantity of traditional food purchased, i.e. $T_2 < T_1$. If traditional food is a normal good (with a positive income elasticity of demand), a positive income shock will result in an increase in the quantity traditional food purchased, i.e. $T_2 > T_1$. The same is true of manufactured food. If manufactured food is an inferior good (with a negative income elasticity of demand), a positive income shock will result in a reduction in the quantity of manufactured food purchased, i.e. $M_2 < M_1$. If manufactured food is a normal good (with a positive income elasticity of demand), a positive income shock will result in an increase in the quantity manufactured food purchased, i.e. $M_2 > M_1$. The exact quantities of traditional food and manufactured food purchased will depend not only on the income elasticities, but also on the shape of each family's indifference curve and on the slope of the budget constraint.

The Oportunidades transfer could affect consumption choices separate from the pure income shock. First, the family's indifference curve could change due to changing preferences. For example, if the health and nutrition talks (*pláticas*) convince the head of household to consume greater quantities of traditional food and lower quantities of manufactured food, the indifference curve may shift, leading to higher consumption of traditional food and lower consumption of manufactured food, regardless of the CCT income shock. An example of this change is shown in Figure 2 below.

Figure 2: Household Budget Constraint and Indifference Curve with Preference Change



Second, household income may change because of family members that enter or exit the workforce (Angelucci et al., 2012). For example, a child that attends school instead of holding a job would decrease family income, although some of that lost income could be regained from the educational transfer payments that that child is subsequently eligible for. This change would cause the budget constraint to shift outwards or inwards, in a similar manner as with the income shock shown in Figure 1, depending upon whether family income ultimately increases or decreases.

V. Summary Statistics

V.1 Data Characteristics

In order to study the impact of Oportunidades on the micronutrient levels of individuals living in Mexico, I am using data from the *Encuesta de Evaluación de los Hogares* (ENCEL). ENCEL is a household-level, longitudinal survey of Oportunidades recipients that is conducted through the Mexican government. The survey is conducted in order to measure the effectiveness of Oportunidades on reducing poverty and improving education and health status among program beneficiaries. It includes questions about parent/child demographics and behaviors, household environment, consumption decisions, and other aspects of family life. ENCEL results are broken down into two primary data sets--rural and urban. As previously mentioned, Oportunidades was first implemented for a group of rural pilot households in 1998. Due to the success of that program, Oportunidades was expanded to other rural localities in following years, and was furthermore offered to urban areas beginning in 2002.

In this paper I will use the rural ENCEL data set. I have made this decision for two primary reasons. First, participation in Oportunidades is significantly higher in rural localities throughout Mexico--97% for rural households versus 50% for urban households (Consejo Nacional de Evaluación de la Política de Desarrollo, 2015). This difference is likely due to program application structure. Rural Oportunidades recipients did not have to explicitly apply for the program (they were automatically informed of their eligible status), while urban Oportunidades recipients were required to visit a local program center and inquire about eligibility, leading to lower program participation. Second, there are significant data measurement problems in the urban data set. When Oportunidades was introduced in urban localities, it was not implemented randomly (as it was for rural localities), but rather, the program used propensity score matching based on Census-estimated poverty levels to determine treatment and control groups (Angelucci et al., 2012). With this system, Oportunidades was first offered to housing blocks with the highest density of poor households. Thus, the treatment and control groups for the urban data sets are not characteristically similar.

The rural ENCEL survey was first conducted in 1998 and was conducted annually from 1998-2000, after which it was conducted again in 2003 and 2007. In its first years (1998 and 1999), the rural survey contains the program's only true natural experiment. In 1998, a group of 506 program-eligible localities were identified for potential treatment, and subsequently, 320 of those localities were selected as treatment localities, and 186 designated control localities (Todd, 2007). The Oportunidades treatment group began first receiving a CCT in March 1998, and the control group was incorporated into the program between September and November 1999 (Todd, 2007). Therefore, the rural data set includes four relevant survey rounds: one baseline survey (March 1998) and three follow-up control/treatment surveys, collected in roughly 6-month intervals (October 1998, March 1999, and November 1999). The Figure 3 below displays this information.

Figure 3: Timeline of Oportunidades treatment

March 1998	**October 1998**	**March 1999**	**November 1999**
Pre-treatment Baseline survey	6 months post-treatment Control/treatment	1 year post-treatment Control/treatment	1½ years post-treatment Control/treatment

At the point of the last survey round in Oportunidades' natural experiment (November 1999), the survey includes 23,087 households. There was some inconsistency in households completing all portions of the survey, so the usable data set, including consumption quantity data and household characteristics, includes 13,771 households. In the consumption information section, consumption questions are phrased in two different ways. First, "How many days in the last week did the household consume X product" and second, "How many kilograms of X product did the household consume in the last week?" The March 1998 baseline survey only asks the first question about consumption frequency, and does not ask about explicit consumption quantity. In the remaining three rounds, all of which are control/treatment, the ENCEL asks both questions, and therefore gathers data about consumption frequency and consumption quantity.

In order to measure changes in consumption sources, I have created six aggregate consumptions groups: basic grains, fruits/vegetables, processed carbohydrates, animal protein, processed sugar, and edible oils. These consumption groups were constructed because they mirror the general categories of food typically referenced in the nutrition transition literature (Popkin, 2001; Bermudez and Tucker, 2003; Popkin et al., 2012;

Popkin, 2014). Each of these categories of food is one whose consumption tends to uniformly increase or decrease with the introduction of the Western diets in the nutrition transition. In the literature, consumption of basic grains and fruits/vegetables generally decreases over time, while consumption of processed carbohydrates, animal protein, processed sugar, and edible oils tends to increase. Table 2 below shows the specific food products that comprise each consumption group.

Table 2: Consumption Groups

Consumption Group	**Basic Grains**	**Fruits/ Vegetables**	**Processed Carbohydrates**
Included foods	Corn, rice, tortillas, beans	Tomatoes, onion, carrot, leafy greens, oranges, plantains, apples, limes, cactus leaves	White bread, sweet bread, sandwich bread, pasta, boxed cereal, savory pastries
Typical change in consumption during Nutrition Transition	Decrease	Decrease	Increase
Consumption Group	**Animal Protein**	**Processed Sugar**	**Edible Oils**
Included foods	Chicken, beef/pork, lamb/goat, fish/seafood, sardines, eggs, milk, cheese	Cookies, soda, granulated sugar	Vegetable oil, butter
Typical change in consumption during Nutrition Transition	Increase	Increase	Increase

*The March 1998 (baseline) survey does not include consumption levels for cactus leaves or cheese, therefore those products are omitted from the baseline data set.

I will also measure changes in micronutrient and macronutrient levels. To do this, I will employ a food composition table (FCT), which is a data set that includes average macronutrient and micronutrient levels of given foods. The FCT that I am using, *Tabla* *de Composición de Alimentos de Centroamérica*, is specific to the region, and gives values for the 32 foods included in the Oportunidades consumption surveys. This methodology follows the work of Leah Bevis (2015), who employs food composition tables in order to estimate micronutrient levels for given populations (Bevis, 2015; Bevis, 2015) and Hoddinott and Skoufias (2004), who use an FCT to estimate calorie weights for their analysis of calorie acquisition.

To offer an idea of the general tendencies of the data, Table 3 below shows the baseline household consumption rates (in frequency of consumption) for each of the six food groups.[6] For the values below, the survey question asks "How many days in the last week did the household consume X product?" Therefore, for each individual food, there is a minimum value of 0 (did not eat ever) and a maximum value of 7 (ate every day). These responses are aggregated by food consumption group, which increases the maximum value by a multiple of the number of foods in that consumption group.[7]

Table 3: Consumption means (frequency) in baseline data set

Consumption group	Basic Grains	Fruits/ Vegetables	Processed Carbohydrates	Animal Protein	Processed Sugar	Edible Oil
Treatment	17.80	16.57	4.94	6.79	8.35	6.57
Control	18.09	17.09	5.00	7.13	8.50	5.63
Maximum frequency	28	63	42	56	21	14

Table 5 in the appendix shows two-sample t-tests that measure the differences in the means between these two groups. At the 0.01 significance level, the frequency of

[6] Quantity of consumption was not added to the ENCEL survey until the first round in October 1998.
[7] For example, the category basic grains is comprised of four foods (corn, rice, tortillas, and beans), so it's maximum frequency is 28 (4*7).

consumption means for three of the six food groups have a difference that is statistically different than zero, but, for each of these food groups, the difference is very small relative to the mean consumption frequencies. To look at the effect of Oportunidades treatment on mean consumption, Table 4 shows the per capita consumption means (in kilograms of consumption) between control and treatment individuals in November 1999 1½ years after Oportunidades treatment. The means are higher for treatment individuals than for control individuals in five of the six categories. Table 6 shows two-sample t-tests to measure the differences in the means between these two groups. At the 0.01 significance level, mean consumption quantities are higher in the treatment group post-Oportunidades than in the control group for five of the six food groups.

Table 4: Consumption means (quantity in kilograms) in November 1999 data set

Consumption group	Basic Grains	Fruits/ Vegetables	Processed Carbohydrates	Animal Protein	Processed Sugar	Edible Oil
Treatment	3.92	1.04	1.38	0.70	0.47	0.23
Control	3.65	0.90	1.07	0.61	0.44	0.23

V.2 Empirical Estimation

I specify a linear regression of the form

$$Y_i = \alpha + \beta T + \sigma X_i + \mathcal{E}_i \qquad (9)$$

where Y_i denotes per capita weekly consumption of household i; α, β, and σ are estimated parameters; T is a categorical variable equal to one if the household is a treatment household and equal to zero if it is a control household; X is a vector of household and community characteristics; and $\mathcal{E}$ is an error term. The elements of vector X are household demographic characteristics (wealth index, proportions of children 0-2, 3-5; boys 6-7, 8-12, 13-18; girls 6-7, 8-12, 13-18; men 19-54; women 19-54; men 55 and older; women 55 and older), characteristics of the head of household (age, occupation, education, marital status, literacy, indigenous/not indigenous), and a Laspeyres price index.[8] These control variables follow the models estimated by Hoddinott and Skoufias (2004).

VI. Discussion

VI.1 Overall Program Impact

First, I employed a difference in differences estimator in order to measure the overall impact of Oportunidades on household consumption. This regression compares the March 1998 (baseline) data set and the October 1998 (6 months after program implementation, control/treatment) data set. This regression measures changes in frequency of consumption rather than change in quantity of consumption.[9] A key assumption of the difference in differences estimator is that the two groups (control and treatment) were behaving similarly prior to any policy intervention. Table 3 in the Summary Statistics section illustrates that control and treatment groups consumed products from the six food consumption groups at nearly identical rates prior to the implementation of Oportunidades, demonstrating that a difference in differences estimator can be employed on this data set. Table 5 in the appendix shows 2-sample t-tests between these means, which raises the issue of a statistically significant difference for three of the six consumption groups. The difference is very small, only 2-7% of total

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[8] The Laspeyres price index controls for price differences between states. It is calculated using the following formula: $\frac{\sum_t^Q Pt_k Qt_k}{\sum_t^Q Pt_1 Qt_1}$ for tortillas (t) in each state (k), using a random state as a base.

[9] The March 1998 (baseline) data set does not include consumption quantity data, so it is not possible to run a difference in differences estimator on quantity of consumption.

consumption frequency, so I believe it is still acceptable to run a difference in differences operator.

Difference in differences regressions can be found in Tables 7 and 8 in the appendix. I ran this estimator using OLS and Tobit in order to address the high proportion of 0s in my data set (indicating zero consumption of a given food product), although the results are not substantially different. The dependent variable for the difference in differences model is frequency of consumption for each of the six food consumption groups. The model includes variables treatment (0=control and 1=treatment), time (0=baseline and 1=6 months after program implementation), and time * treatment (interaction between treatment and time). The model also includes household control variables as outlined in the empirical strategy section of this paper.

In Table 7, the variable time can be interpreted as the mean effect of time on consumption, disregarding treatment. For example, the time coefficient for fruits/vegetables, -3.384, indicates that between the baseline time period (March 1998) and the first follow-up survey (October 1998), average consumption of fruits and vegetables fell by 3.301 times/week regardless of Oportunidades program impact. This aligns with empirical findings that total food consumption fell between 1998-1999 when disregarding Oportunidades' effect (Hoddinott and Skoufias, 2004).[10] Treatment represents the mean change in consumption between treatment and control households, disregarding time. The treatment coefficient for fruits/vegetables, -0.472, shows that treatment households, on average, consumed fruits and vegetables 0.467 times/week less

[10] This decline can be attributed to three macroeconomic shocks in 1998 that adversely affected Mexico's economy: the Asian financial crisis, a severe drop in oil prices, and Russia's debt default (Federal Reserve Bank of Dallas, 1999).

than did control households. This is not an impact of the Oportunidades program, and shows small consumption differences between the two groups. These differences are unimportant after testing for similarly in baseline consumption between control and treatment households.

The variable time * treatment represents the change in consumption frequency as a result of Oportunidades treatment. The coefficient on time * treatment can be interpreted as the average change, in times consumed/week by the household, of foods in a particular food group. The time * treatment coefficient is positive and significant for four of the six consumption groups, indicating that Oportunidades treatment caused the weekly frequency of fruits/vegetables, processed carbohydrates, animal protein, and processed sugar to increase significantly. This value ranges from 0.129 (processed sugar) to 0.621 (fruits/vegetables).[11] The coefficient is not significant for the foods groups of basic grains and edible oils, which is not consistent with expectations of increased overall consumption. This regression measures consumption frequency instead of consumption quantity, so it is possible that quantity consumed of these foods increased despite the fact that weekly frequency did not. Further specifications will investigate changes in quantity, which are a more accurate measure of program impact. Despite these shortcomings, overall, this regression follows earlier conclusions that Oportunidades treatment causes an increase in the consumption of animal protein and fruits/vegetables (Hoddinott and Skoufias, 2004).

[11] When interpreting these values, it is important to consider changes relative to consumption baselines and maximum frequency. Refer to Table 3 for this information.

VI.2 Change in Consumption Quantities

Next, I ran analyses to measure the change in consumption for each of the six consumption groups. Ideally, I would want to run a difference-in-differences estimation, but the March 1998 (baseline) data set does not include consumption quantity information, so I am unable to do so. In these regressions, I compare consumption quantities between control and treatment households using the November 1999 (round 3) data set, which is gathered 1½ years after Oportunidades implementation.[12] The consumption question is posed, "How many kilograms of X product did the household consume in the last week?" As before, I employed both OLS and Tobit analyses to account for the high proportion of 0s in my data set, and results are not substantially different between the two estimators.

OLS and Tobit regressions can be found in Tables 9 and 10 respectively. The dependent variable is per capita weekly consumption for each of the six food groups. The independent variable of interest is treatment (0=control and 1=treatment). As before, the regression includes household control variables. Table 9 shows that for five of the six food groups, Oportunidades treatment caused a significant, positive effect on consumption. The coefficient on treatment represents the average impact, in per capita kilograms of food consumed/week that Oportunidades has on individuals. This value ranges from a low of 0.0445 (processed sugar), to a high of 0.336 (basic cereals). To put this in perspective, 0.138 additional kilograms of fruits/vegetables could be reached with one additional piece of hand fruit (such as an apple, orange, or banana), and .336

[12] After November 1999, control households were incorporated into the Oportunidades program, thus in subsequent data sets it is not possible to compare control and treatment households.

additional kilograms of basic cereals could come from two additional servings of rice. As with the difference in differences regression above, these conclusions support the findings of Hoddinott and Skoufias (2004), as well as the conclusions of García-Parra et al. (2016), and Ferré and Sharif (2014).

VI.3 Change in Calorie, Macronutrient, and Micronutrient Quantities

Lastly, I ran analyses to measure the change in calorie, macronutrient, and micronutrient consumption. The previous two regressions (difference in differences on consumption frequency and OLS on consumption quantity) are critical for confirming that this paper's initial findings follow existing literature. This section's regressions are my unique contribution to the study of CCT programs' impact on nutrition.

Changes in calorie, macronutrient, and micronutrient values are divided into three primary groups: macronutrients and calories, vitamins, and minerals. Each model compares nutrient levels between control and treatment households using the November 1999 (round 3) data set, which is gathered 1½ years after Oportunidades implementation. The dependent variable in each regression is quantity of the nutrient consumed per capita/week. The unit of the dependent variable varies based on the typical unit used to analyze that micronutrient or macronutrient. Full information on units used can be found in Table 11. As before, the models include household control variables as outlined in this paper's empirical strategy section.

Table 12 shows changes in macronutrient and calorie consumption. For each of the nine nutrients, Oportunidades had a significant, positive impact on nutrient acquisition. For some nutrients (such as saturated fat and cholesterol), this increase does not necessarily indicate a positive change nutrition-wise, even though these increases fall under the term "macronutrient." I will discuss this in greater depth in the conclusion. Table 13 shows changes in vitamin consumption. Quantities consumed for each of the nine vitamins, as well as an aggregate measure of all nine vitamins together, increased significantly with Oportunidades treatment. To put this in perspective, the weekly change in vitamin C consumption from Oportunidades treatment (84.75 milligrams) is about 14% of total vitamin C needed in a week (Mayo Clinic, 2017). The change in vitamin A consumption (225.2 micrograms) is about 4% of total vitamin A needed. Lastly, Table 14 shows changes in mineral consumption. Quantities consumed for each of the seven minerals, as well as an aggregate measure of all seven minerals together, increased significantly with Oportunidades treatment. The weekly change in iron consumption (12.81 milligrams) represents about 18% of total iron needed in a week, and the change in calcium consumption (301.1 milligrams) is about 4% of total calcium needed (Mayo Clinic, 2017).

In order to better interpret changes in macronutrient and micronutrient consumption, I ran a second set of regressions in log-linear form. By logging the dependent variable (quantity of nutrient consumed per capita/week), the model yields a coefficient on treatment that can be interpreted as the percent change in nutrient consumption for treatment households. Tables 15, 16, and 17 show these regressions for macronutrient and calories, vitamins, and minerals. Table 15 indicates that, on average, treatment households consume 8.9% more calories than do similar control households. In their study of change in calorie acquisition, Hoddinott and Skoufias (2004) find a 6.4% increase in calorie consumption for treatment households. My value is very similar to this finding, which offers increased validity to this paper's conclusions regarding changes in micronutrient and macronutrient consumption. The small difference is likely due to different computations of average calorie values from the FCTs. Figures 4, 5, and 6 below are three kernel density plots that illustrate calorie, vitamin, and mineral consumption between control and treatment households in the March 1998 (6 months after treatment) and November 1999 (1½ years after treatment) surveys.[13]

Figure 4: Changes in calorie consumption

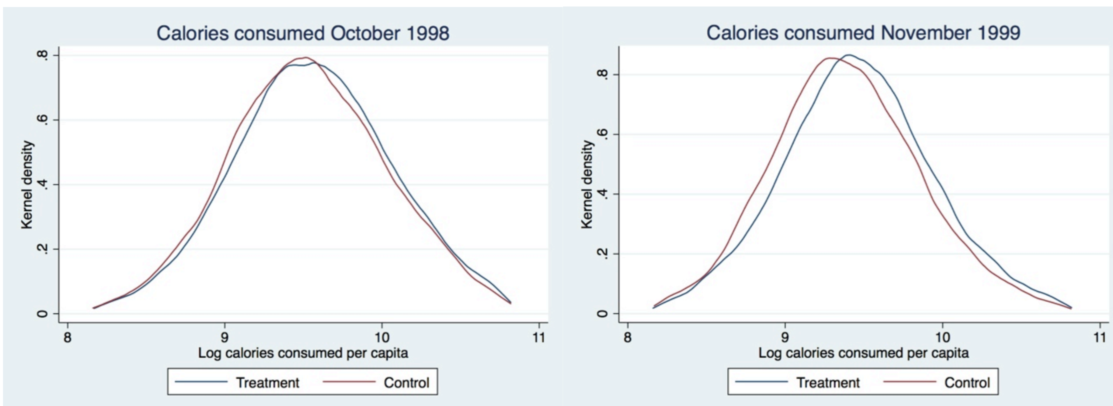
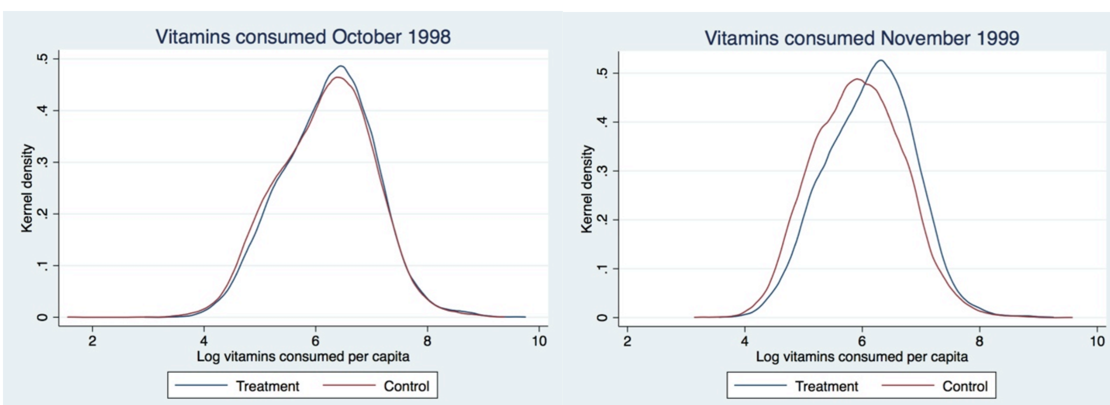


Figure 5: Changes in vitamins consumption



[13] Because of administrative errors, many Oportunidades households had still not received program payments 6 months after Oportunidades implementation, so this survey can be used as a quasi-baseline group in the absence of true baseline quantities of consumption.

Figure 6: Changes in mineral consumption

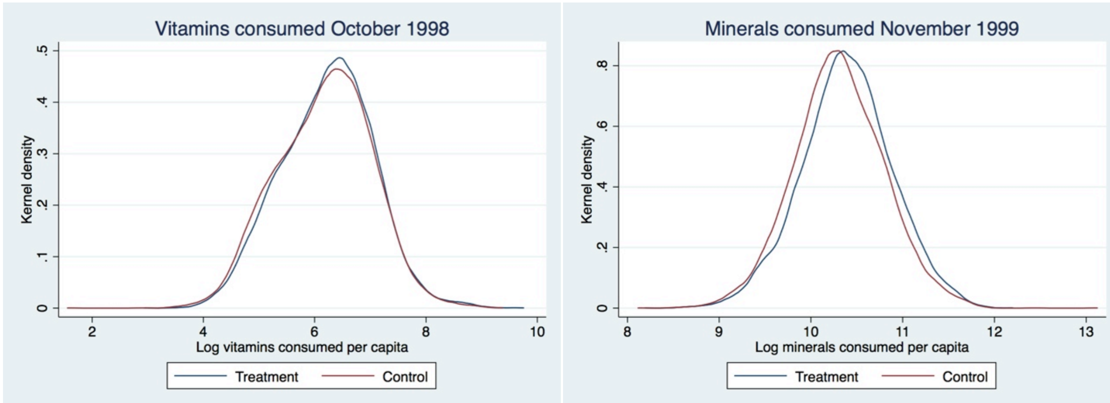
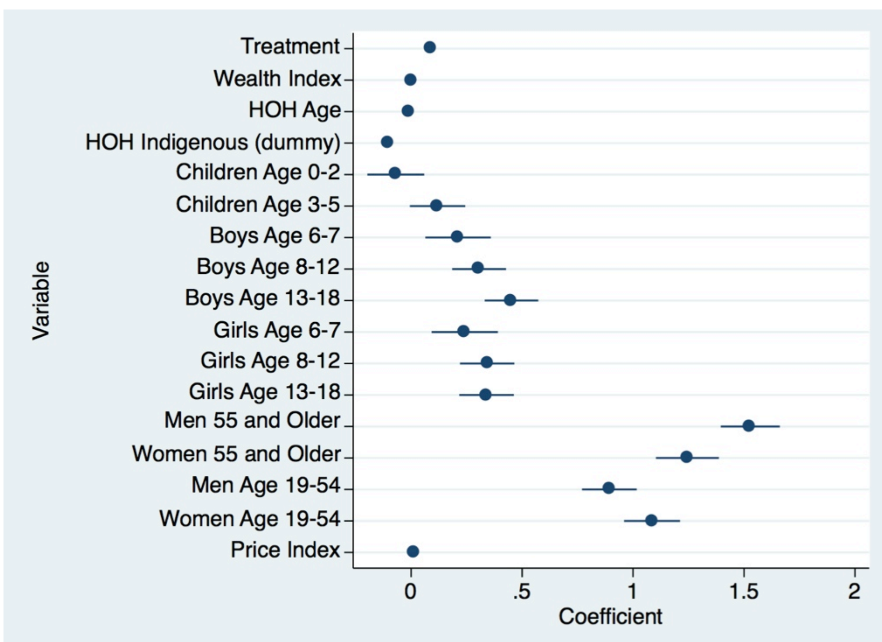


Table 15 illustrates that, on average, treatment households consumed 10.5% more protein than control households. This finding is consistent with earlier conclusions that Oportunidades treatment leads to higher consumption of protein-rich animal source foods. Total fat consumption increased by 5.8% from Oportunidades treatment, saturated fat consumption increased by 8.7% percent, and cholesterol consumption increased by 17.6%. These results follow conclusions that consumption of animal source proteins and processed carbohydrates (both of which are high in fat and cholesterol), increased with Oportunidades treatment. Table 16 shows that on an aggregate level, individuals in treatment households consumed 20.5% more vitamins than individuals in similar control households. The specific levels of vitamin consumption vary, with the highest percent changes occurring with vitamins C and A, which increase by 21.1% and 27.5% respectively. Vitamins C and A are typically found in fruit and vegetable products, and thus, an increase in their consumption follows earlier conclusions that Oportunidades treatment results in increased consumption of fruits/vegetables. Lastly, Table 17 demonstrates that on an aggregate level, individuals in treatment households consumed 10.1% more minerals than individuals in similar control households. The largest increase in minerals acquisition came from potassium (11.1%) phosphorus (14.4%), and sodium (11.1%). Potassium is found primarily in fruits and vegetables and thus follows the general increase in consumption of fruits and vegetables from Oportunidades. Phosphorus is found in animal source foods as well as fruits and vegetables, both of which were shown to be consumed in higher quantities with treatment. Sodium, which is found in large quantities primarily in processed foods, warrants careful review when analyze with respect to overall nutrition. Although sodium is a mineral, and is necessary for proper body functions, too much sodium is dangerous to health. I will discuss this in further detail in this paper's conclusion. Figure 7 below gives a visual representation of the effect of Oportunidades treatment on calorie consumption relative to the effect of other control variables on calorie consumption.

Figure 7: Proportion change in calorie consumption from model variables



VI.4 Robustness Checks

The first tool I used to test for robustness is the Tobit estimator. The Tobit model, which is alternatively called the censored regression model, better estimates linear regressions when there is a left-hand or right-hand censoring in the dependent variable. I ran a Tobit analysis for the difference in differences model (Table 8) and for consumption quantity changes (Table 10). In both cases, the results of the Tobit analysis were not substantially different than the results of the OLS analysis.

To further check for robustness, I changed the definition and form of several control variables. Instead of using a Laspeyres price index to capture price differences between states, I ran regressions that substituted dummy variables for the different states themselves and, secondly, that substituted explicit state-level prices. Dummy variables for states did not change regression results, but using explicit state-level prices reduced the significance of the dependent variable. The state-level prices came from a 1997 pre-program data set that was sparsely collected, and therefore, there were only 5-10 individual prices listed for each food item. I deemed this data set too small in sample size to adequately measure food prices at the locality level. Furthermore, instead of using the proportion of children, boys, girls, and adults in the household, I ran regressions using the total number of those individuals in the household. I also ran regressions where I included control variables for frequency of consumption of all 32 food products. Lastly, I ran regressions where I substituted the initial variable "age" with "age^2" in order to exaggerate differences in age. By exaggerating age differences, which are small in nominal terms, the regression may better account for changes in behavior that come with aging. None of these alternative methods changed results significantly.

VI.5 Estimation Challenges

One of the primary challenges of this paper's analysis lies in the difference in differences estimator, which is used to evaluate overall program impact. In the data rounds used for the difference in differences regression, the wording of the consumption question ("How many days in the last week did the household consume X product?") causes issues. Because this question asks about frequency of consumption rather than the quantity of consumption, this paper's conclusions of overall program impact are somewhat ineffective. Although the model demonstrates that there is a statistically significant increase in the frequency of food products consumed, this could mean that beneficiary households are consuming those products more days per week, but not necessarily consuming *more* of those products. Despite this shortcoming, the subsequent OLS and Tobit regressions of consumption quantity indicate that it is not unreasonable to assume that increased consumption frequency could represent increased consumption quantity.

A second challenge for this paper is the potential error of food composition tables (FCTs). Although FCTs are effective in offering estimates of macronutrient and micronutrient contents for various foods, it is important to remember that these values are only estimates. Although FCTs can offer the basic nutritional information for a food product, there is significant heterogeneity in the nutritional content of different foods, especially when those food products are put in general groups such as "chicken" or "rice." For example, a 100-gram serving of boneless chicken breast will have more calories than will a 100-gram serving of chicken wings with bones, although these types of food could be listed under the same FCT food product (Hoddinott and Skoufias, 2004).

In my use of the FCT, I tried to reduce these concerns by averaging among multiple types of different food products to increase accuracy. Beyond nutritional differences in FCT products, it has also been documented that FCTs will often underestimate the micronutrient levels of food products in low- and middle-income countries. This occurs for two primary reasons. First, crops harvested in LMICs are typically lower in nutrient levels than Western-produced crops due to poorer soil and less agricultural advancement. Second, many processed Western-produced foods come "enriched" with micronutrients, such as cereal enriched with iron or salt enriched with iodine, and those foods produced in LMICs may not always include such enrichments.

VII. Conclusion

In conclusion, I find that Oportunidades' conditional cash transfer program has had a positive, significant effect on macronutrient and micronutrient levels of individuals living in Mexico in beneficiary households. With respect to micronutrients, the increase in aggregate vitamin consumption (20.5%) and aggregate mineral consumption (10.1%) represent improvements to overall health that, if continued, would likely reduce micronutrient deficiency. These positive consumption-based impacts are aided by the micronutrient supplement that Oportunidades offers to children and pregnant women–two groups who are in the greatest need of adequate micronutrient consumption. Because sufficient micronutrient consumption is necessary at times of critical cognitive and physical development (specifically in utero and during early childhood), it may take several generations to see the full impacts of the Oportunidades program on overall growth and development. Moving forward, it will be important to study the children first impacted by the Oportunidades program as they age to see whether increased micronutrient consumption has positive nutrition and health effects in the long run.

Along with positive increases in micronutrient consumption, Oportunidades treatment has led to increases in the consumption of animal source foods, processed carbohydrates, and processed sugar. Together, these food groups form the base of the Western diet. Increased consumption from these sources is likely responsible for the program's demonstrated effect on higher levels of total fat, saturated fat, cholesterol, and sodium consumed. These findings demonstrate that although Oportunidades has made headway in increasing consumption of critical micronutrients, it has not stopped the negative forces of the nutrition transition. Despite the program's mandatory nutrition and health seminars (*pláticas*), the nutrition transition continues to incur negative impacts on the diets of individuals living in Mexico. Oportunidades likely exacerbates these effects by giving households more money to purchase manufactured food.

Overall, Oportunidades has impacted the diets of individuals living in Mexico in both beneficial and harmful ways. In order to improve the positive program impacts of micronutrient acquisition and mitigate the negative impacts of Western diet consumption, additional studies should be conducted to look at what portions of the conditional cash transfer are responsible for increases in micronutrient consumption, and which are responsible for increases in Western diet consumption. Further research could also be conducted to examine the impact of Oportunidades' school attendance policy and mandatory health care visits on consumption decisions. This research could be conducted both on the current heads of households and on the children in the households (once they are able to independently make those decisions). With this information, legislators and food policy experts around the world can better devise conditional cash transfer programs that will pre-emptively address the negative program impacts observed with Oportunidades, and that will amplify the benefits.

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Appendix

**Note for t-tests*: diff= mean(control) - mean(treated).

Table 5
Two-sample t-tests of consumption frequency at baseline

Food group	Mean Difference	Standard Error	T statistic	P-value diff < 0	P-value diff = 0	P-value diff > 0
Basic Grains	0.291	0.065	4.485	1	0	0
Fruits/Vegetables	0.512	0.118	4.332	1	0	0
Processed Carbohydrates	0.066	0.058	1.146	0.874	0.252	0.126
Animal Protein	0.338	0.063	5.366	1	0	0
Processed Sugar	0.140	0.046	3.046	0.998	0.002	0.001
Edible Oils	0.066	0.030	2.227	0.990	0.026	0.013

Table 6
Two-sample t-tests of consumption quantity at 1½ years after treatment

Food group	Mean Difference	Standard Error	T statistic	P-value diff < 0	P-value diff = 0	P-value diff > 0
Basic Grains	-0.266	0.031	-8.460	0	0	1
Fruits/Vegetables	-0.133	0.017	-7.892	0	0	1
Processed Carbohydrates	-0.307	0.030	-10.35	0	0	1
Animal Protein	-0.092	0.0122	-7.52	0	0	1
Processed Sugar	-0.032	0.007	-4.775	0	0	1
Edible Oils	-0.005	0.003	-1.801	0.035	0.070	0.965

Note for all regressions: Sample consists of individuals living in households eligible for Oportunidades in both treatment and control localities. Household controls include household size, wealth index, proportions of children 0-2, 3-5; boys 6-7, 8-12, 13-18; girls 6-7, 8-12, 13-18; men 19-54; women 19-54; men 55 and older; women 55 and older, HOH age, HOH occupation, HOH education, HOH marital status, HOH literacy, HOH indigenous/not indigenous, and a price index. Individuals who reported consuming less than 500 calories per day or more than 20,000 calories per day were removed from the data set. Standard errors are in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 7
Program impact on consumption frequencies (OLS)

VARIABLES	(1) Basic grains	(2) Fruits/vegetables	(3) Processed carbohydrates
Time	-1.593***	-3.384***	-1.975***
	(0.0898)	(0.150)	(0.0728)
Treatment	-0.0620	-0.472***	-0.112
	(0.0822)	(0.143)	(0.0720)
Time * Treatment	-0.153	0.621***	0.211**
	(0.114)	(0.191)	(0.0917)
Constant	17.95***	14.11***	4.620***
	(1.053)	(1.896)	(0.980)
Household controls	YES	YES	YES
Observations	28,838	28,837	28,831
R-squared	0.055	0.103	0.095

VARIABLES	(4) Animal protein	(5) Processed sugar	(6) Edible oils
Time	-1.918***	-1.538***	-0.155***
	(0.0821)	(0.0595)	(0.0406)
Treated	-0.300***	-0.153***	-0.0392
	(0.0774)	(0.0581)	(0.0365)
Time * Treatment	0.338***	0.129*	0.0628
	(0.103)	(0.0752)	(0.0522)
Constant	8.332***	8.580***	6.188***
	(1.003)	(0.586)	(0.263)
Household controls	YES	YES	YES
Observations	28,834	28,831	28,834
R-squared	0.124	0.074	0.013

Table 8
Program impact on consumption frequencies (Tobit)

VARIABLES	(1) Basic grains	(2) Fruits/vegetables	(3) Processed carbohydrates
Time	-1.596***	-3.486***	-2.465***
	(0.0901)	(0.154)	(0.0818)
Treatment	-0.0628	-0.468***	-0.109
	(0.0822)	(0.140)	(0.0737)
Time * Treatment	-0.152	0.644***	0.281***
	(0.114)	(0.195)	(0.103)
Constant	17.95***	13.65***	4.151***
	(1.048)	(1.790)	(0.952)
Household controls	YES	YES	YES
Observations	28,838	28,837	28,831
Pseudo R-squared	0.0094	0.0157	0.0213
Left-censored observations	39	638	4,027

VARIABLES	(4) Animal protein	(5) Processed sugar	(6) Edible oils
Time	-2.084***	-1.586***	-0.172***
	(0.0854)	(0.0610)	(0.0429)
Treated	-0.288***	-0.154***	-0.0401
	(0.0776)	(0.0556)	(0.0391)
Time * Treatment	0.367***	0.138*	0.0670
	(0.108)	(0.0773)	(0.0543)
Constant	8.186***	8.592***	6.148***
	(0.993)	(0.709)	(0.499)
Household controls	YES	YES	YES
Observations	28,834	28,831	28,834
Pseudo R-squared	0.0234	0.0149	0.0029
Left-censored observations	1,792	1,019	863

Table 9
Consumption group changes in kilograms per capita per week (OLS)

VARIABLES	(1) Basic Cereals	(2) Fruits/Vegetables	(3) Processed Carbohydrates
Treatment	0.336***	0.138***	0.308***
	(0.0309)	(0.0173)	(0.0360)
Constant	2.596***	0.632**	0.286
	(0.549)	(0.308)	(0.640)
Household controls	YES	YES	YES
Observations	13,771	13,771	13,771
R-squared	0.272	0.062	0.032

VARIABLES	(4) Animal Protein	(5) Processed Sugar	(6) Edible Oils
Treatment	0.0874***	0.0445***	0.00448
	(0.0135)	(0.00838)	(0.00338)
Constant	0.486**	0.295**	0.140**
	(0.240)	(0.149)	(0.0601)
Household controls	YES	YES	YES
Observations	13,771	13,771	13,771
R-squared	0.088	0.049	0.100

Table 10
Consumption group changes in kilograms per capita per week (Tobit)

VARIABLES	(1) Processed Carbohydrates	(2) Basic Cereals	(3) Fruits/Vegetables
Treatment	0.405***	0.336***	0.143***
	(0.0430)	(0.0308)	(0.0174)
Constant	-0.103	2.595***	0.611**
	(0.770)	(0.548)	(0.310)
Household controls	YES	YES	YES
Observations	13,771	13,771	13,771
Pseudo R-squared	0.0081	0.0742	0.0221
Left-censored observations	2,665	3	120

VARIABLES	(4) Animal Protein	(5) Processed Sugar	(6) Edible Oils
Treatment	0.107***	0.0471***	0.00488
	(0.0143)	(0.00851)	(0.00341)
Constant	0.458*	0.271*	0.127**
	(0.254)	(0.152)	(0.0608)
Household controls	YES	YES	YES
Observations	13,771	13,771	13,771
Pseudo R-squared	0.0360	0.0340	-0.3299
Left-censored observations	936	276	176

Table 11
Units of measure for macronutrients and micronutrients

Macronutrients

Nutrient	*Unit*
Protein	Grams
Total fat	Grams
Monounsaturated fat	Grams
Polyunsaturated fat	Grams
Saturated fat	Grams
Carbohydrates	Grams
Fiber	Grams
Cholesterol	Milligrams

Micronutrients

Nutrient	*Unit*
Vitamin C	Milligrams
Vitamin A	Micrograms
Vitamin B6	Milligrams
Vitamin B12	Micrograms
Folic Acid	Micrograms
Folate	Micrograms
Niacin	Milligrams
Riboflavin	Milligrams
Thiamine	Milligrams
Magnesium	Milligrams
Calcium	Milligrams
Potassium	Milligrams
Sodium	Milligrams
Zinc	Milligrams
Iron	Milligrams

Table 12
Macronutrient and calorie changes per capita per week

VARIABLES	(1) Calories	(2) Protein	(3) Total Fat	(4) Saturated Fat	(5) Fiber
Treatment	1,197***	33.17***	22.55***	5.584***	15.42***
	(108.8)	(3.308)	(4.089)	(0.837)	(1.811)
Constant	9,290***	245.0***	264.4***	48.82***	167.6***
	(1,936)	(58.83)	(72.73)	(14.88)	(32.21)
Household controls	YES	YES	YES	YES	YES
Observations	13,771	13,771	13,771	13,771	13,771
R-squared	0.245	0.183	0.194	0.158	0.285

VARIABLES	(6) Carbohydrates	(7) Monounsat. Fat	(8) Polyunsat. Fat	(9) Cholesterol
Treatment	207.1***	7.782***	6.486***	128.5***
	(18.48)	(1.263)	(1.906)	(22.71)
Constant	1,519***	83.27***	76.01**	1,042***
	(328.7)	(22.47)	(33.89)	(403.9)
Household controls	YES	YES	YES	YES
Observations	13,771	13,771	13,771	13,771
R-squared	0.223	0.166	0.108	0.058

Table 13
Vitamin changes per capita per week

VARIABLES	(1) Vitamins (aggregate)	(2) Vitamin C	(3) Vitamin A	(4) Vitamin B6	(5) Vitamin B12
Treatment	104.8***	84.75***	225.2***	0.721***	1.117***
	(8.806)	(7.873)	(20.99)	(0.0803)	(0.193)
Constant	264.1*	190.2	713.6*	7.183***	4.042
	(156.6)	(140.0)	(373.4)	(1.428)	(3.433)
Household controls	YES	YES	YES	YES	YES
Observations	13,771	13,771	13,771	13,771	13,771
R-squared	0.057	0.047	0.083	0.346	0.043

VARIABLES	(6) Folic Acid	(7) Folate	(8) Niacin	(9) Riboflavin	(10) Thiamine
Treatment	107.7***	376.1***	16.51***	0.900***	1.259***
	(35.66)	(48.15)	(1.404)	(0.128)	(0.134)
Constant	1,903***	2,091**	47.68*	9.289***	5.028**
	(634.4)	(856.5)	(24.97)	(2.280)	(2.376)
Household controls	YES	YES	YES	YES	YES
Observations	13,771	13,771	13,771	13,771	13,771
R-squared	0.078	0.067	0.062	0.431	0.061

Table 14
Mineral changes per capita per week

VARIABLES	(1) Minerals (aggregate)	(2) Iron	(3) Calcium	(4) Potassium
Treatment	3,312***	12.81***	301.1***	1,617***
	(283.7)	(1.372)	(54.94)	(145.0)
Constant	25,499***	108.8***	3,590***	13,184***
	(5,046)	(24.40)	(977.3)	(2,579)
Household controls	YES	YES	YES	YES
Observations	13,771	13,771	13,771	13,771
R-squared	0.229	0.322	0.430	0.173

VARIABLES	(5) Phosphorus	(6) Zinc	(7) Magnesium	(8) Sodium
Treatment	1,202***	3.637***	175.9***	584.8***
	(90.04)	(0.424)	(19.72)	(146.0)
Constant	6,561***	37.42***	2,018***	1,500
	(1,602)	(7.542)	(350.8)	(2,596)
Household controls	YES	YES	YES	YES
Observations	13,771	13,771	13,771	13,771
R-squared	0.115	0.372	0.421	0.038

Table 15
Macronutrient and calorie proportion changes per capita per week

VARIABLES	(1) Calories	(2) Protein	(3) Total Fat	(4) Saturated Fat	(5) Fiber
Treatment	0.0893***	0.105***	0.0581***	0.0879***	0.0713***
	(0.00679)	(0.00786)	(0.00682)	(0.00866)	(0.00678)
Constant	9.058***	5.398***	5.472***	3.736***	4.951***
	(0.121)	(0.140)	(0.121)	(0.154)	(0.121)
Household controls	YES	YES	YES	YES	YES
Observations	13,771	13,771	13,771	13,771	13,771
R-squared	0.314	0.250	0.330	0.236	0.376

VARIABLES	(6) Carbohydrates	(7) Monounsat. Fat	(8) Polyunsat. Fat	(9) Cholesterol
Treatment	0.0976***	0.0757***	0.0776***	0.176***
	(0.00731)	(0.00768)	(0.00965)	(0.0159)
Constant	7.215***	4.251***	4.095***	6.780***
	(0.130)	(0.137)	(0.172)	(0.285)
Household controls	YES	YES	YES	YES
Observations	13,771	13,771	13,771	13,258
R-squared	0.296	0.266	0.186	0.084

Table 16
Vitamin proportion changes per capita per week

VARIABLES	(1) Vitamins (aggregate)	(2) Vitamin C	(3) Vitamin A	(4) Vitamin B6	(5) Vitamin B12
Treatment	0.205***	0.211***	0.275***	0.0679***	0.199***
	(0.0127)	(0.0140)	(0.0164)	(0.00680)	(0.0190)
Constant	5.517***	5.170***	6.604***	1.801***	1.368***
	(0.226)	(0.249)	(0.291)	(0.121)	(0.340)
Household controls	YES	YES	YES	YES	YES
Observations	13,771	13,771	13,771	13,771	13,217
R-squared	0.081	0.072	0.112	0.443	0.080

VARIABLES	(6) Folic Acid	(7) Folate	(8) Niacin	(9) Riboflavin	(10) Thiamine
Treatment	0.0730***	0.151***	0.286***	0.0337***	0.172***
	(0.0121)	(0.0113)	(0.0164)	(0.00802)	(0.0116)
Constant	7.208***	7.570***	3.666***	2.037***	1.608***
	(0.215)	(0.201)	(0.292)	(0.143)	(0.206)
Household controls	YES	YES	YES	YES	YES
Observations	13,754	13,771	13,766	13,771	13,771
R-squared	0.126	0.120	0.099	0.524	0.104

Table 17
Mineral proportion changes per capita per week

VARIABLES	(1) Minerals	(2) Iron	(3) Calcium	(4) Potassium
Treatment	0.101***	0.0708***	0.0132	0.111***
	(0.00724)	(0.00716)	(0.00909)	(0.00754)
Constant	10.03***	4.590***	7.894***	9.324***
	(0.129)	(0.127)	(0.162)	(0.134)
Household controls	YES	YES	YES	YES
Observations	13,771	13,771	13,771	13,771
R-squared	0.282	0.413	0.530	0.227

VARIABLES	(1) Phosphorus	(2) Zinc	(3) Magnesium	(4) Sodium
Treatment	0.144***	0.0598***	0.0576***	0.111***
	(0.00904)	(0.00678)	(0.00644)	(0.0160)
Constant	8.679***	3.486***	7.451***	7.339***
	(0.161)	(0.121)	(0.115)	(0.285)
Household controls	YES	YES	YES	YES
Observations	13,771	13,771	13,771	13,771
R-squared	0.141	0.460	0.487	0.150