Cash, Food, or Vouchers? Evidence from a randomized experiment in Northern Ecuador

Melissa Hidrobo, John Hoddinott, Amber Peterman,
Amy Margolies, and Vanessa Moreira

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Abstract: The debate over whether to provide food-assistance and the form that this assistance should take has a long history in economics. Despite the ongoing debate, there is little rigorous evidence comparing food-assistance in the form of cash versus in-kind. This paper uses a randomized evaluation to assess the impacts and cost-effectiveness of cash, food-vouchers, and food transfers on food consumption. We find that all three modalities significantly improve food consumption. However, differences emerge in the types of food consumed with food leading to significantly larger increases in calories consumed, and vouchers leading to significantly larger increases in dietary-diversity.
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*Poverty, Health and Nutrition Division (PHND) at the International Food Policy Research Institute (IFPRI). Corresponding author: Melissa Hidrobo, 2033 K St. N.W., Washington D.C. 20006. m.hidrobo@cgiar.org.

1. Introduction

There are a set of design issues common to all social transfer interventions: who should receive benefits; how much should be given and with what frequency; for how long should benefits be provided; what form of assistance should be provided; what conditions should be attached; whether the intervention is incentive compatible with the behaviors or outcomes that are the objective of the program; and the cost-effectiveness of different design options. Analysis of these issues has a long history within economics. They appear in Senior's (1834) report on the operation of the Poor Laws in nineteenth century England, the functioning of the Famine Codes in late nineteenth century and early twentieth century India (Drèze, 1990), discussions surrounding welfare reform in the United States in the 1990s (Blank, 2002) and in contemporary debates regarding the design and implementation of social protection programs in developing countries (Grosh, Del Ninno, Tesliuc, & Ouerghi, 2008). The form of assistance – in cash, near-cash transfers such as vouchers and in-kind – has been especially contested.

The case for cash assistance is justified primarily on the grounds that it generates the largest welfare gains because it allows beneficiaries to use these transfers as they see fit. As Glaeser (2012) notes, "I am grateful for the freedom I enjoy when spending my earnings; surely, aid recipients also like autonomy. They can choose the spending that best fits their needs if they are given unrestricted income." It is also argued that there is less stigma attached to cash transfers which compared with in-kind or near-cash transfers such as vouchers or food stamps are less visible to non-beneficiaries (Grosh, et al., 2008). Once the necessary administrative structures are in place, cash transfers are perceived to be less costly to administer. Blackorby and Donaldson (1988) note that under the second theorem of welfare economics, given certain assumptions, lump-sum cash transfers are efficient in that they move the economy from one pareto optimum to another without introducing welfare-destroying distortions.

Two arguments are made to justify near-cash transfers such as food stamps and in-kind transfers. The first relates to targeting. Where it is not possible or very costly to identify beneficiaries, in-kind transfers are advantageous because only those truly in need will take-up these in-kind benefits (Currie & Gahvari, 2008; Drèze, 1990). Blackorby and Donaldson (1988) note that when the cost of acquiring information on beneficiaries is high, in-kind transfers may be less distortionary than cash transfers. Bruce and Waldman (1991) extend this argument, showing that in the presence of a Samaritan's Dilemma, in-kind transfers are more efficient than cash transfers even under conditions of perfect information. The second argument is essentially paternalistic. Policy makers and program implementers seek to change a particular behavior or the consumption of a particular good (Currie & Gahvari, 2008). Underpinning this motive is an assumption that in-kind transfers do not crowd out private spending on the good being provided.

Other arguments in favor of one form of transfer over another are circumstance dependent (Coate, 1989). For example, the provision of cash transfers can adversely affect non-beneficiaries living in the same locality when food markets are not integrated as the injection of cash may cause food prices to rise (Basu, 1996; Gentilini, 2007). By contrast, Senior (1834) criticized the provision of in-kind housing assistance because it increased rents paid by non-beneficiaries. Although cash transfers are preferable when prices are declining, beneficiaries are protected from price rises when they receive in-kind transfers.

In the United States over the past 40 years in-kind programs have been growing faster than cash programs (Glaeser, 2012). Rather than debating which type of assistance is *most* effective, the debate usually centers on the effectiveness of in-kind programs such as the food stamp program (Supplemental Nutrition Assistance Program (SNAP)) and whether funding to these programs should be cut. Only a handful of studies in the United States compare different policy

options for food assistance. One such study compares food stamps to equivalent cash transfers and finds that food stamp beneficiaries spend a greater fraction of their transfers on food, a result commonly referred to as the cash-out puzzle (Fraker, Martini, & Ohls, 1995). A more recent study compares the less restricted SNAP program to the more restricted WIC program and finds that WIC leads to greater nutritional impacts, especially among children (Yen, 2010).

In developing country contexts, the merits of the provision of cash rather than near-cash or in-kind transfers, particularly food, has produced a debate that Devereux (2006) describes as polarized and acrimonious. There are concerns regarding the cost-effectiveness of alternative transfer modalities, a belief that in-kind transfers have especially pernicious disincentive effects and the impression that in-kind recipients often sell a portion of their transfers at prices below their market value, thereby reducing their value. This debate, however, has been hobbled by the absence of rigorous evidence. While there are numerous studies on the impact of cash transfers (for review see Fiszbein et al. (2009)) and numerous studies on the impact of food transfers, comparisons of impact is confounded by differences in program design, the magnitude of the transfer, and the frequency of the transfer.[1]

This paper contributes to our understanding of the impact of cash, near-cash and in-kind transfers. It uses a randomized design to compare the impact and cost-effectiveness of cash, food vouchers, and food transfers on the quantity and quality of food consumed. To reduce the probability that impact estimates are confounded by differences in program design, careful attention was paid to

[1] Two recent examples illustrate the limitations of the extant literature. Sharma (2006) reports the result of an intervention in Sri Lanka where beneficiaries were randomized into receiving food or cash transfers of equivalent value. However, cash transfers were provided bi-weekly over a three month period whereas food was provided twice and so differences in their impact may reflect differences in the frequency of transfers rather than the form of transfer. Results from a randomized cash and food transfer in southern Mexico (Cunha, De Giorgi, & Jayachandran, 2011) suffers from two limitations: the food transfer was worth 33 percent more than the cash transfer and the food transfer was provided bi-monthly while the cash transfer was given monthly.

ensuring that all aspects of the transfer program – transfer levels, transfer frequency, conditions attached to program participation - were as similar as possible across modalities. Moreover, it was fielded in several urban and peri-urban localities in Ecuador with well-functioning food markets. This, together with the fact that the intervention was small relative to the size of the local economy, means that results are not confounded by differences in price trajectories faced by beneficiaries receiving different transfer modalities.

We find that all three treatment arms significantly improve the quantity and quality of food consumed as measured by the value of per capita food consumption, per capita caloric intake, and dietary diversity measures. Moreover, we find no evidence of increases in non-food expenditures. However, across treatment arms differences emerge in the types of food consumed with food leading to significantly larger increases in calories consumed, and vouchers leading to significantly larger increases in dietary diversity measures. Combining impact estimates with costing data, we find that given the significantly higher costs of implementing food transfers, food is always the *least* cost-effective modality of improving any outcome measure, while vouchers are usually the most cost-effective.

The rest of this paper is structured in the following way. Section 2 introduces the program and study design; Section 3 presents the data and descriptive analysis; Section 4 discusses the empirical methods used to evaluate the different transfer modalities; Section 5 presents the impact results; Section 6 presents the costing and cost-effectiveness analysis; Section 7 discusses beneficiaries preferences and costs; and Section 8 concludes.

2. Program design

2.1. Intervention

Responding to a request from the Government of Ecuador (GoE) in April 2011, the World Food Programme (WFP) expanded its assistance to address the food security and nutrition needs of Colombian refugees and to support their integration into Ecuadorian communities. The new program was designed as a prospective randomized control trial and consisted of six monthly transfers of cash, food vouchers, or food transfers to Colombian refugees and poor Ecuadorian households. The objectives of the program were three-fold: 1) to improve food consumption by facilitating access to more nutritious foods, 2) to increase the role of women in household decision-making related to food consumption, and 3) to reduce tensions between Colombian refugees and host Ecuadorian populations.

The program was implemented in seven urban centers in the provinces of Carchi and Sucumbíos. Both Carchi and Sucumbíos are northern border provinces that receive high influxes of Colombian refugees and cross-border traffic; however, Carchi is located in the northern highlands and Sucumbíos is located in the Amazonian lowlands, thus, each has distinct cultural, socio-economic and geographic features. *Barrios* (or neighborhoods)[2] within these urban centers were pre-chosen for the intervention by WFP in consultation with the United Nations High Commissioner for Refugees (UNHCR) as areas that had large numbers of Colombian refugees and relatively high levels of poverty. Each household in the selected *barrios* was visited, mapped, and administered a one-page questionnaire that consisted of basic demographic and socioeconomic questions. These questions were used to develop a proxy means test to define program eligibility. However, based on point scores by nationality, the decision was made to automatically enroll all Colombian and mixed-nationality households. In addition, all households who reported receiving the government's social safety net transfer

[2] *Barrios* are existing administrative units within the urban centers with oversight over social services and other administrative functions.

program, the *Bono de Desarrollo Humano* **(**BDH) were automatically excluded from eligibility. Households residing in the selected *barrios* with low socioeconomic status as measured by the proxy means test that met the criteria described above were eligible to participate in the program.

During enrollment and sensitization, the program was described as a poverty and food security transfer targeted toward women, and therefore, the majority of the entitlement cardholders were expected to be women. However, based on household demographics (for example, if there was no adult woman available), men could also be entitlement holders and participate in all program activities. Overall, approximately 79 percent of cardholders in Carchi and 73 percent of cardholders in Sucumbíos were women (WFP-Ecuador, 2011).

Participating households received benefits from April 2011 to September 2011. The value of the monthly transfer was standardized across all treatment arms at $40 per month per household. The transfer size for all modalities was set to be roughly comparable to the national cash transfer scheme, the BDH, which at the time of program design, was $35 per month per household. For the cash treatment arm, the $40 was transferred monthly onto pre-programmed ATM cards. Cash transfer households were able to retrieve the cash at any time after it had been transferred onto the card; however, it had to be taken out in bundles of $10. The food vouchers were also valued at $40 and given in denominations of $20, redeemable for a list of nutritionally-approved foods at central supermarkets in each urban center. The list of approved foods is included in Appendix 1 (along with the recommended amount of food items to buy) and is composed of cereals, tubers, fruits, vegetables, legumes, meats, fish, milk products, and eggs. The food vouchers could be used over a series of two visits per month and had to be redeemed within 30 days of initial receipt of the voucher. The vouchers were serialized and printed centrally, and were non-transferable. The food basket was valued according to regional market prices at $40 and included rice (24

kilograms), vegetable oil (4 liters), lentils (8 kilograms), and canned sardines (8 cans of 0.425 kilograms). The quantity of food received is higher than what the median household in our sample consumes at baseline, which suggest that for many households the items from the food transfer will be extra-marginal.[3]

Nutrition sensitization was a key component of the program, aimed at influencing behavior change and increasing knowledge of recipient households, especially in regards to dietary diversity. To ensure a consistent approach to knowledge transfer, a set of curricula was developed by WFP to be covered at each monthly training. Topics included (1) program sensitization and information, (2) family nutrition, (3) food and nutrition for pregnant and lactating women, (4) nutrition for children aged 0–12 months, and (5) nutrition for children aged 12–24 months. All participants regardless of transfer modality participated in this training, and transfers were conditional on attendance. In addition to monthly meetings, posters and flyers on nutrition were developed and posted at distribution sites, including supermarkets, banks, and community centers, to further expose participants to knowledge messaging.

Particular attention was given to ensuring beneficiaries' experiences with the program would be similar across modalities, and descriptive results indicate this goal was achieved. In particular, across all modalities beneficiaries reported extremely high rates of satisfaction with the program and transparency of the program, believed that the program was fair, and reported program employees treated them with respect. On average, 99 percent of beneficiaries reported receiving their transfers in totality and 97 percent reported that they received all information needed to understand how the program worked. Across the three modalities, a minimum of 88 percent of beneficiaries stated that they received their scheduled payments on time and that they knew how many transfers they

[3] At baseline households consume 20 kgs of cereals, .35kgs of fish and seafood, and 2 kgs of pulses and legumes.

would receive. Knowledge gained from the nutrition sensitization sessions, as measured by a set of questions at baseline and follow-up, was also similar across modalities[4].

Beneficiaries were also asked about how they used their most recent transfer. Voucher households reported using 99 percent on food consumption, compared to 83 percent for cash households, and 63 percent for food households. Cash households reported spending the other 6 percent on non-food expenditures, 2 percent was shared with others outside the household, and 8 percent was saved. Food households reported saving the other 29 percent for later use and sharing 7 percent with others outside the household. We found no evidence from the self-reports of food or voucher beneficiaries selling their transfers.

2.2. Study Design

The program evaluation was based on random assignment. Randomization was conducted in two stages: first, *barrios* were randomized to either treatment or control arms; second, all treatment clusters (geographical units within *barrios*) were randomized to cash, food voucher, or food transfer. Since the geographic area in each urban center was relatively small, this measure was taken to avoid the case that a cluster assigned to the control group might be within the same *barrio* as a cluster assigned to receive a transfer and consequently cause discontent by potential beneficiaries. Due to the distinct socioeconomic and geographic characteristics of Sucumbíos and Carchi, the randomization of cluster centers was stratified at the province level. The number of clusters per *barrio* varied from one to six, with an average of approximately two per barrio. The *barrios* and clusters were randomized into the four treatment arms using percentages of 20/20 for the

[4] Out of 8 items intended to measure nutrition knowledge (for example, food sources of vitamin A or iron) only 1 showed significantly different impacts across modalities.

control and food arms, and 30/30 for the cash and food voucher arms.[5] In total 80 *barrios* and 145 clusters were randomized into the four intervention arms – control, cash, food vouchers and food.

3. Data

The baseline survey was conducted in March-April 2011 before the first transfers were distributed. The follow-up survey was conducted approximately seven months later (October-November 2011) after the last of the six transfer distributions. In total the baseline sample for the evaluation consists of 2,357 households of whom 2,122 were re-surveyed at follow-up.

Household-level baseline and follow-up questionnaires include detailed information on a household's food and non-food expenditures, in addition to information on education, labor, health, discrimination, and decision-making. The follow-up questionnaire also includes a section on a household's experience with the transfers. Using information from the food and non-food expenditure module we create measures of a household's food consumption, non-food expenditures, dietary diversity, and caloric intake.

3.1. Outcome indicators

Household food consumption aggregates are constructed from data on the total value of food consumed in the last seven days. This data is asked with reference to 41 different food items. Aggregates are constructed using not just

[5] One unexpected complication in the study design was the change in beneficiary criteria implemented during the baseline survey data collection. In the process of surveying households, it was concluded that the targeting for the transfers was too broad, resulting in the inclusion of households who were relatively well off. This led to a re-targeting process where households who were relatively well off were dropped from the program. Since there were not enough households in existing *barrios* to replace those that had been excluded and still reach program enrollment targets, the decision was made to expand coverage to additional *barrios* on the outer circle of urban areas. These areas were subsequently re-randomized into treatment arms according to the approximate percentage lost.

food purchased in the market place but also food that is home-produced, food that is received as gifts or remittances from other households or institutions, and food that is received as payments for in-kind services. Median prices from food purchased are inputted to calculate the total value of food consumed from home production or received as gift or in-kind payment. Weekly household values on food consumed are converted to monthly values which are then converted to household per capita values by dividing by the number of members in the household. Given that the distribution of per capita food consumption is skewed to the right, we convert all values to their logarithms for the analysis, and we trim the top and bottom 0.5 percent of outliers (further details are available in the appendix).

Caloric intake is constructed from the amount of food consumed by households (from purchases, own stock, or in kind payments). In particular, the amount of food consumed for each item is multiplied by the energy value for that item to obtain the kilocalories consumed. Energy values are taken from the Nutrition Database for Standard Reference (USDA, 2010) and from the *Tabla de Composicion de Alimentos de Centroamerica* (Manchu & Mendez, 2007). Total monthly household caloric values are then converted to daily amounts and divided by household size to obtain caloric availability per person per day. Although we use per capita values, our results are robust to using adult equivalent values.[6] Similar to consumption aggregates, all values are converted to their logarithms, and the top and bottom 0.5 percent of outliers are trimmed. In addition to calculating the total kilocalories consumed, we calculate the kilocalories consumed per dollar in order to see if households are changing their food consumption behavior towards cheaper foods that are higher in calories. An

[6] Adult equivalent values are calculated using the following formula: $AE = (A + \propto K)^{\theta}$ where $\propto = .5$ and $\theta = .9$ (Deaton & Zaidi, 2002)

indicator for kilocalories consumed per dollar is constructed by dividing total daily per capita caloric intake by the value of total daily per capita consumption.

Food consumption and caloric intake play important roles in meeting food security needs. However, households do not solely value quantity – a more varied diet is also important. Increased dietary diversity is associated with a number of improved outcomes in areas such as birth weight, child anthropometrics, hemoglobin concentrations, hypertension, cardiovascular disease, and cancer (Hoddinott & Yohannes, 2002). We construct three separate measures for dietary quality: the Dietary Diversity Index (DDI), Household Dietary Diversity Score (HDDS), and the Food Consumption Score (FCS). The most straightforward of these measures, the Dietary Diversity Index, sums the number of distinct food items consumed by the household in the previous seven days. The household questionnaire covers 41 such food items, and thus the DDI in this survey can feasibly range from 0 (no consumption at all) to 41. Hoddinott and Yohannes (2002) show that the DDI correlates well with both household dietary quantity and quality, and thus provides a useful summary point of comparison within the measured sample. The HDDS captures a similar element of food access, although it differs from DDI in that frequency is measured across standardized food groups, instead of individual food items. The score is calculated by summing the number of food groups consumed in the previous seven days from the following 12 groups (Kennedy, Terri Ballard, & Dop., 2011): cereals, roots/tubers, vegetables, fruits, meat/poultry/offal, eggs, fish/seafood, pulses/legumes/nuts, milk/milk products, oils/fats, sugar/honey, miscellaneous. Lastly, WFP measures food insecurity using a proxy indicator called the food consumption score (FCS). The FCS is calculated by summing the number of days eight different food groups (staples, pulses, vegetables, fruit, meat/fish, milk/dairies, sugar/honey, oils/fats) were consumed by a household, multiplying these by weighted frequencies and summing across categories to obtain a single proxy indicator. Households are then

categorized as having poor to borderline consumption if their FCS score is less than or equal to 35 (WFP, 2008). The FCS has been found to correlate well with caloric availability at the household level (Wiesmann, Bassett, Benson, & Hoddinott, 2009) and thus reflects the quality of the diet in terms of energy and diversity.

Non-food expenditures are calculated from expenditures on the following items: entertainment, personal hygiene, clothing, shoes, transportation, services, communication (telephone and internet), durable goods, jewelry, housing (rent and repairs), water, and electricity. In addition, expenditures on health and education are calculated separately from the education and health modules. All expenditures are converted to monthly values and similar to the food consumption aggregates the top 0.5 percent of outliers is trimmed.[7]

3.2. Attrition

The attrition rate in this sample is 10 percent. If attrition is correlated with treatment assignment, then this could potentially bias our impact estimates. Table 1 shows no significant difference in attrition rates between the control arm and the pooled treatment arm. However, when we compare attrition across each individual treatment arm, we do find a significant difference in rates for the food transfer arm when compared to the control arm (Table 2).

Attrition could bias the study results in a number of unanticipated ways. If poorer households are the ones more likely to leave the study, and significantly more households in the control arm left the study than in the food treatment arm, then our estimates will be underestimates of the impact of food transfers. Even across arms with similar attrition rates, differential attrition would threaten the internal validity of the study. In particular, if households that leave the treatment

[7] We do not trim the bottom 0.5 percent because a significant portion of households report 0 expenditures on education and health.

arms are poorer than households that leave the control arm, then our treatment estimates will be biased because any change in outcomes will be due to both treatment *and* differential attrition. In order to examine if differential attrition threatens the internal validity of the study, we compare baseline characteristics of households that leave the study across treatment and control arms. Table 3 reveals that in the treatment and control arms, there are significant differences between those that leave the study and those that stayed. For example, in both the treatment and control arms, Colombians are significantly more likely to leave the study. However, internal validity is only threatened if those that leave the study in the control arm are significantly different from those that leave the treatment arm. Consequently, we focus on columns 7 and 8 that compare the "attrited" groups across the two arms, and we find significant differences at the 5 percent level only for household head's age and ownership of agricultural plots. In particular, those that leave the treatment arm are significantly younger and less likely to own agricultural land than those that leave the control arm. However, baseline analysis across treatment and control arms for households that stay in the study (Table 4) reveals that differences in age and owning agricultural land are not significant; therefore, we conclude that the bias due to the differential attrition of these variables is likely to be very small.

3.3. Balance of baseline characteristics

In order to ensure that randomization was successful, we compare baseline characteristics across treatment and control households. We conduct the analysis on the 2,122 households that are in the baseline and follow-up surveys. We first combine all three treatment arms (cash, voucher, and food transfer) and compare pooled treatment households to control households (Table 4), and then we compare each treatment arm separately to the control arm (Table 5).

Table 4 reveals that household heads in our sample have a mean age of approximately 42 years, 35 percent have secondary schooling or higher, only 28 percent are married, 29 percent are Colombian, and slightly more than one quarter are females. The average household size is 3.8 and the average monthly household expenditure is approximately $243. Thus, the transfer of $40 is approximately 16 percent of a household's pre-transfer expenditures. While these households are poor, the daily caloric intake per adult equivalent is high, at 2,532 kcals. Across 21 difference-in-means test between the treatment group and control group, only five are statistically different, which reveals that randomization was, for the most part, effective at balancing baseline characteristics. In particular, control households are significantly more likely to be Colombian, have more children ages 6–15 years, have larger households, and have lower per capita food consumption and caloric intake.

Table 5 conducts difference-in-means test for each treatment arm compared to the control arm. Results show a similar pattern where, across the 63 (21 x 3) tests, 12 have means that are significantly different at the 5 percent level. Overall, these confirm previous tests by pooled treatments that indicate that the baseline randomization was generally successful with respect to household observable characteristics. However, the few significant differences reaffirm our decision to add baseline covariates as controls in our empirical analysis.

3.4. Graphical analysis

Figure 1 shows the densities at baseline and follow-up of two main outcome indicators: 1) log of the value of per capita food consumption, and 2) the FCS. At baseline there are no large differences between treatment and control arms for either indicator. However, at follow-up the density for the treatment group has shifted more to the right causing a larger difference between the treatment and

control group. Our estimation strategy explained in more detail below captures these differences of the treatment group compared to the control group.

4. Methods

Our estimation strategy relies on the randomized design of the transfer program. Random assignment of clusters assures that, on average, households will have similar baseline characteristics across treatment and control arms, as demonstrated in the previous section. Such a design eliminates systematic differences between beneficiaries and non-beneficiaries in targeted programs and minimizes the risk of bias in the impact estimates due to "selection effects". Moreover, we take advantage of the baseline survey and estimate the treatment effect using Analysis of Covariance (ANCOVA) which controls for the lagged outcome variable. Given the high variability and low autocorrelation of our food expenditure data, ANCOVA estimates are preferred over difference-in-difference estimates (McKenzie, 2012). The ANCOVA model that we estimate is the following:

$$Y_{h1} = \propto + \beta_f food_h + \beta_c cash_h + \beta_v voucher_h + \gamma Y_{h0} + \delta X_{h0} + \varepsilon_h$$

where Y_{h1} is the outcome of interest for household h at follow-up and Y_{h0} is the outcome of interest at baseline. $food_{h,} cash_h, voucher_h$ are indicators that equal one if household h is in the corresponding treatment arm. The β represents the intent-to-treat estimator, which is the effect of being assigned to either the food, cash, or voucher arm. In order to test whether the estimator is statistically different by treatment arm, we conduct Wald tests of equality and report the p-values.

X_{h0} is a vector of control variables for household h at baseline. Given the relative success of the random assignment, the inclusion of baseline controls is not necessary to obtain unbiased estimates of β. In all estimates, however, we

account for baseline socioeconomic characteristics in order to increase the precision of the estimates and control for any minor differences between treatment and control arms at baseline. The core group of baseline control variables that we use are indicators for urban centers, an indicator for whether household head is female, an indicator for whether household head is Colombian, an indicator for whether household head has at least some secondary education, household head's age, household size, number of children 0–5 years old, number of children 6–15 years old, and household wealth quintiles (five indicators for each quintile). The household wealth quintiles are constructed from a wealth index that is created using the first principal from a principal components analysis (PCA). Variables used to construct the index are housing infrastructure indicators (e.g., type of floor, roof, toilet, light, fuel, and water source) and 11 asset indicators (e.g., refrigerator, mobile phone, TV, car, and computer). In all regressions we cluster the standard errors at the level of randomization that is the cluster.

5. Results

5.1. Food versus non-food consumption

We begin our analysis by comparing the impact of treatment on food versus non-food consumption. The outcomes of interest are: the value of food consumption, health and education expenditures, and non-food expenditures. Table 6 reveals that across all treatment arms, the transfer is being used on food, rather than non-food items. In particular, being in the program significantly increases the value of a household's food consumption by \$14-\$18.6 depending on the treatment arm.[8] The size of the impact is not significantly different across

[8] We also find increases in food shares that are slightly lower than what Schady and Rosero (2008) find under the BDH in Ecuador, however, there are no differences across treatment arms.

arms, which implies that the amount of the transfer being used on food consumption is the same across transfer modalities. While the results are large and significant, the magnitude is slightly lower than what we would expect to see if households used the whole transfer on food. One possible explanation for this discrepancy is that households report saving a significant amount of their transfer. Another possible explanation is that for many households the endline survey was conducted more than 2 weeks after the last transfer was received. Given that the survey only asks about consumption in the last week, it may not be capturing lumpy consumption occurring immediately after receiving the transfer.

5.2. Value of food versus caloric intake

Although the amount of money spent on food is similar across treatment arms, there may be differences in the types of food being bought, and in particular the amount of calories being consumed as a result of the transfer. The first column in Table 7 reinforces the results from the previous table in that all treatment arms lead to significant increases in the value of per capita food consumption. There are also significant improvements in per capita caloric intake across all three treatment arms that range from 6-16 percent. In contrast to the results on the value of food consumption, the size of the impact is significantly different across arms, with the food arm leading to significantly larger increases compared to the cash arm. The fact that all transfers lead to large increases in the value of food consumed, but that the food transfer leads to significantly larger increases in calories implies that cash and voucher households are buying more expensive goods that are lower in calories. Evidence of this is found in the last column which shows that the number of calories per dollar significantly decreases for the cash and voucher arms but not the food arm.

In order to better understand the difference in caloric intake across treatment arms, we disaggregate daily caloric intake by the 12 food groups that

make up the HDDS (Table 8). As shown from the baseline means in the bottom panel of Table 8, 41 percent (or 766 kcals) of a household's calories come from cereals. Thus an 18 percent increase in calories from cereals by the food arm is equivalent to an increase of 138 kcals. On the other hand, cash only leads to an 8 percent increase in cereals which is significantly different to the increase by the food transfer. Food also leads to significantly larger increases than cash or vouchers in calories from fish and seafood and pulses, legumes, and nuts. These significantly larger increases in items that make up the food basket – cereals, fish and seafood, pulses and legumes – suggests that these items were extramarginal.

5.3. Dietary Diversity

Although caloric intake plays an important role in meeting food security needs, a more varied diet is important for improving health outcomes. Table 9 reveals that all three treatment arms significantly increase the measures of dietary quality - the HDDS, DDI, and FCS - however, the size of the impact differs by treatment arms. In particular, vouchers lead to significantly larger increases than food for the DDI and significantly larger increases than food and cash for the FCS. Even though all three modalities significantly increase the FCS, only the voucher and food significantly decrease the percent of households with poor to borderline food consumption scores, and the size of the decrease is significantly larger for the food arm when compared to the cash arm.

In order to see what items are being consumed more frequently by the voucher group compared to the other two groups, we disaggregate the frequency of consumption by the same 12 food groups (Table 10). Consistent with the composition of the food transfer, there are large and significant increases in the number of days the food group ate cereals, fish and seafood, and pulses and legumes. There are also significant increases in the number of days the food group ate roots and tubers and meat and poultry which imply that these items are not

substitutes for those in the food basket. On the other hand, cash leads to significant increases in the number of days a households consumes the following seven items: roots and tubers, vegetables, meat and poultry, eggs, fish and seafood, pulses and legumes, and milk and dairy. The voucher leads to the largest number of significant increases in 9 out of the 12 food groups. When compared to the food transfer, the voucher leads to significantly larger increases in the frequency of consumption of vegetables, eggs, and milk and dairy. When compared to the cash arm, the voucher leads to significantly larger increases in the frequency of consumption of fish and seafood, and pulses and legumes.

5.4. Heterogeneity

Tables 7-10 reveal the average impact of the transfers on food consumption outcomes, but they do not provide any information on how the different treatment arms impact those at the lower end of the wealth distribution. In particular we are interested in how the impacts compare for the poorest households who are the most food insecure. We conduct this comparison by creating interaction terms of each treatment arm with an indicator that equals one if households are in the top two wealth tertiles. Thus the coefficients on the treatment arm represent the impact for those in the poorest wealth tertile and the interaction term represents the differential effect with respect to being in the top two tertiles. Table 11 reveals that all three treatment modalities significantly increase the value of food consumption for those in the poorest tertiles, however, only food leads to significant increases in the caloric intake for those in the poorest tertile. Even more revealing is that for those in the bottom tertile, the impact of food is significantly larger than the impact of voucher for both the value of food consumption and caloric intake. Although the differential effect with respect to wealth tertile is not significant, it is always negative for food and positive for voucher, which implies that food has larger impacts on the poorest tertiles while

vouchers have larger impacts on the top two tertiles. Cash and vouchers also lead to significant decreases in the calories per dollar indicator for those in the bottom wealth tertile and this impact is significantly different to the impact for those in the top two wealth tertiles. In other words, for those at the bottom end of the wealth distribution, cash and vouchers are leading households to buy fewer calories per dollar, but this does not hold for those at the top end of the distribution.

Table 12 reveals similar results. In particular, all three treatment arms lead to significant improvements in dietary diversity for those in the bottom wealth tertile. Moreover, for these poor households, there are no differences across treatment arms in the size of the impact for DDI and FCS, although now the food arm leads to significantly larger impacts than the cash arm for HDDS. The differential impact with respect to wealth tertiles again reveals that food has a larger impact for those at the bottom of the distribution. In particular, the impact on HDDS and FCS for the food arm is significantly larger for those in the bottom wealth tertile than those in the top two wealth tertiles. On the other hand, for the cash or voucher arm the differential effect with respect to wealth on the three dietary diversity measures is not significant. As would be expected, the last column in table 12 reveals that the decrease in poor food consumption is concentrated on households at the bottom end of the wealth distribution.

One concern for policy makers is that transfers, and especially the food modality is increasing caloric intake of a population that is already meeting the recommended daily requirements for calories. In order to see if there are larger improvements for those not meeting the daily requirements we create interaction terms similar to the ones for wealth tertiles. Specifically we interact each treatment arm with an indicator that equals one if a household consumes more

than 2100 adult equivalent kcals a day.[9] Given that we are using an adult equivalent cutoff, we estimate the impact on adult equivalent outcomes instead of per capita outcomes. The first column in table 13 reveals the average impact of the treatment arms on adult equivalent caloric intake, and the second column reveals the heterogeneous impacts with respect to being above the cutoff. Similar to the per capita outcomes in table 7, the average treatment effects across all arms are large and significant. The treatment effects of food are significantly larger for households not consuming more than 2100 adult equivalent kcals a day than for households consuming more than 2100 adult equivalent kcals a day. Although the differential effect is significant for the food arm, the impact on caloric intake for households receiving more than 2100 kcals a day is still large (11 percent increase) and significant. In contrast to the food arm, the differential effect is not significant for the cash or voucher arm.

6. Costing

As part of this study, we collected detailed information on the costs of implementing the three modalities using an ABC-I (Activity-based Costing – Ingredients) method. The ABC-I method combines activity-based accounting methods with the "ingredients" method whereby program costs are obtained from inputs, input quantities, and input unit costs (Edejer et al., 2003; Fiedler, Villalobos, & De Mattos, 2008). An advantage of the detailed information on costs that we obtained from WFP's accounting ledgers and from interviews is that we can separate out costs which are common across all modalities from those that are modality specific. For example, the cost of obtaining the data needed to implement the proxy means test is a common cost – it is independent of the type

[9] 2,100 is the recommended kilocalories per day for woman 18-30 years with moderate activity. 2,150 is the recommended kilocalories per day for woman 30-60 years with moderate activity (Smith & Subandoro, 2007). Our results are robust to either cutoff.

of transfer a household received. By contrast, the cost of manufacturing the debit cards used by cash beneficiaries is a cost specific to the cash transfer. A second strength of these cost data is that we can calculate the staff costs associated with this intervention. Again some of these costs, such as those associated with the project launch, are common across all modalities while others such as time spent identifying which supermarkets would be able to accept food vouchers are modality specific.

We are interested in the marginal cost of implementing these modalities. That is to say, after all common costs of program implementation (planning costs, targeting, sensitization, nutrition training and others) are accounted for, what additional costs are incurred to deliver these transfers in the form of food, cash and vouchers. Expressing these in per transfer terms, it cost $11.50 to provide a food transfer, $3.03 to provide a cash transfer and $3.30 to provide a voucher (details on costing can be found in Table A.1 in the appendix). The cost of physical materials associated with vouchers, such as printing, is trivial. However, there is significant staff costs associated with supermarket selection, the negotiation of contracts with individual supermarkets and voucher reconciliation and payment. These staff costs account for nearly 90 percent of the cost of implementing the voucher component of the intervention. The cost of generating the debit cards is the main cost item in the cash transfer. The food transfer is significantly more expensive because of the cost of transporting the food to the distribution sites and rental of storage facilities. Taking bulk items and re-packaging them for distribution is also very costly, accounting for approximately 30 percent of the cost of distributing the food ration.

In order to compare the cost-effectiveness across modalities, we do a simulation whereby beneficiaries' outcomes increase by 15 percent. Specifically, we calculate how much it would cost to achieve this goal using food, cash and vouchers, conditional on the transfer size and abstracting from costs common to

all modalities. Given the different metrics by which our outcomes are measured, we conduct the simulations for each outcome. For example, table 9 tells us that cash transfers increase the FCS by 6.48 points which is an 11 percent increase. Therefore, the modality specific cost of increasing FCS by 15 percent using cash transfers is (15% / 11%) *x* $3.03 which equals $4.13. Table 14 shows the results of these calculations for each modality for the following five outcomes - the value of per capita food consumption, per capita caloric intake, HDDS, DDI and FCS. There are two key findings. First, across all outcomes food is always the most costly means of improving these outcomes by 15 percent. Second, vouchers are usually the least costly means of improving these outcomes by 15 percent, although for increasing the value of food consumption, there is virtually no difference in the cost of vouchers versus cash.

7. Beneficiaries' preferences and costs

Other factors to take into account when assessing whether cash or in-kind transfers should be provided relates to beneficiaries costs (time and money) associated with receiving payments and beneficiaries preferences. Beneficiaries are asked how they would like to receive these transfers in the future. Table 15 shows that 55 percent of food beneficiaries prefer to receive transfers entirely in food, 77 percent of cash beneficiaries prefer to receive transfers entirely in cash and 56 percent of voucher beneficiaries prefer to receive transfers entirely as vouchers. While these numbers suggest widespread satisfaction with these transfer modalities, they may be subject to bias towards what beneficiaries are receiving. More interesting are the proportions who having received one form of transfer do not wish to receive it in the future. Only 9 percent of cash beneficiaries do not wish to receive further transfers in the form of cash. By contrast, 28 percent of food beneficiaries do not wish to receive further transfers in the form of food and 31 percent of voucher beneficiaries do not wish to receive further

transfers in vouchers.[10] This is consistent with Glaeser's comment at the beginning of the paper; these beneficiaries appear to appreciate the autonomy that comes with cash.

In terms of beneficiaries' costs, cash and voucher recipients spend an average of $1.46 and $1.65 per month respectively on transportation and other out-of-pocket expenses to retrieve transfers. Food recipients spend slightly more, $2.12, as many had to use taxis to carry home the heavy loads of food given at the distribution points. In terms of opportunity costs from time spent travelling to the distribution point and waiting to receive their transfers, cash recipients spend 45 minutes traveling and waiting while food and voucher beneficiaries spend on average 93 and 92 minutes. Consistent with beneficiaries' preferences, overall cash recipients incur the least costs in terms of time and money.

8. Conclusion

The debate over the merits food assistance and the form this assistance should take has a long history in economics. Despite this enduring debate, there is little rigorous evidence comparing food assistance in the form of cash versus in-kind. This paper uses a randomized evaluation to assess the impacts and cost-effectiveness of cash, food vouchers, and food transfers. We find that all three treatment arms significantly improve the quantity and quality of food consumed as measured by the value of per capita food consumption, per capita caloric intake, and dietary diversity measures - HDDS, DDI and FCS. Across treatment arms we find no differences in the amount of the transfer that is used on food versus non-food expenditures. However, we do find significant differences in the types of food consumed. In particular, food leads to a significantly higher increase

[10] One main complaint from voucher recipients was that the supermarkets had higher prices. While we do find slightly higher prices on some items such as fruits or meats and chicken, for other items such as cereals, pulses, and tubers, there are virtually no differences.

in calories and vouchers lead to significantly larger improvements in dietary diversity.

When we decompose food consumption into food groups, underlying patterns explaining these differences emerge. The larger increase in calories from the food arm is mainly due to significantly larger increases in consumption of cereals which represent 41 percent of a household's caloric intake. Larger increases in dietary diversity from the voucher arm is mainly due to significantly larger increases in the number of days households consume vegetables, eggs, and milk and dairy. These differences in impacts across transfer modalities indicate that transfers of equivalent value and frequency are used differently on food. While food transfers increase food consumption, the increase is mainly concentrated on the food items that make up the food basket. Cash and vouchers also increase food consumption, but they are used on food that has fewer calories compared to the food items from the food transfer. The difference in food consumption between cash and vouchers is a little more subtle and most likely due to the fact that voucher beneficiaries were limited to purchasing nutritious food items and flyers on how to spend the vouchers were posted on the windows of supermarkets. Differences in types of food available at the supermarkets versus central markets may be another reason for the differences in food consumption between cash and voucher recipients.

Differences across treatment arms also emerge when we investigate the impacts on the poorest households compared to those that are better off. In particular, food leads to significantly larger improvements for households in the poorest wealth tertile compared to households in the top two wealth tertiles. On the other hand, cash and vouchers lead to similar impacts across the wealth distribution. Consequently, food is more targeted to the poorest households and leads to larger increases in the value of food consumption and caloric intake than vouchers.

Especially for policy makers, an important component of our analysis is related to costs and the cost-effectiveness of implementing the different transfer modalities. We find that the marginal cost is $11.50 to provide a food transfer, $3.03 to provide a cash transfer and $3.30 to provide a voucher. Given these costs and impacts, food is the *least* cost-effective means of improving all food consumption and dietary diversity outcomes. However, the direct comparison of cash versus vouchers is not as straightforward and ultimately depends on the specific objectives of policy makers. If the objective is to increase the value of food consumption, then there is not a difference between cash or food vouchers. However, if the objective is to increase dietary diversity or caloric intake, then vouchers are more cost-effective than cash.

Although we find that the food voucher is the most cost effective modality across most indicators, this conclusion may not apply to other settings. In particular, our findings are specific to urban populations with well-functioning markets and supermarkets. Our findings may not hold in areas where supermarkets do not have the capacity to receive more clients, or where they do not have a consistent supply of various food items. Moreover, the caloric intake of the targeted population is relatively high and not as vulnerable to weather shocks. Thus, the way in which beneficiaries spend the transfer may be different from that of populations with low food energy consumption or populations whose food energy consumption is more vulnerable to weather shocks such as rural farmers. For these populations, increasing and smoothing their food energy availability may be more of a priority than improving the diversity of their diet.

In the context considered here, choosing the "winner" among the different modalities depends on the objectives of the policy makers. If the objective of these transfers is simply to improve welfare, cash is preferable. Cash is the modality that beneficiaries are most satisfied with, and it is the cheapest means of making transfers. Given the budget available to WFP for this project, shifting

from food to cash could have increased beneficiary numbers by 12 percent. Moreover, cash allows for savings which helps households smooth their food and nonfood consumption. If the objective is to increase calories or dietary diversity, vouchers are the most cost-effective means of doing so, followed by cash. Although, vouchers are the most cost-effective means of increasing caloric availability and diet quality, it is the modality *least* preferred by beneficiaries. Thus policy makers are faced with the tradeoff of improving overall welfare or improving specific outcomes. The former gives aid recipients' autonomy while the latter restricts their choices in order to achieve specific objectives.

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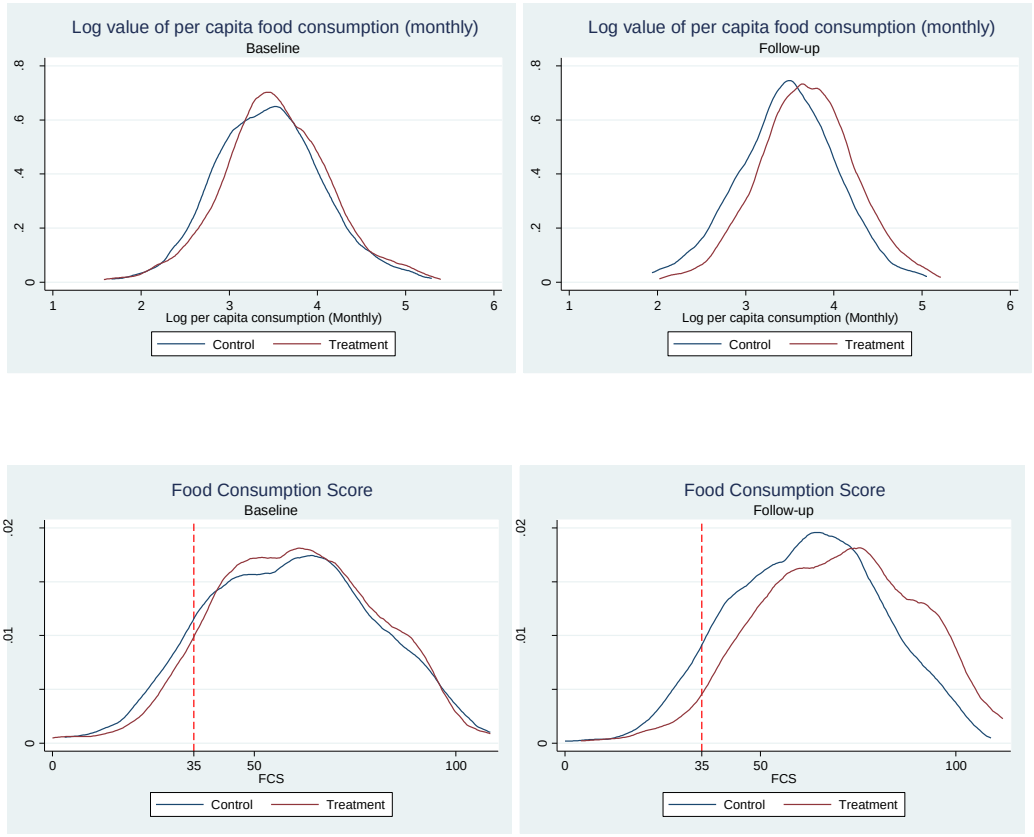
Figures

Figure 1: Density by treatment and control group at baseline and follow-up



Tables

Table 1 Attrition rates, by treatment and control groups

	Control	Treatment	Difference
Attrition rates	0.11	0.09	0.02
	(0.01)	(0.01)	(0.01)
N	652	1,705	

Notes: Treatment refers to all treatment arms (food, cash, and voucher) combined. Standard errors reported in parentheses. Difference in means conducted using t-tests. Stars indicate the following significance levels: * p < 0.10, ** p < 0.05, *** p < 0.01.

Table 2 Difference in attrition rates, by treatment arms

	Means				Difference in means		
	Control	Food	Cash	Voucher	Control-Food	Control - Cash	Control - Voucher
Attrition rates	0.11	0.08	0.09	0.11	0.04**	0.02	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)
N	652	453	601	651			

Notes: Standard errors reported in parentheses. Difference in means conducted using t-tests. Stars indicate the following significance levels: * p < 0.10, ** p < 0.05, *** p < 0.01.

Table 3 Differential attrition analysis (baseline characteristics)

	Control arm			Treatment Arm			Difference	
	(1) Attrited	(2) In study	(3) P-value	(4) Attrited	(5) In study	(6) P-value	(7) Col(1)-Col(4)	(8) P-value
Characteristics of the household head								
Female	0.31	0.26	0.36	0.34	0.27	0.10	-0.02	0.71
Colombian	0.57	0.37	0.00	0.55	0.26	0.00	0.01	0.83
Married	0.23	0.28	0.41	0.22	0.28	0.10	0.01	0.83
Age (years)	42.08	41.87	0.90	36.67	41.63	0.00	5.41	0.01
Has secondary education or higher	0.41	0.32	0.14	0.47	0.36	0.01	-0.06	0.39
Household characteristics								
Number of children 0-5 yrs	0.57	0.58	0.92	0.59	0.62	0.65	-0.02	0.83
Number of children 6-15 yrs	0.80	1.01	0.15	0.72	0.86	0.11	0.08	0.58
Household size	3.66	4.01	0.17	3.34	3.75	0.01	0.33	0.19
Floor type: dirt	0.08	0.06	0.37	0.03	0.04	0.65	0.05	0.09
Owns television	0.69	0.80	0.03	0.64	0.81	0.00	0.05	0.46
Owns computer	0.31	0.27	0.44	0.31	0.30	0.73	0.00	1.00
Owns mobile phone	0.82	0.84	0.69	0.81	0.82	0.81	0.01	0.85
Owns Car/truck/motorcycle	0.20	0.24	0.51	0.17	0.23	0.08	0.03	0.60
Owns land	0.12	0.13	0.91	0.05	0.13	0.00	0.07	0.05
Total household expenditure (monthly)	253.63	245.85	0.74	241.63	242.38	0.96	11.99	0.62
Outcome variables								
Per capita food consumption (monthly)	37.93	36.94	0.76	39.84	40.27	0.86	-1.91	0.64
Caloric intake per capita (daily)	1867.96	1793.68	0.58	1851.90	1913.78	0.54	16.06	0.93
Caloric intake per adult equivalent (daily)	2557.10	2475.08	0.64	2382.88	2554.88	0.14	174.23	0.37
Dietary diversity index	16.52	16.99	0.52	16.00	17.39	0.00	0.52	0.55
Household dietary diversity score	8.77	9.08	0.14	8.87	9.19	0.02	-0.11	0.71
Food consumption score	57.49	59.29	0.48	56.95	60.49	0.04	0.54	0.86

In columns (3) and (6), p-values are reported from t-tests on the equality of means for each variable between the "In Study" and "Attrited" groups. Column (7) reports the difference in means between the "Attrited" group in the control arm and the "Attrited" group in the treatment arm. Column (8) reports the p-values for the difference in means between the two "Attrited" groups. "In study" sample consists of households that were in the baseline and follow-up. "Attrited" refers to households that were in the baseline survey but not in the follow-up.

Table 4 Baseline characteristics by treatment and control group

	N	All	Control	Treatment	P-value of diff
Characteristics of the head					
Female	2122	0.27	0.26	0.27	0.54
Colombian	2122	0.29	0.37	0.26	0.00
Married	2122	0.28	0.28	0.28	0.88
Age (years)	2122	41.69	41.87	41.63	0.75
Has secondary education or higher	2122	0.35	0.32	0.36	0.09
Household characteristics					
Number of children 0-5 years	2122	0.61	0.58	0.62	0.28
Number of children 6-15 years	2122	0.90	1.01	0.86	0.01
Household size	2122	3.82	4.01	3.75	0.00
Floor type: dirt	2122	0.04	0.06	0.04	0.08
Owns television	2122	0.80	0.80	0.81	0.84
Owns computer	2122	0.29	0.27	0.30	0.19
Owns mobile phone	2122	0.83	0.84	0.82	0.25
Owns Car/truck/motorcycle	2122	0.23	0.24	0.23	0.88
Owns land	2122	0.13	0.13	0.13	0.97
Total household expenditures (monthly)	2077	243.32	245.85	242.38	0.69
Outcome variables					
Per capita food consumption (monthly)	2010	39.35	36.94	40.27	0.02
Caloric intake per capita (daily)	2034	1880.83	1793.68	1913.78	0.04
Caloric intake per adult equivalent (daily)	2035	2532.88	2475.08	2554.88	0.24
Dietary diversity index	2096	17.28	16.99	17.39	0.15
Household dietary diversity score	2096	9.16	9.08	9.19	0.19
Food consumption score	2096	60.17	59.29	60.49	0.22

P-values are reported from t-tests on the equality of means for each variable between the control arm and treatment arm.

Table 5 Baseline Characteristics by treatment arms

	Means				P-value of difference		
	Control	Food	Cash	Voucher	Food - Control	Cash - Control	Voucher - Control
Characteristics of the head							
Female	0.26	0.25	0.28	0.29	0.72	0.46	0.35
Colombian	0.37	0.28	0.24	0.26	0.00	0.00	0.00
Married	0.28	0.30	0.28	0.26	0.36	0.94	0.65
Age (years)	41.87	41.26	41.47	42.04	0.53	0.66	0.85
Has secondary education or higher	0.32	0.35	0.35	0.38	0.30	0.34	0.04
Household Characteristics							
Number of children 0-5 years	0.58	0.66	0.59	0.62	0.12	0.84	0.34
Number of children 6-15 years	1.01	0.89	0.88	0.82	0.13	0.07	0.01
Household size	4.01	3.82	3.75	3.69	0.15	0.03	0.00
Floor type: dirt	0.06	0.04	0.03	0.04	0.29	0.05	0.33
Owns television	0.80	0.81	0.78	0.82	0.70	0.42	0.35
Owns computer	0.27	0.32	0.29	0.29	0.10	0.42	0.39
Owns mobile phone	0.84	0.81	0.82	0.83	0.13	0.28	0.72
Owns Car/truck/motorcycle	0.24	0.22	0.23	0.25	0.42	0.93	0.72
Owns land	0.13	0.12	0.12	0.13	0.75	0.79	0.69
Total household expenditures (monthly)	245.85	255.18	239.55	235.87	0.45	0.57	0.32
Outcome variables							
Per capita food consumption (monthly)	36.94	40.56	40.79	39.60	0.04	0.03	0.10
Caloric intake per capita (daily)	1793.68	1830.11	2024.55	1871.01	0.59	0.00	0.24
Caloric intake per adult equivalent (daily)	2475.08	2480.01	2658.49	2512.79	0.95	0.04	0.64
Dietary diversity index	16.99	17.48	17.43	17.30	0.19	0.20	0.36
Household dietary diversity score	9.08	9.23	9.21	9.15	0.19	0.21	0.52
Food consumption score	59.29	61.42	60.39	59.91	0.10	0.36	0.61

P-values from difference in means t-tests reported in the last three columns.

Table 6: Impact of treatment arms on food and non-food consumption

	Value of food consumption	Health and education expenditures	Non-food expenditures
Treatment==Food	18.59	8.10	7.60
	(6.58)***	(12.76)	(4.92)
Treatment==Cash	14.10	2.98	-0.35
	(6.20)**	(12.63)	(4.54)
Treatment==Voucher	18.29	8.29	2.73
	(5.91)***	(12.12)	(4.52)
N	1,985	2,044	2,044
Baseline Mean	131.79	46.91	91.16
P-value: Food=Voucher	0.96	0.99	0.32
P-value: Cash=Voucher	0.45	0.60	0.49
P-value: Food=Cash	0.46	0.62	0.09

Standard errors in parenthesis clustered at the cluster level. * $p<0.1$ ** $p<0.05$; *** $p<0.01$.
All estimations control for the following baseline variables: household head's gender, age, ethnicity, and education, household size, number of children, wealth quintiles, baseline outcome variable, and contain urban center fixed effects.

Table 7: Impact of treatment arms on the value of food consumption and caloric intake

	Log value of per capita food consumption	Log per capita caloric intake	Log calories per dollar
Treatment==Food	0.16	0.16	-0.01
	(0.04)***	(0.04)***	(0.02)
Treatment==Cash	0.12	0.06	-0.05
	(0.04)***	(0.03)*	(0.02)**
Treatment==Voucher	0.13	0.11	-0.03
	(0.04)***	(0.03)***	(0.02)*
R^2	0.35	0.32	0.13
N	1,985	2,006	1,947
Baseline Mean	3.51	7.38	7.32
P-value: Food=Voucher	0.38	0.10	0.26
P-value: Cash=Voucher	0.69	0.18	0.41
P-value: Food=Cash	0.22	0.01	0.08

Standard errors in parenthesis clustered at the cluster level. * $p<0.1$ ** $p<0.05$; *** $p<0.01$.
All estimations control for the following baseline variables: household head's gender, age, ethnicity, and education, household size, number of children, wealth quintiles, baseline outcome variable, and contain urban center fixed effects.

Table 8: Impact of treatment arms on caloric intake by food groups

	Outcome variable: Log per capita caloric intake (daily) ...											
	Cereals	Roots & Tubers	Vegetables	Fruits	Meat & poultry	Eggs	Fish & seafood	Pulses legumes & nuts	Milk & dairy	Sugar & honey	Other	Oils & fats
Treatment==Food	0.18	0.29	0.12	0.14	0.26	0.04	1.08	0.89	0.31	-0.01	0.19	0.05
	(0.05)***	(0.12)**	(0.06)*	(0.08)	(0.12)**	(0.10)	(0.18)***	(0.15)***	(0.17)*	(0.11)	(0.12)*	(0.10)
Treatment==Cash	0.08	0.22	0.12	0.09	0.35	-0.00	0.30	0.38	0.50	0.04	0.06	-0.12
	(0.05)	(0.12)*	(0.06)**	(0.08)	(0.11)***	(0.09)	(0.13)**	(0.13)***	(0.14)***	(0.09)	(0.11)	(0.08)
Treatment==Voucher	0.11	0.22	0.13	0.16	0.31	0.11	0.43	0.59	0.70	0.06	-0.05	-0.07
	(0.05)**	(0.11)*	(0.05)**	(0.08)**	(0.11)***	(0.09)	(0.13)***	(0.13)***	(0.14)***	(0.09)	(0.11)	(0.06)
N	2,006	2,006	2,006	2,006	2,006	2,006	2,006	2,006	2,006	2,006	2,006	2,006
Baseline Mean	765.60	147.51	30.65	232.56	144.05	38.17	22.62	51.26	102.99	295.25	50.17	.
P-value: Food=Voucher	0.13	0.54	0.95	0.69	0.69	0.42	0.00	0.02	0.01	0.45	0.03	0.22
P-value: Cash=Voucher	0.55	1.00	0.99	0.24	0.67	0.20	0.17	0.07	0.09	0.81	0.28	0.56
P-value: Food=Cash	0.04	0.52	0.97	0.52	0.42	0.72	0.00	0.00	0.20	0.57	0.22	0.12

Standard errors in parenthesis clustered at the cluster level. * $p<0.1$ ** $p<0.05$; *** $p<0.01$. All estimations control for the following baseline variables: household head's gender, age, ethnicity, and education, household size, number of children, wealth quintiles, baseline outcome variable, and contain urban center fixed effects. Oils and fats was not included in the baseline survey, and thus we do not have a baseline mean and it was not controlled for in the estimation.

Table 9: Impact of treatment arms on dietary diversity outcomes

	HDDS	DDI	FCS	Poor food consumption
Treatment==Food	0.51	1.98	6.10	-0.06
	(0.12)***	(0.50)***	(1.46)***	(0.02)***
Treatment==Cash	0.40	2.39	6.48	-0.03
	(0.11)***	(0.44)***	(1.34)***	(0.02)
Treatment==Voucher	0.51	2.89	9.41	-0.04
	(0.11)***	(0.46)***	(1.36)***	(0.02)**
N	2,087	2,087	2,087	2,087
Baseline Mean	9.16	17.28	60.17	0.11
P-value: Food=Voucher	0.99	0.04	0.03	0.19
P-value: Cash=Voucher	0.18	0.18	0.03	0.22
P-value: Food=Cash	0.23	0.31	0.78	0.02

Standard errors in parenthesis clustered at the cluster level. * $p<0.1$ ** $p<0.05$; *** $p<0.01$.
All estimations control for the following baseline variables: household head's gender, age, ethnicity, and education, household size, number of children, wealth quintiles, baseline outcome variable, and contain urban center fixed effects.

Table 10: Impact of treatment arms on food frequency by food groups

	Outcome variable: Number of days in the last week household consumed...											
	Cereals	Roots & Tubers	Vegetables	Fruits	Meat & poultry	Eggs	Fish & seafood	Pulses legumes & nuts	Milk & dairy	Sugar & honey	Other	Oils & fats
Treatment==Food	0.43	0.42	0.13	0.26	0.19	0.06	0.61	1.20	0.19	0.05	0.12	0.00
	(0.10)***	(0.19)**	(0.12)	(0.17)	(0.09)**	(0.16)	(0.12)***	(0.15)***	(0.20)	(0.10)	(0.18)	(0.11)
Treatment==Cash	0.15	0.45	0.30	0.15	0.34	0.26	0.15	0.59	0.66	-0.05	0.24	-0.10
	(0.10)	(0.17)***	(0.11)***	(0.15)	(0.11)***	(0.16)*	(0.08)*	(0.12)***	(0.17)***	(0.11)	(0.17)	(0.08)
Treatment==Voucher	0.30	0.56	0.39	0.29	0.28	0.46	0.40	0.83	0.90	0.01	0.16	-0.13
	(0.10)***	(0.17)***	(0.10)***	(0.14)**	(0.10)***	(0.15)***	(0.09)***	(0.11)***	(0.18)***	(0.10)	(0.19)	(0.08)
N	2,087	2,087	2,087	2,087	2,087	2,087	2,087	2,087	2,087	2,087	2,087	2,087
Baseline Mean	6.17	5.15	6.06	4.75	1.90	3.64	0.85	1.53	3.01	6.38	4.60	.
P-value: Food=Voucher	0.11	0.46	0.02	0.87	0.36	0.03	0.07	0.01	0.00	0.59	0.81	0.21
P-value: Cash=Voucher	0.11	0.52	0.38	0.33	0.64	0.23	0.00	0.06	0.15	0.56	0.59	0.74
P-value: Food=Cash	0.00	0.87	0.12	0.49	0.17	0.25	0.00	0.00	0.01	0.26	0.38	0.34

Standard errors in parenthesis clustered at the cluster level. * $p<0.1$ ** $p<0.05$; *** $p<0.01$. All estimations control for the following baseline variables: household head's gender, age, ethnicity, and education, household size, number of children, wealth quintiles, baseline outcome variable, and contain urban center fixed effects. Oils and fats was not included in the baseline survey, and thus we do not have a baseline mean and it was not controlled for in the estimation.

Table 11: Impact of treatment arms on food consumption outcomes by SES tertiles

	Log value of per capita food consumption	Log per capita caloric intake	Log calories per dollar
Treatment==Food	0.23	0.19	-0.06
	(0.06)***	(0.06)***	(0.04)
Treatment==Cash	0.18	0.08	-0.11
	(0.06)***	(0.06)	(0.03)***
Treatment==Voucher	0.12	0.05	-0.10
	(0.06)*	(0.05)	(0.04)***
Food X Highest 2 tertiles	-0.09	-0.04	0.06
	(0.06)	(0.06)	(0.05)
Cash X Highest 2 tertiles	-0.10	-0.03	0.08
	(0.07)	(0.06)	(0.04)**
Voucher X Highest 2 tertiles	0.02	0.09	0.09
	(0.07)	(0.06)	(0.04)**
Highest 2 tertiles	0.01	-0.07	-0.10
	(0.06)	(0.05)	(0.04)**
Constant	2.73	5.78	6.14
	(0.10)***	(0.18)***	(0.20)***
N	1,985	2,006	1,947
P-value: Food=Voucher	0.05	0.02	0.23
P-value: Cash=Voucher	0.27	0.52	0.76
P-value: Food=Cash	0.44	0.10	0.12

Standard errors in parenthesis clustered at the cluster level. * $p<0.1$ ** $p<0.05$; *** $p<0.01$.
All estimations control for the following baseline variables: household head's gender, age, ethnicity, and education, household size, number of children, baseline outcome variable, and contain urban center fixed effects.

Table 12: Impact of treatment arms on dietary diversity outcomes by SES tertiles

	HDDS	DDI	FCS	Poor food consumption
Treatment==Food	0.90	2.75	9.53	-0.14
	(0.22)***	(0.81)***	(2.54)***	(0.04)***
Treatment==Cash	0.56	2.67	7.52	-0.07
	(0.20)***	(0.70)***	(2.27)***	(0.04)*
Treatment==Voucher	0.66	2.87	11.50	-0.10
	(0.23)***	(0.76)***	(2.88)***	(0.04)***
Food X Highest 2 tertiles	-0.56	-1.15	-4.94	0.12
	(0.23)**	(0.84)	(2.72)*	(0.04)***
Cash X Highest 2 tertiles	-0.21	-0.37	-1.26	0.06
	(0.21)	(0.71)	(2.51)	(0.04)
Voucher X Highest 2 tertiles	-0.19	0.06	-2.85	0.08
	(0.23)	(0.73)	(3.08)	(0.04)**
Highest 2 tertiles	0.27	0.40	3.54	-0.08
	(0.19)	(0.64)	(2.30)	(0.03)**
Constant	7.57	11.31	39.12	0.16
	(0.32)***	(0.80)***	(2.95)***	(0.04)***
N	2,087	2,087	2,087	2,087
P-value: Food=Voucher	0.19	0.87	0.49	0.15
P-value: Cash=Voucher	0.58	0.74	0.14	0.26
P-value: Food=Cash	0.03	0.89	0.38	0.01

Standard errors in parenthesis clustered at the cluster level. * $p<0.1$ ** $p<0.05$; *** $p<0.01$.
All estimations control for the following baseline variables: household head's gender, age, ethnicity, and education, household size, number of children, baseline outcome variable, and contain urban center fixed effects.

Table 13: Heterogeneous impact on adult equivalent caloric intake

	Log adult equiv. caloric intake	Log adult equiv. caloric intake
Treatment==Food	0.16	0.22
	(0.04)***	(0.05)***
Treatment==Cash	0.07	0.08
	(0.03)*	(0.04)*
Treatment==Voucher	0.12	0.13
	(0.03)***	(0.04)***
Food X High caloric intake (kcals>2100)		-0.11
		(0.06)**
Cash X High caloric intake (kcals>2100)		-0.03
		(0.06)
Voucher X High caloric intake (kcals>2100)		-0.02
		(0.05)
High caloric intake (kcals>2100)		0.06
		(0.05)
Constant	6.03	6.17
	(0.18)***	(0.25)***
R^2	0.20	0.20
N	2,007	2,007
P-value: Food=Voucher	0.20	0.03
P-value: Cash=Voucher	0.09	0.33
P-value: Food=Cash	0.01	0.00

Standard errors in parenthesis clustered at the cluster level. * $p<0.1$ ** $p<0.05$; *** $p<0.01$.
All estimations control for the following baseline variables: household head's gender, age, ethnicity, and education, household size, number of children, wealth quintiles, baseline outcome variable, and contain urban center fixed effects.

Table 14: Modality specific cost of improving outcomes by 15 percent

	Food	Cash	Voucher
Consumption	$10.78	$3.79	$3.81
Calories	$10.78	$7.58	$4.50
HDDS	$28.75	$11.36	$8.25
DDI	$15.68	$3.25	$2.91
FCS	$17.25	$4.13	$3.09

Modality specific costs per transfer are used to calculate the cost of increasing each outcome by 15%.

Table 15: Satisfaction with transfer modality, by treatment status

How would you like to receive your transfer	Food	Cash	Voucher
All in food	0.55	0.07	0.08
All in cash	0.07	0.77	0.20
All in voucher	0.18	0.02	0.56
None in food	0.28	0.83	0.86
None in cash	0.77	0.09	0.66
None in voucher	0.75	0.92	0.31
Number of observations	341	425	441

Sample consists of households who participated in the program.

Appendix

Figure A.1: WFP Poster for Supermarkets

Cleaning of food consumption variables:

At baseline we had 2,357 households, of which 2,122 were resurveyed at follow-up. Food consumption values for household that reported consuming zero food were converted to missing. In addition we conducted an extra cleaning on the noisier baseline variables by converting to missing values on individual food groups (from the list of 12 food groups in the HDDS) that were more than 1.25 times the maximum value of the follow-up variable. Consequently of the 2,122 households at follow-up, 2,018 have non-missing food consumption values at baseline and follow-up. For the analysis, we also trim the top and bottom .5% of the distribution at baseline and follow-up, for a sample of 1,985. Similar steps were followed for creating the caloric intake variable. Of the 2,122 households, 2,043 had non-missing values at baseline and follow-up, and after trimming the top and bottom .5% at baseline and follow-up, we are left with 2,006 households for the analysis.

Table A.1: Modality specific costs

	CASH		VOUCHER		FOOD	
	HR*	RF**	HR	RF	HR	RF
PROJECT IMPLEMENTATION						
2.1.2 Prepare contracts with supermarkets						
2.1.2.a WFP staff			2228			
2.1.3 Meetings and contracts with supermarkets						
2.1.3.1 Field visit Sucumbíos						
2.1.3.1.a. WFP staff			85			
2.1.3.1.b. Travel				884		
2.1.3.1.c. Legal Consulting		250		250		250
2.1.3.1 Field visit Carchi						
2.1.3.1a. WFP staff			85			
2.1.3.1b. Transport						
2.1.4 Prepare contracts with bank						
2.1.4.a WFP staff	912					
2.1.5 Meetings and contracts with bank						
2.1.5.a WFP staff	271					
2.1.5.b Contracting with Bank						
2.2.2 Preparation of virtual bank accounts						
2.2.2a. Production of debit cards		13219				
2.2.2.b Transfer Bank		215				
2.2.2.c Bank staff						
2.2.2.d WFP staff	3799					
2.2.2.e Travel		773				
2.2.3 Supermarket selection						
2.2.3.a WFP staff			1374			
2.2.4 Travel preparation				1118		
2.2.4.a WFP staff	74		85		53	
2.4 Voucher development						
2.4.1 Design of vouchers						
2.4.1.a. WFP staff			215			
2.4.1.b. Printing materials				582		
2.4.1.c. Voucher Provided						
2.4.1.c.i. WFP staff			11060			
2.4.2 Voucher Liquidation						
2.4.2.a WFP staff			6857			
2.4.2.b Bank Transfer to Supermarkets						
2.5 Food Handling						

2.5.1 Food storage						
2.5.1.a WFP staff					2341	
2.5.1.b Bodega rental monthly						
2.5.1.b.i WFP						19506
2.5.1.b.i Partner B						1200
2.5.1.b.iii Partner A						1813
2.5.1.c Bodega repairs and investment						
2.5.1.c.i WFP						
2.5.1.c.ii Partner B						500
2.5.1.c.iii Partner A						1596
2.5.2 Rations preparation						
2.5.2.a. Ration preparation & packaging						18764
2.5.2.b WFP staff						
2.5.2.c Other materials						
2.5.2.d Cost of food ration						
2.5.3 Food distribution						
2.5.3.a. Transport (truck, gas, drivers, etc.)						
2.5.3.a.i WFP					4365	
2.5.3.a.ii Partner B						900
2.5.3.a.iii Partner A						600
2.5.3.b Partners staff for distribution						
2.5.3.b.i Partner B					4800	
2.5.3.b.ii Partner A					5444	
2.9 Execution of payments						
2.9.a WFP staff	2794		2604		282	
PROJECT MONITORING AND EVALUATION						
3.1 Monitoring data basic						
3.1.a WFP staff	1014		1078		884	
TOTAL COST (TYPE):	8863	14457	25672	2834	18169	45129
TOTAL COST:		23320		28506		63298
TOTAL COST PER TRANSFER:		$3.03		$3.30		$11.50
TOTAL COST PER BENEFICIARY:		**$18.16**		**$19.78**		**$69.03**

*HR refers to human resources
**RF refers to physical resources