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Impact of Cash Transfer programs on Food Security and Nutrition in sub-Saharan Africa: A Cross-Country Analysis

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Abstract

This paper explores the extent to which government-run cash transfer programs in four sub-Saharan countries affect food security and nutritional outcomes. These programs include Ghana's Livelihood Empowerment Against Poverty, Kenya's Cash Transfer for Orphans and Vulnerable Children, Lesotho's Child Grants Program and Zambia's Child Grant model of the Social Cash Transfer program. Our cross-country analysis highlights the importance of robust program design and implementation to achieve the intended results. We find that a relatively generous and regular and predictable transfer increases the quantity and quality of food and reduces the prevalence of food insecurity. On the other hand, a smaller, lumpy and irregular transfer does not lead to impacts on food expenditures. We complement binary treatment analysis with continuous treatment

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analysis to understand not only the impact of being in the program but also the variability in impacts by the extent of treatment.

Keywords

Cash Transfers; Food Security; Africa; Nutrition

1 Introduction

The goal of this paper is to evaluate four unconditional cash transfers (CTs) in sub-Saharan Africa (SSA) to understand the extent to which such programs affect food security and nutrition outcomes. For the poor households targeted by these programs, the most immediate impact of a CT is expected to be an increase in food consumption. This change may occur in two distinct ways: 1) directly through an increase in purchasing power, which enables households to increase the quantity of food purchased. The degree to which this is verified depends on Engel's law according to which as income rises, the proportion of income spent on food falls; 2) indirectly by increasing agricultural production and crop diversification. In fact, regular and reliable transfers can alleviate credit constraints faced by farmers, as well as provide greater certainty and security which enables higher-risk, higher-return investments (Gertler et al., 2012). Further, cash transfers can affect local markets by generating increased demand that can, in turn, trigger a supply response by local producers (Thome et al., 2016).

Cash transfers can directly improve the quality and diversity of diet through increased household income. Households that benefited from *Familias en Acción* in Colombia significantly increased items rich in protein, such as milk, meat, and eggs (Attanasio and Mesnard, 2006). Cash transfers may also improve availability, access and utilization of food for households at risk of experiencing shortages because of seasonal fluctuations or of sudden shocks such as drought and floods. Further, cash transfers can potentially play an important role to smooth consumption by stabilizing household income fluctuations (Maluccio, 2005).

Much evidence on the impact of CTs on food security and nutrition originates from Latin America, where CCTs programs have operated for a number of years (Fiszbein et al., 2009) and have contributed to an increase in households' food expenditure, both overall and as a share of income, and particularly for specific food groups, such as animal products. Hidrobo et al. (2015) is the most recent and comprehensive review of studies that assess the impact of social protection on household food security and includes studies from after 1994 for conditional or unconditional cash transfers, public works, and food transfers. This review shows that social assistance programs, regardless of type, do on average have a sizeable impact on several aspects of food security, in particular with regard to the consumption of animal products. But they do not indicate whether these improvements also turned into improved nutrition outcomes.

An increase in food expenditure should also translate into larger per capita caloric intake. Rubalcava et al. (2009) found that *Oportunidades* improved the protein per calorie intake for participating households. Hidrobo et al. (2014) show that both cash and in-kind transfers significantly lead to an increase in calories consumed in an emergency context in Northern Ecuador. However, this relationship between increased income and caloric intake may not be linear, since income-calorie elasticity, which measures the responsiveness of caloric acquisition, tends to be small for better-off households. Hoddinott and Wiesemann (2010), for instance, found that the exposure to CCTs in Mexico, Nicaragua and Honduras raised caloric acquisition by households mostly in the poorest tertiles.

Evidence in the African context has recently emerged. While CTs in the continent have increased tenfold from last decade (Garcia and Moore, 2012), these programs have been accompanied by rigorous impact evaluations only recently. Miller et al. (2011) found that the pilot social CT in Mchinji, Malawi, had a sizable impact on beneficiary households' food consumption, expenditures and dietary diversity. In Uganda, Gilligan et al. (2013) estimated the impact on food consumption of a World Food Program (WFP) project providing either food or cash transfer to households with children participating in Early Childhood Development centers in the Karamoja sub-region. They found that only cash had a significant and positive impact on food expenditure and consumption, dietary diversity and caloric intake. In Kenya, Merttens et al. (2013) and Haushofer and Shapiro (2014) found large impacts on food expenditures and consumption brought about by two different unconditional CTs.

Impact evaluation reports covering a broad range of outcomes, including food security and nutrition, have been completed for all four programs covered in this paper: the Livelihood Empowerment Against Poverty (LEAP) in Ghana, the Cash Transfer for Orphans and Vulnerable Children (CT-OVC) in Kenya, the Child Grants Program (CGP) in Lesotho and the Child Grant (CG) model of the Social Cash Transfer (SCT) program in Zambia. These countries were chosen as they were part of The Transfer Project,[1] a multi-country research initiative, supporting knowledge and evidence generation on the impact of large-scale national cash transfer programs in SSA. This project is made up by a community of researchers, donors and development partners who focus on coordination efforts and uptake of results.

We contribute to the literature on the effects of CTs in two fundamental ways. First, we fill the gap of international evidence and offer a cross-country perspective by analyzing the role of cash transfers on the same set of outcomes and conditional on a common set of observables. The paper complements the results of each country's impact evaluation and provides a more in-depth analysis by using homogeneous and consistently measured variables in order to recover comparable estimates of the effects of cash transfers on a range of outcomes pertaining to food security and nutrition. Second, in terms of methodological contribution, we employ recently developed econometric techniques to estimate a continuous relationship between the amount the cash transfer and household food security. We perform both binary as well as continuous treatment analyses to understand not only the impact of being in the program but also the variability in impacts by the extent of treatment. In the section that follows, we briefly describes the four cash transfer programs and discuss the outcome variables used in the analysis. In section 3, the econometric strategies used to

[1]https://transfer.cpc.unc.edu/

test the hypotheses are described followed by the results in section 4. Finally, section 5 concludes.

2 Programs and data

2.1 Programs description

We focus on government-run cash transfer programs in four countries, each with broadly similar human development and rural poverty reduction objectives (Table 1). The Livelihood Empowerment Against Poverty (LEAP) is a program which provides cash and free health insurance to extremely poor households across Ghana. LEAP eligibility is based on poverty and having a household member in at least one of three demographic categories: single parent with OVC, elderly poor, or person with extreme disability unable to work. During the 24-month evaluation period from April 2010 to April 2012, LEAP households received between 8–15 Ghanaian Cedis GHS (9–18 international dollars) per month depending on the number of eligible beneficiaries per household. The LEAP evaluation strategy is a longitudinal propensity score matching (PSM) design. Prior to program initiation, 699 future LEAP beneficiaries were selected to participate in the evaluation study. Subsequently, a comparison group of 699 households from a national longitudinal survey conducted by the Institute of Statistical Social and Economic Research, University of Ghana (ISSER), were selected by PSM, using one-to-one nearest neighbor approach, and re-interviewed after 24 months along with LEAP beneficiaries. The matched comparison group was drawn from the same three regions as the LEAP households as well as bordering regions with similar agro-ecological conditions. Supplementary 215 households from the ISSER sample were re-interviewed at follow-up, in order to generate higher statistical power for the study. These households had similar propensity scores to beneficiaries and were residing in the same communities already being visited by the enumeration teams. Further details on the program, targeting procedure and the analysis of the matched comparison can be found in (Park et al., 2012).

Kenya’s CT-OVC program started as a pilot in 2004 and was scaled up in 2007 with the main aim of building human capital and improving the care of OVC. A flat monthly transfer of 1500 KES (approximately 24 international dollars) is given to those households who are ultra-poor and contain OVC (Kenya CT-OVC Evaluation Team, 2012). A baseline household survey was conducted in mid-2007 before households were told that they were selected into the program. Two follow-up rounds of data collection occurred 24 and 48 months after the baseline. We use data from the second follow-up in this study, in order to maintain the same length of the evaluation period across countries. The design of the impact evaluation is a Randomized Controlled Trial (RCT). First, seven districts were selected for inclusion into the program, based on overall poverty levels and the prevalence of HIV/AIDS. In a second stage, within each of the seven districts, four locations were identified as eligible, two of which were subsequently randomized out of the initial expansion phase and served as control locations. The third stage involved targeting of households in the intervention locations. Approximately 20 percent of the poorest households in each location were enrolled in the program.

The Lesotho CGP is an unconditional social cash transfer targeted to poor and vulnerable households. Originally set at a flat rate of 360 LSL (78.6 international dollars) quarterly per household, from April 2013 the transfer value has been indexed to the number of children and varies between 360 LSL and 750 LSL quarterly. The sampling design was based on a stratified random cluster. In the first step, 96 electoral divisions (EDs) were randomly chosen and paired based on a range of observed characteristics. Once all pairs have been constructed, 40 out of the 48 pairs were randomly selected to be covered by the survey. Then, within each selected ED, 2 villages were selected and in every village a random sample of 20 households (10 eligible and 10 non eligible at baseline) were randomly selected and interviewed. Eligibility of the households in the village was based on proxy means testing (PMT) and community validation. PMT was used to group households into Ultra poor, Very poor, Poor, Less poor and Better off. Those households with at least one child and that were categorized as Ultra poor or Very poor and were also deemed by members of their community as being the ‘poorest of the poor’, were eligible for the program. After the baseline data had been collected in all evaluation EDs in 2011, public meetings were organized to assign the elements of each pair to either treatment or control through a lottery. More details about the program and its evaluation can be found in Pellerano et al. (2014).

The Zambia’s CG model of the SCT is an unconditional CT scheme started by the Ministry of Community Development and Social Services in 2010 with the aim of alleviating poverty among the poorest households and block its intergenerational transmission. The CG targeted any household with a child under 5 years old in three of the poorest districts of the country with high rates of stunting among children. Beneficiary households received a flat amount of 55 new kwacha (ZMK) a month (equivalent to 21 international dollars), subsequently increased to ZMK 60, which was deemed sufficient to purchase one meal a day for everyone in the household for one month. The impact evaluation design of the CG is a longitudinal RCT. There were two levels of random selection of participants, at the community and household level. The first stage of the randomization consisted in randomly extracting 30 communities within each of the three districts and in identifying all eligible households with at least one child under 3 years old. In the second stage 28 households were then randomly sampled from each community for inclusion in the study. Random assignment of the communities to the treated and control groups occurred only after baseline data were collected by flipping a coin to determine whether the first half of the list of randomly selected communities would be in the treatment or control condition. For more information concerning the program design, operational performance and the overall impact evaluation, see American Institutes for Research (2011, 2013a).

Overall, these government-run CTs share a common feature: they provide cash without any explicit conditions on their receipt although in some cases there appears to be either some messaging or soft conditions. For example, in Lesotho the transfer is provided with messaging on the importance of children’s needs like food, clothes, shoes, school uniforms and related expenses (Oxford Policy Management, 2014). In Ghana, OVC caretakers were supposed to register children and ensure they are enrolled in school but these conditions are not monitored (Oxford Policy Management, 2013). The targeting in Ghana, Kenya and Lesotho is similar, as it tends to emphasize very poor households with limited availability of labor (e.g. elderly, single parents, OVCs being supported by grandparents or single parents, etc.). The CG model in Zambia is an exception to this approach for two reasons: first it targets households with children in a more narrow age range (between 0 and 5 years), which has the implication of giving preferential access to families with relatively younger parents; second, it adopts a pure categorical targeting approach within communities. Finally, the transfers were meant to be disbursed on a regular basis: bimonthly in Ghana, Kenya and Zambia, quarterly in Lesotho. However, operational performance varied from country to country, with schedule of payments suffering major delays in Ghana and Lesotho. This is likely to have influenced how households spent their transfers.

2.2 Outcome variables

The definition of food and nutrition security (FSN) combines both aspects of food security and of nutrition security. Food security exists when all people at all times have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life (FAO, 1996). The term of nutrition security emerged with the recognition of the necessity to include nutritional aspects into food security. The extent to which individual food security results in good nutrition depends on a set of non-food factors such as sanitary conditions, caring practices and access to health services (Pinstrup-Andersen, 2009; Pangaribowo et al., 2013).

FSN is an intrinsically unobservable and a too complex concept to be captured by a single indicator (Maxwell et al., 1999; Barrett, 2002). This implies the need to use a set of indicators to cover the four main dimensions of FSN: availability, access, utilization and stability. Availability refers to the amount of food physically available, but it does not ensure by itself access to food. While utilization is a measure of a population's ability to obtain sufficient nutritional intake and nutrition absorption, stability implies freedom from risk of insufficient availability, access and utilization of food. Due to data limitations, the indicators used in this paper guarantee only a partial coverage of the FSN dimensions.

We use per capita food expenditure and the share of food expenditure on total expenditure to measure the impacts of cash transfers on access to food. Household food consumption aggregates are constructed from the value of food eaten at home and the value of food eaten outside the home. However, consumption modules were designed to assess programs' targeting performances and not to allow cross-country comparisons. Therefore these sections were heavily drawn from existing national household budget surveys, and differed across countries on some features. For instance, the recall periods is seven days for Kenya and Lesotho, fourteen days for Zambia, and four weeks for Ghana. We recognize this limitation of the data, which will have strong implications for the estimation of mean consumption and indices of dietary diversity described later.

Dietary diversity indicators and the share of calories derived from certain food groups are used to capture the impacts on the utilization dimensions. Households do not solely value quantity; a more varied diet is also important. For this reason we constructed several measures of dietary diversity: the Household Dietary Diversity Score (HDDS), the Simpson index, the Shannon index and the number of food items consumed. The HDDS is calculated by counting the number of food groups consumed by the household (Swindale and Bilinsky, 2005). This implies categorizing the food items into 12 food groups. However, HDDS does not capture the fact that the household could buy other food items from the same food group. In order to incorporate this possibility, we also estimate the impacts on number of food items consumed. While HDDS is a crude measure of diversity, the Simpson and Shannon indexes incorporate distribution or evenness of food consumption (Lee and Brown, 1989). They measure how many different types (food groups/items) there are in a dataset, and simultaneously takes into account how evenly the basic entities (individuals) are distributed among those types. The Simpson and the Shannon indices are computed, respectively, as $1-\Sigma_i\pi_i^2$ and $-\Sigma_i\pi_i \log(\pi_i)$, where π_i is the share of expenditure on the i-th food item. If only one food was consumed, these indices would be zero. So, variety increases both with the number of foods and with the evenness of expenditure across food items (Ruiz-Arranz et al., 2002).

Other diet variety indicators that we use are the percentage of food expenditures on various food groups and the food energy acquired from them. At the household level it is measured as the percentage of per capita expenditure on 1) cereals; 2) animal products; 3) roots and tubers; 4) pulses and legumes; 5) fruits and vegetables. By looking at shares we are able to understand changes in dietary patterns, how households allocate their resources and whether a particular item is a normal or an inferior good.

We use the per capita daily caloric intake (kcal/day) as an indicator of food availability (Pangaribowo et al., 2013). The process entails converting quantities of food items into grams and milliliters that are in turn converted into kilo calories. Energy values are taken from the food composition tables for Africa (Wu Leung, 1968). The energy content is calculated indirectly when quantities cannot be converted into standard metric units, information on kilo calories per gram is not available, and if food was eaten outside of the house, received in kind or as wages. In these cases, we impute the energy content by finding the amount of kilo calories that can be bought per local currency unit and multiplying that with the amount spent by the households (Cafiero et al., 2014). This indicator is available only for Zambia and Lesotho due to data limitations on food quantities in the other countries. In addition, we use the caloric intake indicator to assess the impact of the CTs on nutritional aspects of FSN, namely, on undernourishment and weak nourishment. We compare the household's actual caloric intake with the relevant energy requirement thresholds– the Minimum Dietary Energy Requirements (MDER) and the Average Dietary Energy Requirements (ADER) (Anríquez et al., 2010). A household is considered undernourished if the household dietary energy intake is lower than the household's MDER and weakly nourished if the household dietary energy intake is higher than its MDER but lower than its ADER.

We also use a set of self-reported indicators of food insecurity that reflect uncertain access to enough and appropriate food, such as having had fewer/ smaller meals or having experienced a hungry day in the reference period prior to the survey. Finally, nutritional aspects of FSN are captured by the percentage of undernourished and weakly nourished

[2]The food groups are namely cereal, roots and tubers, pulses/ legumes/nuts, meat/poultry/offal, vegetables, fruits, eggs, fish & seafood, milk/milk products, oil/fat, sugar/honey, and miscellaneous.

population (Pangaribowo et al., 2013). Although the concept of food security refers to individuals, generally FSN indicators have been presented at the household or even more aggregate level because of data limitations (Barrett, 2002). For the same reason the household is the statistical unit of analysis also in this study.

The weighted baseline averages by treatment status for outcome variables are provided in Table 2. Consistently across countries, on average between 60 to 65 percent of the household expenditure goes to food. The monthly per capita food expenditures were converted in international dollars at the 2012 conversion rates provided by the World Bank to achieve maximum comparability. They varied greatly across countries, ranging from around 40Int$ in Ghana to around 12Int$ in Kenya. Areas targeted by the CG in Zambia have a higher incidence of food insecurity – around 96 percent of the household report that they have had fewer or smaller meals in the last four weeks as opposed to around 75 percent in Lesotho. We also see that around 80 percent of households in Zambia and around 62 percent in Lesotho are severely undernourished. The biggest chunk of food expenditure goes to cereal except in Ghana where roots and tubers make up the biggest portion of food expenditure.

Given the longest recall period, Ghana has the highest average HDDS. Households in Lesotho and Zambia consumed an average of around 5 food groups. Despite the shortest recall period, Kenyan households consume around 7 of the 12 food groups. Further, in Zambia only eight food items out of more than one hundred are consumed on average. Despite the long recall list, this indicates the high levels of food shortage suffered by the target population.

2.3 Control variables

Table 3 reports summary statistics for observed characteristics in the estimation sample at baseline by country and treatment group. Since different targeting approaches have been implemented across countries, the characteristics of beneficiary households can vary between programs. The sample in Ghana has the largest concentration of elderly people, especially in LEAP beneficiary households. This is reflected also in the largest share of households with an elderly head. In Zambia, most households are headed by women, and it also has the highest number of young children (0–5 years of age). Farmers across countries have relatively low access to cultivated land (generally less than one hectare). We see also some variation in prices (beans and maize). Some differences are also observed in terms of livestock ownership, with Kenyan households having more chicken and cattle than the samples in the other countries. The significance stars attached to the estimated overall mean of a given covariate refer to a test of the difference between the means in the treated and control groups of that covariate. Observed characteristics seem balanced in Zambia, Lesotho and in Ghana with few means being statistically different in the two treatment arms in these countries. For Kenya the treated and the controls seem to differ under a larger number of observed covariates with 10 covariates out of 21 being unequally distributed between treated and controls.

3 Methodology

3.1 Binary treatment Analysis

The statistical approach we take to derive average treatment effects of the four CT programs is the difference-in-differences (DiD) estimator. This entails calculating the change in an indicator such as food consumption between baseline (prior to program initiation) and post intervention for treatment and control/comparison group units, and comparing the magnitude of these changes. The regression equivalent for the DiD estimator is represented as follows

$$Y_{it} = \beta_0 + \beta_1 D_{it} + \beta_2 R_t + \beta_3 (R_t * D_{it}) + \boldsymbol{\beta_4 X_{it}} + \varepsilon_{it} \quad (1)$$

where Y_{it} is the level of the outcome of interest; D_{it} is a dummy equal to 1 if household *i* received the treatment; R_t is a time dummy equal to 0 for the baseline and to 1 for the follow-up round; R_t*D_{it} is the interaction between the intervention and time dummies, and $\boldsymbol{\varepsilon}_{it}$ is the error term. Lastly, $\mathbf{X_{it}}$ is a matrix containing the set of conditioning variables and $\boldsymbol{\beta_4}$ is the corresponding vector of coefficients. As for the scalar coefficients, β_1 controls for the time-invariant differences between the treatment and control; β_2 represents the effect of going from the baseline to the follow-up period; and β_3 is the DiD estimator.

When differences between groups at the baseline exist, the DiD estimator with conditioning variables has the advantage of minimizing the standard errors as long as the effects are unrelated to the treatment and are constant over time. The addition of conditioning variables $\mathbf{X_{it}}$ in equation (1) controls for the observable differences between the households in control and treatment households. A vector of household, household head’s characteristics, community variables and district level characteristics are included in all the specifications. Inclusion of these variables controls for differences across districts, any remaining differences between households prior to the CT and increases precision of the estimates (Angrist and Pischke, 2009).

Finally, in order to avoid confounding the heterogeneity of treatment with the heterogeneity of impacts we follow the methodology from Behrman and Hoddinott (2005). We pool data across all countries so that to form a single panel with each household observed twice, at baseline and follow-up. Estimation is based on an enhanced version of equation (1) whereby we add household and country specific fixed effects as follows:

$$Y_{it} = \beta_0 + \beta_1 D_{it} + \beta_2 R_t + \beta_3 (R_t * D_{it}) + \boldsymbol{\beta_4 X_{it}} + \boldsymbol{\beta_5 C} + \boldsymbol{\beta_6 C} * D + \boldsymbol{\beta}_7 \mathbf{C} * D + \boldsymbol{\beta_8 C} * D * T + a_i + \varepsilon_{it} \quad (2)$$

where **C** is a matrix containing country dummies for Zambia, Ghana and Lesotho while the Kenya is left out as the reference category. The term a_i represents household specific fixed effects and the rest of the variables are the same as in equation (1). By adding country specific fixed effects we eliminate any time invariant unobserved differences among countries thus making results more generalizable than those of the single country. As to unobserved heterogeneity "within" each country adding household fixed effects offers some extra protection relative to the DiD. While the double differencing of the DiD eliminates unobserved confounders at the treatment group level, the household and country fixed effects allow to difference away the potentially biasing influence of unobserved characteristics at the household and country level. The DiD eliminates bias stemming from unobservables that drive selection of subjects into treatment, as long as the average of the distribution of unobservables evolves in parallel at the group level and can be differenced away. The household fixed effects estimator relies on the assumption that unobservables stay the same at the household level and can therefore be differenced away.

3.2 Continuous treatment Analysis

We also employ a continuous treatment approach to study the variation in household behavior given the variation in amount received. In order to get unbiased impact estimates, it is crucial to establish that the variation in the amount received by the households is exogenous, i.e. it does not depend on observed or unobserved determinants of our outcomes of interest. Contingent factors, like missed payments from either beneficiaries or program implementers, are likely to be unrelated to the unobserved determinants of household food security and nutrition. In Ghana and Lesotho, the program design was such that the amount received by the household depended respectively on the number of vulnerable members and the number of children in the household. This created a variation in the amount of transfer received by the household. As a result, if the amount of cash received during the last year does not vary conditional on the indexing variables we cannot separately identify the effects of the CTs from that of the indexing variables. In our data there is considerable variation in the level of received cash even conditional on the indexing variables. This is probably due to the misapplication of the assignment rule, missed payments by the designated beneficiary households and for reasons that we assume to be unrelated to the determinants of the outcomes of interest. In support of our claim, the distribution function of the treatment variable (here not shown) has some variation as demonstrated by the existence of a proper density even after conditioning on the number of children or on the number of vulnerable members.

The treatment level in this study is represented by the self-reported amount of cash a household received during the year preceding follow-up data collection divided by the number of household members. In Ghana the amount of CTs was supposed to be variable across households by design according to the number of vulnerable household members. The average amount of per capita CTs received by households during the twelve months preceding data collection at follow-up was 58 Int$. In the case of Zambia, despite a flat amount had been planned, there was some variability in the amount of cash received by the households during the last year of the program. We attribute this to the double payments received by those households with a disabled member. Further, some households reported having received more than the maximum planned amount. The average per capita yearly amount of self-reported transfer equals 26 Int$. In Lesotho, the transfer value was originally set at a flat rate of 78.6 Int$ quarterly per household but from April 2013 the cash transfer has been indexed to the number of children. Since follow up data collection was conducted between June and August of 2013 we have some variation in the value of the CTs received by the households. In this case, the average per capita amount of the transfer is 42 Int$. In Kenya, the size of the transfer was set to a flat monthly amount of 24Int$ per household. However, since we observed only three values of the transfer, we decided not performing a continuous treatment analysis for Kenya.

Following the continuous treatment approach put forth by Cerulli (2014), we start with a potential outcome model adapted to the context of continuous treatment,

$$\begin{aligned} w = 1: Y_1 &= \alpha_1 + \delta_1 X + h(t) + e_1 \\ w = 0: Y_0 &= \alpha_0 + \delta_0 X + e_0 \end{aligned} \quad (3)$$

where t is the level of CT and w=**1**[t>0] is the derived binary treatment indicator that equals one for the group of treated subjects as a whole. Y_1 and Y_0 are the two mutually exclusive potential outcomes for a particular subject and δ_1X and δ_0X are the subject's response to the vector of observed confounding variables X when the subject is treated and untreated, respectively. Finally, h(t) is a flexible function of the treatment level.

Our causal parameters of interest is the average treatment effect on the treated for a particular level of treatment (ATT(t)). From system (2) it is easy to obtain the ATT conditional on X, t and w, as

$$\begin{aligned} ATT(X, t, w) = \; & E\left[Y_1 - Y_0 \middle| X, t, w = 1\right] = \\ & = (\alpha_1 - \alpha_0) + (\delta_1 - \delta_0)X_{t>0} + h(t)_{t>0} = \\ & = \alpha + \delta X_{t>0} + h(t)_{t>0} \end{aligned} \quad (4)$$

By averaging over X, w and t we obtain the ATT= $\alpha + \delta\,\overline{x}_{t>0} + \overline{h}(t)_{t>0}$ which is the average difference in the outcome of interest, like caloric intake, by the treated group as a whole and the calories they would have acquired had they not received any CT. By substituting the latter parameter into equation (3), it can be shown by simple algebra that the ATT(t) = ATT+ $(h(t)_{t>0} - \overline{h}(t)_{t>0})$ is a continuous function of *t*. This is also known as the *relative dose response function* (DRF) which is shown to identify the average difference in outcomes between a group of treated subjects that received a given level of treatment and what would have been observed had they not received any treatment. In the continuous treatment setup the average difference in the outcome of the treated and the controls, given their observed characteristics, is allowed to vary by an arbitrary function of the treatment level h(t). Intuitively, the DRF is obtained by first estimating the average outcome of the treated as a function of the continuous treatment t given a set of controls and then subtracting the estimated average outcome for the controls which does not depend on t.

In order to estimate the identified parameters we switch from the potential outcome model in (2) to the following regression model by using the relationship between potential and observed outcomes $Y=Y_0 + w(Y_1-Y_0)$ so as to obtain

$$Y = \alpha + \delta_0 x + (\alpha + \delta\bar{x} + h)\, w + \delta(x - \bar{x})\, w + (h(t) - h)\, w + \varepsilon \quad (5)$$

Where $\varepsilon = e_0 + w\,(e_1 - e_0)$ and $E[\varepsilon|X]=0$. The coefficient in front of the third term is the ATT. In order to estimate ATT(t), we assume a parametric form for $h(t)=at^3+bt^2+ct+d$, whose parameters are estimated along with the rest of the coefficients in equation (4).

4 Results

Results from the binary treatment analysis are presented in Table 4 and Table 5. In Zambia, we find that even though the share of expenditure on food was unaffected, the program significantly increased the per capita food expenditure by 2.5Int$. This is a large impact – an increase of around 35 percent with respect to the baseline average. The increase in per capita food consumption also amounts to 12% of the monthly transfer value. Within food, there are significant increases in the expenditure on cereals (1.02Int$), animal products (0.7Int$) and pulses and legumes (0.23Int$). When we look at the share of food expenditure allocated to different food groups, we find that households are shifting away from roots, tubers, fruits and vegetables and replacing them with pulses and legumes. We find no impact on shares allocated to cereal and animal products. These results conform with those found by American Institutes for Research (2013b). Because we have converted all monetary variables into real international dollars for comparison purposes, the magnitude of impacts do not match those of the respective impact evaluations. When we explore the impacts by wealth index, we find that CT significantly increased the per capita food expenditure and per capita expenditure on cereal for both poor and less-poor households.

Some of Zambia's story emerges from Kenya as well. The impact on shares of food expenditure by food groups show that there is a clear shift from fruits, vegetables, roots and tubers to more nutritious animal products, with the share of expenditure on former food groups significantly decreasing and that on the latter significantly increasing. The CT significantly decreased per capita expenditure on roots and tubers, a result which is common with Romeo et al. (2014). However, these authors also estimated positive and statistically significant effects on some food groups, like cereals and animal products which are not found in our estimations. There are two possible explanations for these differences in the statistical significance: 1) the sample in Romeo et al. (2014) is restricted to panel households participating in three evaluation surveys (2007, 2009 and 2011), while our sample considers panel households in 2007 and 2009. 2) The set of covariates used in the two studies is different: Romeo et al. (2014) included the full set of household characteristics used to determine participation in the CT-OVC program through proxy mean tests (PMT), while in our estimates we used a set of independent variables which is common to the four programs evaluated in this study and that only partially overlap with all the household characteristic used in the PMT.

In Ghana, we find that the program had no significant impact on per capita food expenditure. This is in line with the results from the impact evaluation report that shows that households instead significantly increased spending on non-consumption items (Handa et al., 2014).

Within food, we find that there are considerable decreases in consumption of animal products and roots and tubers (2.7Int$). Among the poor households, we also find a sizable decrease in the per capita expenditure on cereal. In Lesotho, we find no impacts on per capita food expenditure. This conforms with the results found in the initial impact evaluation done by Pellerano et al. (2014). In terms of consumption shares, we find a significant shift from fruits and vegetables to pulses and legumes. Further, the heterogeneity analysis for the Lesotho CGP confirms the lack of impacts found in the overall sample. The results from binary treatment analysis can be visually confirmed by the Dose Response Functions (DRF). In Figure 1 we present for each country the DRF describing the impact on per capita food expenditure for different levels of per capita transfer size. A consistent finding across countries is the increasing patterns of impacts. Higher per capita transfers lead to higher impacts on per capita food expenditure. For Ghana and Lesotho, after a critical level of around 16.5 int$ per capita transfer, the impacts become positive and statistically significant, while for Zambia households receiving a CT, increase food expenditure regardless of the size of the transfer. In Figure 2, the DRF for the share of food expenditure shows a similar increasing pattern across countries. For Ghana and Lesotho impacts become positive for per capita treatment sizes above 16.5 int$, even though the whole curve is statistically insignificant for Lesotho. For Zambia impacts are always positive regardless of treatment level, but statistically significant only at the upper end of the treatment distribution.

Another indicator used to gauge the quantity of food consumed is the daily per capita caloric intake. We find that Zambia's CG model significantly increased per capita caloric intake by around 215 kcal/day, around 15 percent of the average intake at baseline. Most of this impact is due to an increase in calories from cereals, while at the same time households reduced consumption from roots and tubers (impact results not shown). This increase leads to a reduction in the probability that a household is severely undernourished by 5.4 percentage points, an 7 percent decrease from baseline. We also find that the program has increased the probability that a household is weakly nourished by 5.2 percentage points. Looking at these two results together, it is obvious that the program has helped households transition from being severely undernourished to weakly nourished. Figure 3 shows the DRF describing the impact on per capita caloric intake for different levels of per capita transfer size. As with the previous outcomes, the impacts increase with the amount of per capita transfer size, with a slight reduction at the top end of transfer distribution. Higher transfers lead to higher increases in per capita caloric intake. Moreover, impacts become positive and statistically significant for per capita transfer sizes above a certain level. Further, we find that the CG model in Zambia significantly decreases the share of daily per capita caloric intake from fruits and vegetables by 0.03 and increases that from pulses and legumes by 0.02. This confirms the results on consumption expenditure, that there is a switch from fruits and vegetables to pulses and legumes. Consistent with the results from the analysis of food expenditure in Lesotho, we find no impact on daily per capita caloric intake. However, if we look at the heterogeneity of impacts, caloric intake increased considerably among the group of the poorest (around 310 kcal/day), a result which is very similar in magnitude also in Zambia (264 kcal/day). Therefore, despite not leading to an overall significant increase in food consumption, the CGP in Lesotho brought about a shift in the diets of the poorest households, making them eventually to consume more nutritious foods.

In terms of food variety, the numbers of food items consumed by the households have significantly increased by 1.9 and 1.5 in Zambia and Kenya respectively. Additionally, for Zambia, we also find that there are significant increases in both Shannon and Simpson indices. This implies that regardless of the weighting, the households in Zambia are consuming a more diverse diet as a result of CTs. We do not find any impact on any of the variety indicators in Ghana. These results align with those from the impact evaluations of the respective countries except for the impact on HDDS in the case of Lesotho. This difference in results could be due to the fact that we use a different methodology to create HDDS using 12 food groups. Pellerano et al. (2014) find no impact on a diversity score based on an 8 food groups.

Moving to the results for coping strategy indicators, in Zambia the CG model reduced the probability of at least one member of the household eating fewer and smaller meals by 5.5 and 4.2 percentage points respectively. It also decreased the probability of going to sleep or going the whole day without food by 16.8 percentage points. Again, this is in line with the results from American Institutes for Research (2013b). In the case of Lesotho, the probability of an adult spending a whole day/night hungry decreases in absolute terms by 8.4 percentage points, just like in Pellerano et al. (2014), and by 17 percent relative to the baseline average of the indicator. Interestingly, more positive results are observed for similar indicators on children food insecurity, probably a reflection of the messaging of the program, and on food availability, which is represented by a strong reduction in the number of months the household had extreme food shortages.

Finally, we comment on the fixed effects estimation results obtained using data pooled across all four countries. Impacts here refer to a more general context than that of a single country. Unobserved differences among countries can in fact drive differences in impacts' estimates. Including countries fixed effects allows to net estimates out of the confounding influence of country-specific unobserved characteristics. These are related to the political environment, the economic growth and infrastructure and climatic conditions, all of which may influence food and nutrition security. Estimates of the coefficient β_3 in equation (2) are shown in the last column of Table 4. For per capita food expenditure, share of food expenditure and share of calories we consistently find an increase in cereals, pulses and legumes and a decrease in roots, tubers and vegetables. No statistical impact is observed for total food expenditures. Dietary diversity indicators show a significant increase as a result of the cash transfers while households resort to fewer coping strategies. In terms of caloric intake, the pooled estimation results show an increase in daily per capita caloric intake and a significant reduction in the share of undernourished households and an increase in the share of households weakly nourished.

5 Discussion

We find large variation in impact on food security and nutrition indicators across the four countries. What could be driving these differences? The story that emerges from this cross country analysis is the role of program design and implementation. A first critical feature of program design is the transfer amount, which clearly has implications for the range and intensity of impacts on food security and nutrition outcomes. Transfer levels are set following different criteria across countries. As a result, there is a great deal of variation in the value of the transfer as a share of beneficiary households' per capita consumption. The relative value of transfer reached almost 30 percent of per capita consumption in Zambia, the country with the largest and most consistent impact across indicators, compared to less than 10 percent in Ghana LEAP at the time of the evaluation, which had no impact. In Kenya, where transfer size varied by household size, an average sized household received 14 percent of per capita consumption at baseline (and small-sized households over 20 percent), and in Lesotho, the transfer represented 19 percent of per capita consumption. Further, we are likely to see larger and more positive impacts on households receiving a larger per capita transfer, as shown by the DRF results on per capita food consumption and caloric intake. Contrary to Engel's law, we did not observe significant reductions on the share of food expenses on total consumption. Probably, because of the depth of poverty and food insecurity in the targeted populations, we can expect such behavioral change to occur only at much higher income levels.

A critical feature of program implementation is transfer predictability. At the time of the evaluation, the operational performance varied from country to country in terms of the regularity and predictability of transfers. In Zambia the transfer was intended to be paid on a bi-monthly basis and was delivered regularly, with no major delays experienced throughout the evaluation period. In Lesotho and Ghana, payments were meant to be monthly, but the schedule suffered major disruptions. In Ghana, for instance, beneficiaries did not receive any payment for almost 10 months during the period of the evaluation. In Lesotho, CGP was the programme with the lowest intended transfer frequency (quarterly), yet it was also affected by significant delays in payments forcing the programme to cumulate overdue payments in a couple of occasions during the period of the evaluation.

Predictability and regularity have two implications for food security and nutrition. First, regular and predictable transfers allow beneficiary households to plan ahead and smooth consumption over the full (two to three month) period between payments. Confidence in receiving the next payment allows households to spend all the transfer or purchase food on credit, for example. Irregular and lumpy payments may be viewed differently, as windfall profits, and thus used for investment, savings, paying off debts—or in some cases to purchase food in bulk. Impact evaluation results corroborate this last hypothesis: in Lesotho we did not find significant increases of food expenditure, which occurred three months after pay date. However, we observed impacts on self-reported measure of food insecurity, which are less affected by payments' regularity, due to the long recall period. Qualitative field work in each of the four countries (Barca, et al, 2015) found that in all cases households reported spending at least part of the transfer on food around payment day. But the uncertainty around irregular payments, combined with the difficulty of detecting in household surveys the sporadic increases in food consumption associated with irregular payments, implies that it is more difficult to find significant impacts on food security and nutrition in this context. Interestingly, the positive significant impacts on coping strategy indicators in Lesotho are observed for children rather than adults, probably reflecting the messaging that the CGP money should have been spent on children needs.

Finally, the evaluation design is an additional aspect, which helps explaining observed impacts. Clearly, when RCTs are well implemented and able to separate the treatment from the control group, it is easier to avoid contamination. This clearly facilitates finding impacts and may be one reason why the strongest impacts on food security were observed in countries where RCTs were rigorously implemented, like in Zambia.

Taken together, the results point to the importance of programme design and implementation in achieving desired programme impacts. The CG model in Zambia, with its relatively high transfer level and predictable transfers, achieved large impacts on food security and nutrition outcomes as well as a broad range of other outcomes. The LEAP in Ghana on the other hand, with its low transfer level and unpredictable transfers, had no impact on food consumption and dietary diversity, but did impact a range of non-food expenditures. The CT-OVC in Kenya, with modest transfer levels but consistent payments, had significant and positive impacts on food security and nutrition after two years. Some of these impacts disappeared after four years due to the effects of inflation on real transfer levels (Romeo et al., 2014). Sufficiently large transfers, coupled with attention paid to assuring regular and reliable payments, appear to be important factors in assuring that CT programmes can impact beneficiary food security and nutrition status.

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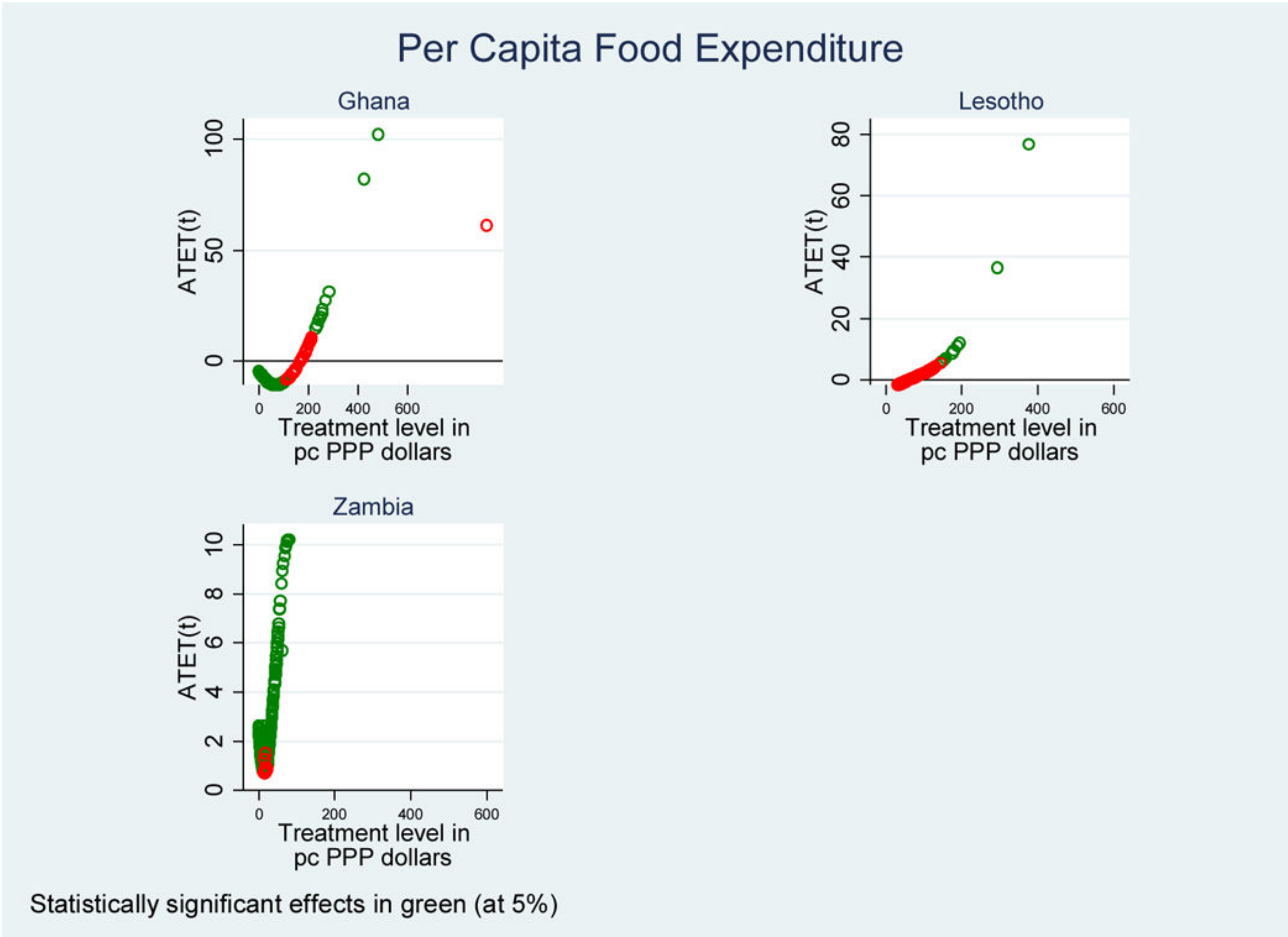

Figure 1:
Dose-Response Function for Per Capita Food Expenditure by Country

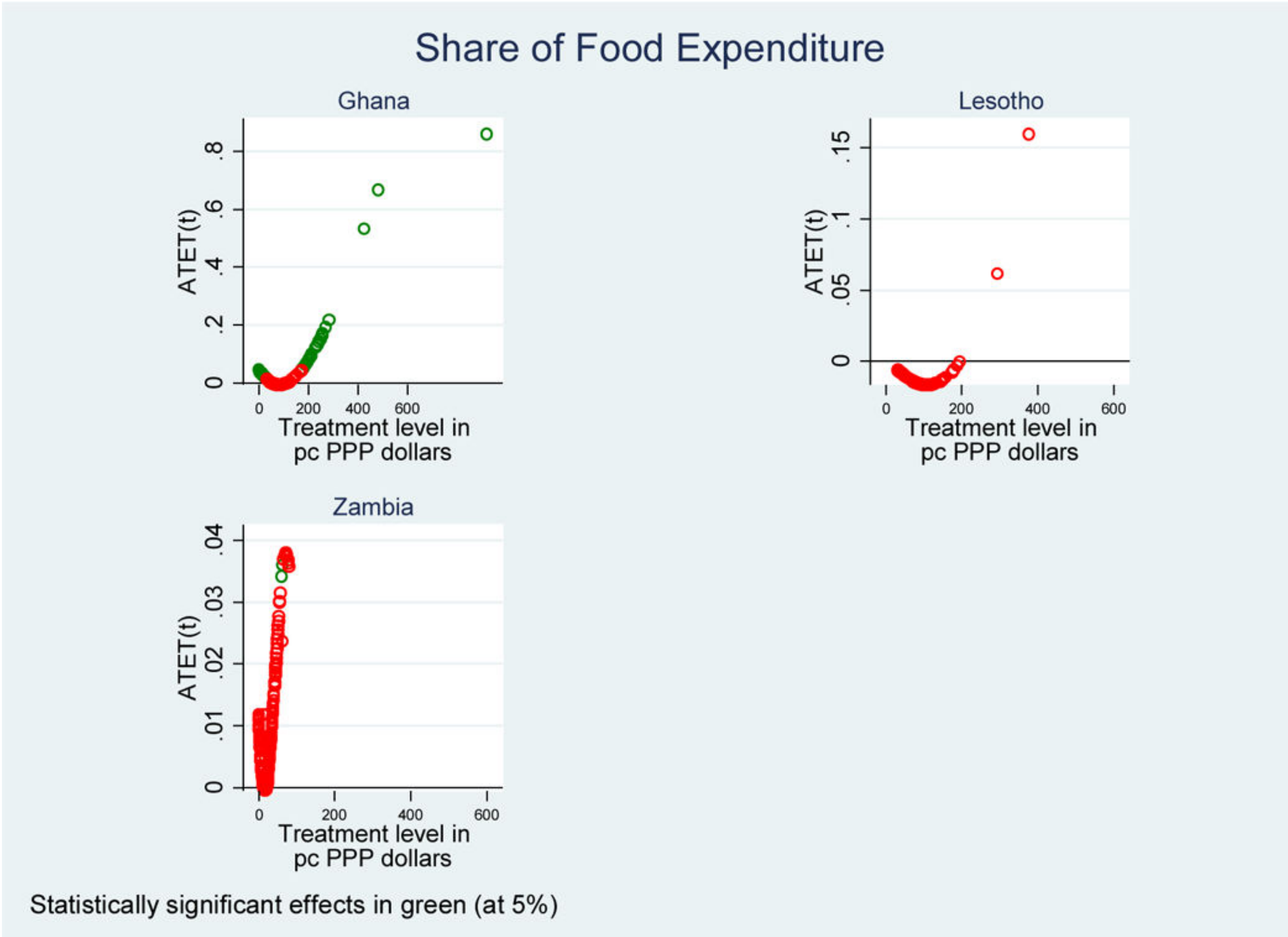

Figure 2:
Dose-Response Function for Share of Food Expenditure by Country

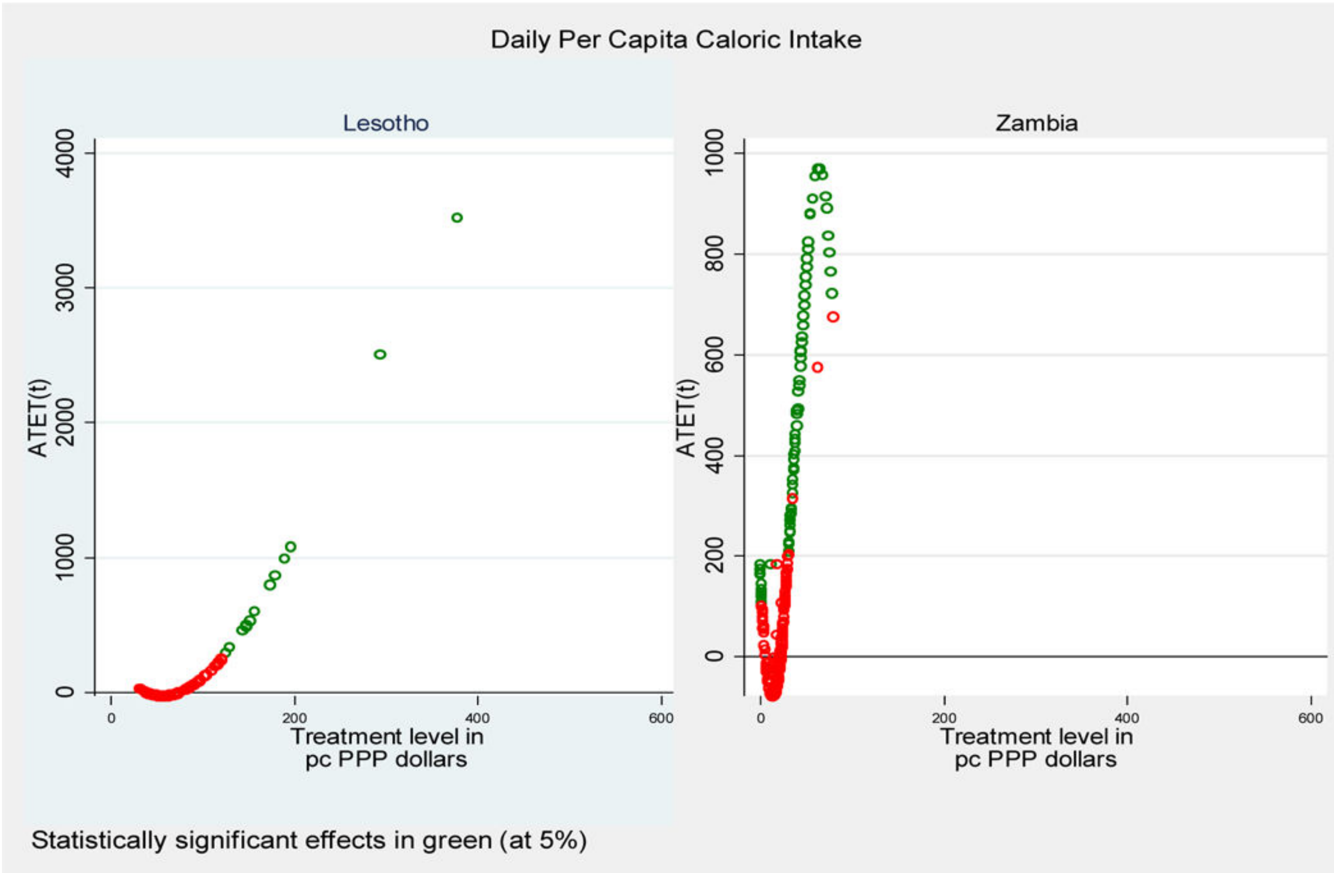

Figure 3:
Dose-Response Function for Daily Per Capita Caloric Intake by country

Table 1:

Countries and programs

Country	Ghana	Kenya	Lesotho	Zambia
CT Program	Livelihood Empowerment Against Poverty (LEAP)	Cash Transfers for Orphan and Vulnerable Children (CT-OVC)	Child Grants Programme (CGP)	Child Grant (CG) model of the Social Cash Transfer (SCT) program
Target group	Ultra-poor households with members in one of three categories: 1) single parent with OVC; 2) elderly poor; 3) people with extreme disability	Ultra-poor households with OVC	Ultra-poor households with children (0–18 years old)	Any household with a child under five years of age
Value of transfer during the evaluation	8G¢ monthly (1 eligible HH member) 10G¢ monthly (2) 12G¢ monthly (3) 15G¢ monthly (4+)	2007: 1,500 KSh monthly per HH 2011: 2,000 KSh monthly per HH	Start: 360LSL quarterly per HH April 2013: 360LSL quarterly (1–2 children) 600LSL quarterly (3–4) 750LSL quarterly (5+)	60 ZMK monthly per HH (bimonthly payments)
Conditions	Unconditional for people over 65 and with disabilities. “Soft” conditions for OVC caretakers.	None	None, but strong message that the cash should be spent on the needs of the children	None
Additional programs/services	National Health Insurance Scheme (NHIS)		Food Emergency Grant	
IE Design	PSM	RCT	RCT	RCT
Baseline survey	December 2009/March 2010	April/June 2007	June/August 2011	October/November 2010
Follow-up survey(s)	2012	1st follow-up: May/July 2009 2nd follow-up: June/July 2011	June/August 2013	October/November 2012

Note: RCT-randomized control trial; PSM-propensity score matching; HH-household; KSh-Kenyan Shilling; G¢-Ghanaian Cedis; ZMK-Zambian Kwacha; LSL-Lesotho Maloti.

Table 2:

Weighted Baseline Averages of Outcome Variables by Treatment Status

	Ghana			Kenya			Lesotho			Zambia		
	T	**C**	**Diff**	**T**	**C**	**Diff**	**T**	**C**	**Diff**	**T**	**C**	**Diff**
Per capita expenditure, PPP$												
food	35.5	39.3	−3.9	7.4	5.0	2.4 *	22.8	25.1	−2.2	6.8	6.4	0.4
cereals	7.6	9.2	−1.5	2.4	1.7	0.8	9.9	10.7	−0.9 *	2.2	2.1	0.2
roots and tubers	8.6	7.9	0.7	0.5	0.3	0.2 **	0.9	0.7	0.2	1.0	1.0	0.0
animal products	8.5	8.6	−0.1	1.5	1.0	0.5	3.8	4.2	−0.4	1.5	1.4	0.1
pulses and legumes	2.3	1.6	0.8 ***	0.5	0.3	0.2 *	1.0	1.2	−0.1	0.2	0.2	0.0
fruits and veg	6.3	6.3	0.0	0.9	0.8	0.1	4.9	5.0	−0.1	1.3	1.4	−0.1
% total expenditure on food	64.3	67.2	−2.8	61.5	60.9	0.6	65.7	68.1	−2.4 *	62.8	62.6	0.2
Share of food expenditure												
cereals	21.8	22.6	−0.9	33.8	33.0	0.8	48.3	47.5	0.8	34.0	31.2	2.8
roots and tubers	23.6	20.3	3.3 *	6.3	5.0	1.3 **	3.8	3.0	0.8	15.3	17.0	−1.7
animal products	20.1	22.6	−2.5 **	15.7	18.4	−2.7 ***	10.5	10.5	0.0	20.5	19.9	0.6
pulses and legumes	6.6	4.2	2.4 ***	5.0	4.5	0.5	4.3	4.8	−0.6	2.8	2.9	−0.1
fruits and veg	18.2	16.8	1.4	17.4	16.0	1.4	23.8	22.2	1.6	20.9	22.6	−1.7
Share of calories												
cereals							74.0	74.2	−0.2	50.7	46.7	4.0
roots and tubers							2.3	1.7	0.6	18.6	21.6	−3.0
animal products							2.7	3.1	−0.4	8.8	8.9	−0.1
pulses and legumes							0.6	0.9	−0.3	2.1	2.1	−0.0
fruits and veg							9.2	8.7	0.5	12.1	13.5	−1.4
Dietary diversity indicators												
# food items	19.7	21.5	−1.8 **	10.5	11.3	−0.8 *	6.6	6.6	0.0	8.3	7.9	0.4
household dietary diversity score	8.7	9.3	−0.5 ***	7.5	7.9	−0.4	5.1	5.1	0.0	5.7	5.6	0.2
Simpson index	0.8	0.8	0.0	0.7	0.8	0.0	0.6	0.6	0.0	0.6	0.6	0.0
Shannon index	1.5	1.6	0.0	1.6	1.7	−0.1 *	1.1	1.1	0.0	1.1	1.1	0.0

	Ghana			Kenya			Lesotho			Zambia		
	T	C	Diff	T	C	Diff	T	C	Diff	T	C	Diff
Coping strategy indicators												
% fewer meals							78.6	84.5	−5.9	95.8	95.4	0.4
% smaller meals							78.4	85.5	−7.1 **	96.1	95.7	0.4
% hungry day and/or night							46.0	51.9	−5.9 *	80.6	82.3	−1.8
% fewer meals (children)							66.0	70.1	−4.1			
% smaller meals (children)							69.0	69.8	−0.8			
% hungry day and/or night (children)							31.1	36.9	−5.8 *			
# months sufficient food							3.4	3.3	0.1			
# months some food shortage							3.9	4.4	−0.5			
# months extreme shortage							4.7	4.3	0.4			
Caloric Intake												
Daily per capita caloric intake							1,579	1,750	−171 **	1,385	1,337	48
% undernourished							64.7	59.5	5.3	73.6	75.7	−2.03
% weakly nourished							15.2	14.2	1.0	26.1	24.1	2.03
Number of Observation	699	914		1,540	754		739	733		1,256	1,259	
Total	1,613			2,294			1,472			2,515		

Note:

*** 1% significant,

** 5%,

* 10%.

Table 3:

Weighted Baseline Averages of Control Variables by treatment status and by country

	Ghana			Kenya			Lesotho			Zambia		
	T	C	Diff	T	C	Diff	T	C	Diff	T	C	Diff
Household demographic characteristics												
Household size	3.8	4.0	−0.2	5.5	5.8	−0.3 *	5.8	5.4	0.4 **	5.75	5.63	0.12
# female	2.1	2.2	−0.1	2.8	3.0	−0.2 **	3.0	2.8	0.2 *	3.08	2.94	0.13
# hh members aged 0–5	0.4	0.5	0.0	0.7	0.9	−0.2 ***	0.9	0.8	0.1 ***	1.88	1.91	−0.03
# hh members aged 6–12	0.8	0.8	0.0	1.5	1.6	−0.1	1.1	1.1	0.1	1.26	1.25	0.01
# hh members aged 13–17	0.5	0.6	0.0	1.0	1.0	0.0	0.7	0.8	0.0	0.5	0.43	0.07 *
# hh members aged 18–59	1.2	1.3	−0.1	1.6	1.8	−0.2 *	2.6	2.3	0.3 **	2.02	1.94	0.07
# hh members aged 60	0.9	0.9	0.0	0.6	0.3	0.3 ***	0.4	0.4	0.0	0.07	0.06	0.01
Household head characteristics												
% female headed	59.2	53.0	6.2	65.9	58.0	8.0 ***	46.3	49.3	−3.0	98.96	99.6	−0.63
Head’s age	61.1	61.6	−0.5	57.9	48.2	9.7 ***	51.3	50.9	0.4	30.07	29.64	0.43
% married head	35.5	45.7	−10.2 *	32.1	43.5	−11.4 ***	47.4	42.3	5.1	73.33	71.24	2.09
Head’s # years of education	2.1	2.6	−0.4	2.8	4.2	−1.4 ***	4.2	4.2	0.0	4.29	3.78	0.51 *
Other household characteristics												
% hh severely labor constrained	46.2	42.1	4.1	29.5	20.3	9.3 ***	9.0	13.3	−4.3 *	3.49	3.73	−0.24
% hh moderately labor constrained	22.7	15.7	7.1 **	29.1	32.1	−3.0	21.5	18.8	2.7	30.07	31.61	−1.53
% hh labor unconstrained	31.0	42.2	−11.1 *	41.4	47.6	−6.3 **	69.6	67.9	1.7	66.42	64.65	1.77
Operated land, ha	0.9	0.9	−0.1	0.7	1.2	−0.5 *	1.0	0.9	0.1	0.49	0.49	0
# cattle	0.2	0.1	0.1	1.0	1.3	−0.3 *	1.0	0.9	0.1	0.48	0.35	0.13
# chicken	3.7	3.9	−0.2	3.4	5.0	−1.5 **	1.4	1.3	0.1	1.99	1.87	0.12
% cement floor	61.7	63.9	−2.2	23.6	18.3	5.3	29.3	28.4	1.0	2.46	2.7	−0.24
% electricity	33.5	34.8	−1.4	5.8	6.4	−0.6	2.8	4.9	−2.1	38.96	37.56	1.4
Community characteristics												
price of maize	2.84	2.93	−0.09	0.49	0.47	0.02	0.96	0.9	0.05	8.56	7.95	0.61

	Ghana			Kenya			Lesotho			Zambia		
	T	C	Diff	T	C	Diff	T	C	Diff	T	C	Diff
price of beans	4.16	3.49	0.67	0.78	0.8	−0.02	3.62	3.34	0.29	1.55	1.45	0.1
	1,613			2,294			1,354			2,515		

Note:

*** 1% significant,

** 5%,

* 10%.

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Table 4:

Binary Treatment Analyses by country

	Ghana ITT	Kenya ITT	Lesotho ITT	Zambia ITT	Pooled ITT
Per capita expenditure PPP$					
food	−3.799	1.67	2.196	2.506 ***	0.047
cereals	−0.455	0.886	0.486	1.017 ***	0.574 **
roots and tubers	−2.708 *	−0.353 **	−0.387	−0.148	−1.084 ***
animal products	−2.76 **	0.836	1.195	0.698 ***	−0.455 *
pulses and legumes	−0.206	0.176	0.415	0.226 ***	0.19 **
fruits and veg	−0.079	0.096	−0.314	0.072	−0.124
% total expenditure on food	0.036	−0.011	−0.006	0.004	0.007
Share of food expenditure					
cereals	0.003	−0.009	−0.025	−0.001	−0.004
roots and tubers	−0.026	−0.018 ***	−0.01	−0.042 ***	−0.027 ***
animal products	0.016	0.044 ***	0.02	0.014	0.019 ***
pulses and legumes	−0.009	0.004	0.02 **	0.017 ***	0.007 ***
fruits and veg	0.005	−0.022 **	−0.027 *	−0.046 **	−0.021 ***
Share of calories					
cereals			−0.016	0.035	0.040 ***
roots and tubers			−0.006	−0.032 **	−0.020 *
animal products			0.011	−0.011	−0.012 *
pulses and legumes			0.004	0.016 **	0.006 **
fruits and veg			−0.012	−0.03 *	−0.024 **
Dietary diversity indicators					
# food items	−1.094	1.533 ***	0.278	1.958 ***	1.363 ***
household dietary diversity score	0.173	0.627 ***	0.268 *	1.025 ***	0.831 ***
Shannon index	0.068	0.092 ***	0.055 *	0.163 ***	0.127 ***

	Ghana ITT	Kenya ITT	Lesotho ITT	Zambia ITT	Pooled ITT
Simpson index	0.005	0.021 *	0.014	0.047 ***	0.037 ***
Coping strategy indicators					
% fewer meals			−0.044	−0.055 ***	−0.06 ***
% smaller meals			−0.023	−0.042 ***	−0.043 ***
% hungry day and/or night			−0.084 *	−0.167 ***	−0.205 ***
% fewer meals (children)			−0.085 *		
% smaller meals (children)			−0.086 *		
% hungry day and/or night (children)			−0.05		
# months sufficient food			0.867 **		
# months some food shortage			1.149 ***		
# months extreme shortage			−1.809 ***		
Caloric Intake					
Daily per capita caloric intake			177.5	214.4 **	257.78 ***
% undernourished			−0.061	−0.054 *	−0.059 **
% weakly nourished			0.023	0.052 *	0.055 **

Note:

*** 1% significant,

** 5%,

* 10%.

Table 5:

Heterogeneity of Impacts by Wealth Index

	Ghana		Kenya	
	poor ITT	**less poor ITT**	**poor ITT**	**less poor ITT**
Per capita expenditure on food	−4.578	−1.207	1.326	2.226
Per capita expenditure on cereals	−1.920 *	2.177	0.958	0.487
Share of total expenditure on food	0.005	0.087 **	0.005	−0.059 **
Share of food expenditure on cereals	−0.017	0.033	−0.010	−0.023
Daily per capita caloric intake				
	Lesotho		**Zambia**	
	poor ITT	**less poor ITT**	**poor ITT**	**less poor ITT**
Per capita expenditure on food	3.195	1.395	2.216 ***	3.111 ***
Per capita expenditure on cereals	0.847	0.091	1.081 ***	0.991 ***
Share of total expenditure on food	0.001	−0.022	0.000	0.011
Share of food expenditure on cereals	−0.026	−0.024	−0.001	0.011
Daily per capita caloric intake	301.348 ***	19.919	264.028 **	119.562

Note:

*** 1% significant,

** 5%,

* 10%.