Comparing the Productive Effects of Cash and Food Transfers in a Crisis Setting: Evidence from a Randomised Experiment in Yemen

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ABSTRACT The productive impacts of transfer programmes have been receiving increased attention. However, little is known about such effects in emergency and crisis settings. Even less is known about whether transfer type – a food basket or a cash grant – influences the productive potential of such transfers. Theory suggests that cash transfers can relieve liquidity constraints associated with investments, but subsidised food provision, by acting as a form of insurance, may prevent households from retreating to conservative income-generating strategies during volatile periods. This report contrasts the effects of transfer modality during a randomised field experiment in Yemen. The results demonstrate a modest productive impact of both modalities and suggest a role for liquidity and price risk channels. Cash transfer recipients invested relatively more in activities with higher liquidity requirements (livestock), while food recipients incorporated higher-return crops into their agricultural portfolios.

1. Introduction
Since 2005, the World Food Programme (WFP) has spent US$40.8 billion on emergency and relief operations.¹ In 2016, the US government’s food commodity programme budgeted over US $1.4 billion for emergency food shipments overseas. Such programmes aim to prevent catastrophes, stabilise food security, and avert death and malnutrition. However, beyond the obvious humanitarian rationale, a sizeable literature has also demonstrated the potential long-term benefits associated with preventing acute food crises. Such studies have focused primarily on nutritional outcomes (Gilligan & Hoddinott, 2007; Hoddinott, Alderman, Behrman, Haddad, & Horton, 2013; Margolies & Hoddinott, 2012).

Increasingly, the development community and researchers are recognising that frequent negative shocks arising because of conflict or natural disaster can severely impede the ability of a person or household to develop the necessary capacity to enjoy improvements in living standards over time. While economists have long acknowledged the importance of the dynamic consequences of crises, the traditional division of aid implementation into emergency and development categories has slowed the integration of such ideas in practice (Barrett & Headey, 2014). Recent emphasis on concepts such as resilience, however, suggest there is a more widespread understanding of these issues (Béné, Wood, Newsham, & Davies, 2012; Schnitzer, 2019).

As a result, there has been growing interest in the productive impacts of transfer programmes, including programmes concerned with food assistance (for example, see United States Agency for...
International Development [USAID], 2016). A focus has been investments in agriculture, which is a key component of the livelihoods of many of the world’s poor (Banerjee & Duflo, 2007). An omnibus review of the cash transfer evaluation literature notes that much of the evidence stems from the From Protection to Production Project of the Food and Agriculture Organisation of the United Nations, which focused explicitly on the potential role of cash transfers in raising agricultural productivity in sub-Saharan Africa (Bastagli et al., 2016). The results of the project and other evaluations have been mixed. The direction and size of outcomes vary from study to study; the most consistent positive outcomes occur in holdings of small livestock and in input purchases (Daidone, Davis, Handa, & Winters, 2019). And the context of many of these evaluations does not include a background on civil conflict or acute need.

At the same time that researchers have reconsidered the potential outcomes of transfers, there has also been a reassessment of the designs of these programmes. Despite a long history of providing food assistance through reliance on food commodities, agencies have begun to shift to alternative modes of assistance, particularly cash and vouchers (Alderman, Gentilini, & Yemtsov, 2018; Lentz, 2014). A plethora of high-quality randomised evaluations have examined the relative impact of the choice among food assistance modalities on factors associated with nutrition, consumption, expenditure, social cohesion, and cost (Aker, 2017; Cunha, 2014; Hidrobo, Hoddinott, Peterman, Margolies, & Moreira, 2014; Hoddinott, Sandström, & Upton, 2014; Valli, Peterman, & Hidrobo, 2019). Most confirm that cash and voucher recipients consume a greater diversity of foods relative to commodity recipients. However, little is known about the productive implications of each modality.

This report contributes to both the literature on the productive impacts of social protection and the literature on the differential impacts of modality choice in food assistance. It is an output of a study on a food assistance intervention implemented by WFP in rural Yemen in 2011 and 2012. Communities in the study were randomly assigned to receive three equal-valued food or cash transfers worth nearly US$50 each. The focus here is on the impact of these transfers on production according to two measures: first, in relation to each other (relative impacts) and, second, relative to villagers who did not receive the benefits (absolute impacts). The transfers arrived in a period of political destabilisation that preceded the full-scale onset of war in Yemen, when widespread civil unrest and uncertainty were accompanied by sporadic and localised violence.

While cash transfers may directly address liquidity constraints on productive investment, food transfers may have particular benefits for households engaged in non-commercial agriculture. In particular, a food transfer may serve a consumption insurance function similar to the role of foodcrop production and thus alleviate the risk constraints associated with the production of higher-value crops or off-farm labour. Given the uncertainty prevailing at the time of the transfer, the insurance benefit of self-sufficiency in food transfers increases with the degree of expected price volatility (Fafchamps, 2003).

The study findings suggest that the transfers likely affected both liquidity and risk constraints, though the scope of the productive impact was modest. Cash transfers, but not food transfers, had a positive impact on the acquisition of small livestock. Consistent with theory, however, food transfers positively and differentially affected the likelihood households planted cash crops, though the magnitude of the effect was small.

The results here speak directly to a recent literature that has attempted to unpack the link between social protection strategies and productive investments. In a large randomised trial comparing a cash intervention and an insurance intervention in Ghana, Karlan, Osei, Osei-Akoto, and Udry (2014) find risk to be the binding constraint on agricultural investment and, similar to the study illustrated in this report, note that farmers with insurance engage in riskier, higher-value production.

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However, a series of recent randomised trials suggests liquidity constraints are indeed significant. In Senegal, Ambler, de Brauw, and Godlonton (2017a) find that a US$200 cash transfer, coupled with agricultural extension, increased livestock holdings and crop production. Ambler, de Brauw, and Godlonton (2017b) find that a US$84 cash transfer in Malawi had similar impacts. Beaman, Karlan, Thuysbaert, and Udry (2015) find that, in Mali, a US$150 cash grant, the same magnitude as the transfer studied here, led to positive impacts on agricultural production among liquidity-constrained farmers.
As in the case of Karlan et al. (2014), the results here show that food transfers, which may be a particularly important form of insurance during periods of expected price volatility, can enable farmers to engage in riskier, but higher-value activities. Yet, cash recipients do appear to use at least part of their grants for agricultural investment, especially in livestock. This suggests that evaluations of the productive impacts of transfer programmes should be clearer about the role of expected effects in the production process, especially among farmers engaged in subsistence production. The study findings here also provide a potential explanation for the heterogeneity of results in the broad literature on transfers and production: the expected price volatility of a staple foodcrop during an intervention may influence the extent to which transfers enable an optimal swap to a higher-value, but riskier production strategy or simply alleviate liquidity constraints on investments in current production.

Transfers appear to raise off-farm labour participation, but the transfer modality does not change the impact. However, unlike de Hoop, Groppo, and Handa (2017) and Brück, Diaz Botia, Ferguson, Ouédraogo, and Ziegelhöfer (2019), the study did not find that transfers increase labour participation by children. These results should, however, be interpreted with caution because the timing of the survey impedes the ability to disentangle transfer impacts from the effect of the start of the school year.

2. Conceptual model and background

2.1. Cash and food transfers

Among households that purchase food at markets, standard microeconomic theory predicts that the modality of an equal valued inframarginal transfer should have no bearing on productive impacts. In such a case, a household’s food consumption and disposable income would rise by the same amount after either a food transfer or a cash transfer. However, aside from the lack of consistent support for this standard model in the literature, the applicability of the model to small farmers in rural settings is questionable because of the seasonality of income patterns and the consistent rejection of the assumption of fully separable household consumption and production decisions (Arslan & Taylor, 2009; Gentilini, 2014; LaFave & Thomas, 2016). As a result, the potential for a productivity difference by modality is highest among subsistence or semisubsistence farmers.

The potential productive superiority of transfers in cash is fairly straightforward. Boone, Covarrubias, Davis, and Winters (2013) note that credit and liquidity constraints are widely considered key barriers to productive investment by small farmers. Seasonal income patterns may exacerbate this problem because farmers lack the facility to purchase inputs at appropriate times. Among farmers consuming from own consumption because of high transaction costs, for example, and obtaining liquidity in the absence of credit markets by selling production would require a reduction in the total consumptive value of a harvest (Key, Sadoulet, & de Janvry, 2000). Thus, a timely cash transfer, as opposed to additional food stocks, would permit households to make investments that would be suboptimal in the absence of such liquidity.

Other barriers, including risk, may persist and bind. In the face of food price risk, farmers may find the optimal strategy is insurance through greater foodcrop self-sufficiency (Fafchamps, 1992). Theoretically, the extent to which farmers sacrifice potentially higher returns to cash-cropping because of such risks depends on several factors, including the food budget share, risk aversion, income elasticity, and the covariance of cash crop and foodcrop prices and returns.

In simulations based on this theoretical model, Fafchamps (2003) explores a variety of conditions relevant to Yemen. Growth in food price volatility increasingly harms less market integrated, poorer households, as it ‘induces them to maintain a high level of food self-sufficiency’ (Fafchamps, 2003, p. 171). Furthermore, the availability of subsidised food can increase cash crop production by enhancing the supply responsiveness of small farmers (Fafchamps, 2003).

An inframarginal food transfer, such as the one analysed here, represents a 100 per cent subsidy for a portion of the household’s food needs and reduces the price variance of the overall two-month food
budget. Thus, the incentive to increase food production, a self-sufficiency strategy, would be less powerful among food beneficiaries relative to cash beneficiaries. In the case of Yemen, where the combination of civil unrest, potential for conflict, and remote geography could impact both price volatility and market access by individuals, the effect of food transfers on risk constraints may be nontrivial. The farmers in the study described here tend to be net buyers of food. So, raising food production would reduce their exposure to sudden price spikes in cereals, which occurred shortly before the baseline survey, and to the risk that the increasing hostilities would reduce their ability to purchase food in the market (“Tribes at war”, 2011).

2.2. The Yemini context

The intervention takes place in rural areas of two governorates: Hajjah and Ibb. In both locations, World Food Programme (WFP, 2012) estimates a food insecurity prevalence of 54 per cent. They differ in some agroecological characteristics, but the two governorates receive substantial amounts of precipitation relative to the rest of the country. Agricultural production in both has a long and storied history and remains widespread. While some areas of Ibb have a short rainy season in the spring (when pulses are mainly produced) and a long summer rainy season (cereal production), Hajjah has only one rainy season, in the summer.

In both governorates, cereal crops are planted in the spring and harvested in the fall. In the sample, between 70 per cent and 75 per cent of farmers grow sorghum, the most important cereal crop. Sorghum is used as both a foodcrop and a source of animal feed.

Yemen’s most important cash crop is khat, a flowering, perennial native to the Horn of Africa and the Middle East. The leaves, which are mildly narcotic, are popular in Yemen, where they are chewed as a stimulant. Though maligned for its water consumption as a crop and the potential health effects, khat remains Yemen’s most profitable crop (Fielding-Smith, 2010; Zahran, Khedr, Dahmash, & El-Ameir, 2014). Milanović (2008) estimates that 70 per cent of Yemeni chew khat leaves, though, in the sample here, less than one third of households consume the plant daily, and about half chew once per week. The plant is highly perishable, though well-developed marketing channels transport the crop from producers to markets daily. Yet, it can thrive even in poor soils, and little capital is required to initiate production (Kennedy, 2012).

Though the study does not directly measure future expectations, that uncertainty about future market conditions was high among the sample of households at the time of data collection should be uncontroversial. During the baseline survey, in fall 2011, the effects of the Arab Spring were reverberating throughout the country. Yemen’s then president, Ali Abdullah Saleh, was in the process of returning to the country after receiving treatment following a bomb attack that occurred subsequent to his refusal to agree to a regional accord on a transition to a new government administration. During the cash and food transfer period, Saleh officially ceded power to his deputy, ending a 33-year rule. Against this backdrop, a separatist campaign in the south intensified. Islamist elements were asserting their growing local power, and tribal hostilities continued. The long-simmering revolt of the supporters of Houthis in Sa’dah, in northwestern Yemen and adjacent to one of the study sites, gained strength. Though violence did not directly affect the majority of study participants, conflict in surrounding areas became common, especially in Hajjah.

Uncertainty about the future would have been justified. Indeed, the Houthis would eventually sweep across much of Yemen, igniting an ongoing, full-scale civil war that would involve regional powers. While the supply of food commodities at the time of the end line survey was normal, the volatility of prices over the previous year was extremely high. Prices rose sharply in spring 2011, shortly before the baseline survey, and prices spiked once again in the second half of 2012, shortly after the end line survey (WFP, 2012). A separate WFP survey concluded that 90 per cent of respondents considered high food prices as the primary negative shock experienced in 2011 (WFP, 2012).

There is also evidence that liquidity constraints were relevant among rural Yemeni. Sawada and Zhang (2012) find that liquidity concerns were important in the majority of business closures in their
rural Yemeni sample. However, they also note that households with higher agricultural incomes were less likely to close nonfarm businesses, suggesting that food production may be used as insurance within livelihood strategies.

3. Intervention and empirical strategy

3.1. Intervention

WFP distributed cash and food transfers in the communities sampled for this study over approximately eight months between August 2011 and April 2012. The transfers were part of a broader emergency safety net initiative designed to assist severely food insecure households across the country. The initiative was prompted by a widespread economic, political, and social crisis, which included not only conflict and civil unrest, but also the erosion of real incomes amid severe price volatility associated with staple goods (Breisinger, Diao, Collion, & Rondot, 2011). The transfers examined here were part of a pilot programme funded by the government of Spain and integrated into the initiative.

Two governorates, Hajjah and Ibb, were selected to host the pilot programme. Within these two governorates, 135 village clusters, hereafter referred to as food distribution points (FDPs), participated in the evaluation. The FDPs were randomly assigned to receive either three cash transfers or three food transfers over the study period. The randomisation was stratified by governorate.

Only the eligible households within each FDP received the transfers. Eligibility was determined by a proxy-means test carried out by the Social Welfare Fund and the World Bank in 2009. Proxy-means scores were used to categorise households based on need. Group A households, at one extreme, were the most in need, and group F households, at the other, did not need assistance. For the pilot study, households in groups A and B were deemed eligible to receive transfers (beneficiaries), while those in groups C–F did not receive transfers (nonbeneficiaries). Data were collected on households in groups A, B, and C.

Schwab, Margolies, and Hoddinott (2013) apply the identical proxy-means test methodology using data collected during the baseline survey. They conclude that, while beneficiaries had lower scores than nonbeneficiaries on average, there was substantial overlap in the distribution of the two groups. The overlap suggests that the measurements of some household characteristics differ between the baseline survey and the original proxy-means exercise because of either reporting differences or changes in circumstances over the two-year gap between the two data collection periods.

Beneficiaries in food transfer FDPs received a basket consisting of 50 kilograms of wheat flour and 5 litres of vegetable oil per transfer. The size of the food basket was based on a presumed daily calorie gap of 500 kilocalories per person per day, and the size of the cash transfer was then calibrated to match the local market value of the food items at the time of the initial disbursement. Cash beneficiaries received slightly more than US$49 (YER 10,500) per transfer.

The potential insurance role of transfers hinges in part on beneficiary expectations of future distributions. The data collection period spanned three transfers, but WFP continued to deliver both modalities of food assistance after the conclusion of the pilot study. Beneficiary cards contained space sufficient to record six transfers and there seems to have been no communication by WFP that notified beneficiaries that the assistance was time-limited in any manner. Thus, while it is assumed that beneficiaries expected their transfers to continue, there is no direct evidence measuring this expectation or whether modality assignment deviated from the original randomisation after the conclusion of the final data collection round.

Though the modality type was randomly assigned and the transfer value was designed to be equivalent, implementation difficulties caused a discrepancy in the timing of transfers. Ideally, the disbursement schedule would be identical for both food and cash transfers so that modality differences would be orthogonal to seasonal influences or other factors associated with the exact timing of the receipt of the transfers. However, in the intervention studied here, the food transfers were...
launched earlier than the cash transfers, and the lag between transfers was thus longer in the case of the food transfer group. In particular, the first food transfer was delivered in August 2011, the second in late October, and the last in early April 2012. The first cash transfer became available in November 2011, the second in January 2011, and the last at the end of February 2012.\textsuperscript{10}

In addition, the first food transfer (but not the first cash transfer) occurred before the baseline survey, which was administered in mid-September 2011. While this limits the ability to use the baseline data for certain comparisons, this report focuses on household decisions unlikely to be overly influenced by the timing of the first food transfer. Importantly for the outcomes considered here, there were no differences in time with respect to cropping decisions. The first two food and cash transfers occurred after the 2011 planting cycle, and the last transfer occurred during the period of land preparation and planting for the 2012 cereal crop season.\textsuperscript{11} As a result, cropping outcomes should not be affected by the timing differences. Other outcomes, such as livestock purchases, are potentially biased by the inclusion of the baseline data, especially if the initial food transfers generated immediate impacts. However, because the accumulation of productive assets is likely to take place over a longer time horizon relative outcomes such as consumption, the potential degree of bias is likely more limited.\textsuperscript{12} Nonetheless, timing differences may have interacted with changes in seasonal livestock prices in ways that could lead to an underestimate of the impact of food transfers on animal purchases.

3.2. Empirical strategy

The empirical approach here exploits the assignment of modality type (cluster randomised), the sampling of beneficiaries and nonbeneficiaries (non-random), and the panel structure of the data (baseline and end line). The focus is on two classes of effects on productive activity and investment: (a) the relative impact of food and cash and (b) the absolute effect of each modality.

For the estimate of (a), the focus is only on beneficiaries. For this group, the changes are estimated between baseline and end line within food and cash clusters, that is, a difference in differences among the benefit-eligible group only. This measure is the relative difference in differences (RDiD). For any outcome, $Y$, one may write the average value by treatment modality (subscript $M$ or $F$ for money or food), eligibility group (subscripted by $E$ or $N$ for eligible or noneligible), and survey round $t$ (1 or 2) and define it as follows:

$$
RDiD = \left( \bar{Y}_{FE2} - \bar{Y}_{FE1} \right) - \left( \bar{Y}_{ME2} - \bar{Y}_{ME1} \right)
$$

(1)

For household $i$, living in cluster $c$, the linear regression model for the estimate of RDiD can be written as follows:

$$
Y_{ict} = \alpha + \beta_1 F_{c|e=1} \# Post_t + \beta_2 Post_t + \beta_3 F_{c|e=1} + \delta X_{ict} + \epsilon_{ict}
$$

(2)

where $F_{c|e=1}$ represents a dummy variable equal to 1 if the beneficiary household resides in a food FDP and 0 if the beneficiary resides in a cash FDP, and $X_{ict}$ is a vector of household control variables, which includes a dummy variable for governorate (the randomisation stratum). Other variables included are household size; the gender, educational attainment, and marital status of household heads; and baseline values of an asset index.

For the estimate of absolute effects, the nonbeneficiaries are incorporated. To obtain consistent estimates, one must difference out the disparity between these noneligible households and the beneficiaries because beneficiary status is not randomly assigned. The difference in differences strategy thus takes differences between these groups (within a treatment area) in each round. The approach can then use an absolute difference in differences (ADD) estimator to examine impacts separately for each modality, as follows:
The linear regression model for the ADD estimators for a given treatment is specified as follows:

\[ Y_{idtj_{c}} = F_{idtj_{c}} + M_{idtj_{c}} = \alpha + \beta_{1} Elg_{idc=F,M} + \beta_{2} Post_{t} + \delta X_{idtj_{c}} + \sigma_{d} + \epsilon_{idtj_{c}} \]  

The term \( \sigma_{d} \) indicates a fixed effect in a subdistrict (uzla). This fixed effect captures differences between eligible and noneligible households that vary within a locality.\(^{13}\) Unlike the RDiD, the consistency of the ADD estimate requires the additional assumption of parallel trends among beneficiaries and nonbeneficiaries. The short time between surveys (seven months) suggests that the assumption is reasonable here. The sizes of the absolute effects for each modality are compared using a triple difference estimator, which can be written as the difference in difference in differences (DDD) between modalities and estimated within a single linear regression, as follows:

\[ DDD = ADD_{F} - ADD_{M} \]  

A positive triple difference coefficient indicates that the change in the outcome variable for food beneficiaries relative to nonbeneficiaries exceeded the change for cash beneficiaries relative to nonbeneficiaries. Thus, food transfers provided recipients with a bigger boost than cash in the outcome over time relative to their neighbours. A negative coefficient would indicate the opposite case.

Another approach to the non-random assignment of treatment eligibility is also implemented using a form of matching based on the probability of treatment. As proposed by Heckman, Ichimura, and Todd (1998), kernel matching is used to weight the observations based on closeness of propensity scores. These kernel weights, which effectively limit the influence of nonbeneficiaries that appear unlikely to be treatment eligible, are then integrated into the basic regression adjustment estimates of the ADD and DDD.\(^{14}\)

The initial propensity scores are estimated based on a logit regression of treatment eligibility on variables used by the Social Welfare Fund to determine the proxy-means scores originally applied to determine eligibility groups. These include household size, numbers of children attending or not attending school, housing characteristics (floor material, water source), characteristics of the household head (gender, literacy, marital status), and asset ownership (televisions, phones, sewing machines).

The results using the kernel matching approach appear in both the main text and in Appendix A. For all regressions, a bandwidth of .004 is used, which is based on the upper limit of the optimal bandwidth derived from a pair-matching algorithm.\(^{15}\) Throughout this report, the focus on the nonweighted results is maintained because the estimates are similar, and inference is more straightforward.\(^{16}\) Selected results based on household fixed effect regressions, which are substantially similar, are included in Appendix A, Table A5.

4. Data

4.1. Surveys and measurement

The original survey sampling strategy called for randomly selecting 15 beneficiary households and 11 nonbeneficiary households in each FDP. However, a full complement of 11 group C nonbeneficiary households could not be located in every FDP. In such cases, replacement households were drawn from FDPs within the same district and treatment assignment. In total in the original sampling frame, 14 FDPs (seven food and seven cash) had fewer than 11 nonbeneficiary respondents, and seven FDPs
had fewer than six nonbeneficiary respondents. The baseline survey was conducted in September and October 2011, and the end line survey in April and May 2012.

The sample used for analysis consists of a balanced panel of 3,350 households surveyed in both rounds. Of the households in the original sampling frame, but excluded here, only 26 were lost to pure attrition. The largest number of excluded households, 56, were beneficiary households discovered to include multiple members receiving transfers. The sample used for analysis consists of a balanced panel of 3,350 households surveyed in both rounds. Of the households in the original sampling frame, but excluded here, only 26 were lost to pure attrition. The largest number of excluded households, 56, were beneficiary households discovered to include multiple members receiving transfers. The outcomes considered here can be classified into the following categories: crop choice, livestock, agricultural assets, expenditure, land investment, and labour. Crop choice variables are derived from a plot roster that collects data on the crops grown in 2011 (baseline) and the crops grown (or planned to be sown) in 2012 (end line). The indicators used here aggregate the plot information into a single dummy variable equal to 1 if the relevant crop is grown or planned to be grown on any of the household’s plots. Four such aggregates were created, as follows: anycrop indicates whether any crop is planted in any of the plots, that is, not fallow or pasture only; anycash indicates whether any noncereal or pulse crop is sown on any household plots; anykat indicates whether khat is planted on any plots, and anywheat indicates the planting of wheat. An additional dummy outcome measures if all plots in a given round are devoted to sorghum.

Livestock numbers are taken from a livestock roster wherein the cattle category aggregates bulls, cows, and oxen. In addition, all livestock (excluding beehives) are aggregated to calculate the total tropical livestock units owned by the household in each round. For six categories of assets (ploughs; small implements, such as sickles, axes and hoes; large assets, such as water pumps, motorised tillers and carts; hand-grinding mills; knapsack chemical sprayers; and tractors), respondents report the number owned by any member of the household. Asset values are self-reported replacement value estimates. Data on agriculture expenditure reflect a 30-day recall period, whereby respondents are asked to estimate the amount spent on farm inputs, equipment, and veterinary expenses. Expenditure on debt repayment is also based on a 30-day recall period. Land investment variables are calculated based only on end line survey data, whereby respondents are asked if they have made any investments in their plots, changed their irrigation systems, or modified their plot areas since the baseline round.

Labour data are gathered for all household members ages above 10. Several aggregates are constructed based on the data, which rely on a four-week recall period. First, dummy variables are defined equal to 1 if any household member worked for a wage or devoted time to off-farm self-employment during the recall period. A raw count is also provided of the number of household members performing wage work or active in off-farm self-employment. In addition, the household off-farm hours worked per worker are calculated by aggregating the total hours, across members, of each respondent who reports either wage or off-farm self-employment and then dividing by the total number of household members ages 10 or older. Finally, the extensive margin of child labour is the focus of an examination of whether any children worked either on- or off-farm.

Because of the large number of outcomes for which treatment effects are estimated, concerns about multiple comparisons arise. In particular, the probability of rejecting a true null-hypothesis increases with the number of independent tests. Therefore, p-values are also estimated based on the resampling method of Westfall and Young (1993) as implemented by Jones, Molitor, and Reif (2018). An advantage of this method is that outcomes are not assumed to be independent, which allows for effective control of the familywise error rate without drastic loss in power. The Westfall-Young p-values calculated here are used to account for the multiple tests of outcomes within the same category (for example, livestock).

4.2. Balance and summary statistics

For the examination of the observed performance of the randomisation and the differences between beneficiaries and nonbeneficiaries, the means at baseline of outcome variables and household characteristics are compared across transfer type and treatment status (Table 1). No outcome or
Table 1. Balance and summary statistics

| Variable                  | Beneficiary |           | Nonbeneficiary |           | T-test |           |
|---------------------------|-------------|-----------|----------------|-----------|--------|-----------|
|                           | (1) Food FDPs | (2) Cash FDPs | (3) Food FDPs | (4) Cash FDPs | (1) - (2) | (1) - (3) | (2) - (4) | (3) - (4) |
| Grows any crop            | 617         | 1.00 [0.00] | 537           | 0.99 [0.00] | 0.01   | 0.01      | 0.01       | 0.01       |
| Grows a cash crop         | 617         | 0.21 [0.04] | 537           | 0.26 [0.03] | -0.06  | -0.03     | -0.03      | -0.05      |
| Grows khat                | 617         | 0.16 [0.03] | 537           | 0.25 [0.03] | -0.09* | -0.03     | -0.02      | -0.07      |
| Grows wheat               | 617         | 0.05 [0.02] | 537           | 0.06 [0.03] | -0.00  | 0.01      | 0.01       | 0.00       |
| Grows only sorghum        | 614         | 0.83 [0.03] | 531           | 0.81 [0.02] | 0.01   | 0.04      | 0.04       | 0.01       |
| Cattle                    | 1000        | 0.47 [0.04] | 980           | 0.47 [0.04] | 0.00   | 0.08**    | 0.03       | -0.05      |
| Sheep and goats           | 1000        | 2.44 [0.25] | 980           | 2.22 [0.25] | 0.22   | 0.79***   | 0.50*      | -0.06      |
| Camels and donkeys        | 1000        | 0.42 [0.03] | 980           | 0.45 [0.04] | -0.03  | 0.05      | -0.01      | -0.08      |
| Poultry                   | 1000        | 0.67 [0.03] | 980           | 0.69 [0.04] | -0.02  | 0.33***   | -0.04      | -0.39**    |
| Beehives                  | 1000        | 0.10 [0.10] | 980           | 0.05 [0.13] | 0.04   | 0.08*     | 0.04       | 0.01       |
| Tropical livestock units  | 1000        | 0.89 [0.04] | 980           | 0.88 [0.03] | 0.01   | 0.18***   | 0.07       | -0.10      |
| Total livestock value     | 1000        | 341.20 [25.27] | 980      | 335.20 [23.78] | 6.00   | 49.29*    | 21.89      | -21.40     |
| Ag expenditure            | 1000        | 2.73 [0.88] | 980           | 1.23 [0.41] | 1.50   | 1.95**    | 0.58       | 0.13       |
| Total value of agricultural assets | 1000 | 16.19 [1.23] | 980 | 12.94 [1.10] | 3.26* | -16.73 | -2.67 | 17.32 |
### Table 1. (Continued)

| Variable                                      | Beneficiary | Nonbeneficiary | T-test |
|-----------------------------------------------|-------------|----------------|--------|
| Food FDPs                                    | (1)         | (2)            | (3)    |
| N/ [FDPs] Mean/ SE                           | 1000 0.42   | 980 0.44       | 682 0.50 | 688 0.46 |
| Cash FDPs                                    | (4)         | (3)            | (2)    |
| N/ [FDPs] Mean/ SE                           |             | 682 0.13       | 688 0.18 |
|oggle (4)                                      |             |               | -0.01  |
| Difference                                    | -0.02       | -0.08***       | -0.02  |
| Anyone in household worked for a wage         |             | -0.05          | -0.08***|
| [67] [0.02]                                  | -0.01       | 0.03**         | 0.00   |
| Anyone in household worked in a business      |             | -0.05          | -0.12**|
| [67] [0.02]                                  |             | -0.04          | -0.06  |
| Number earning wage (primary)                |             | -0.04          | 0.02   |
| [67] [0.02]                                  |             | 0.04           | -0.05  |
| Number in business (primary)                  |             | -0.04          | -0.05  |
| [67] [0.03]                                  |             | 0.04           | -0.05  |
| Hours worked off-farm per worker              |             | -0.45          | -1.98***|
| [67] [0.27]                                  |             | -1.75***       | -0.22  |
| Any child worked                             |             | 0.04           | 0.04   |
| [67] [0.01]                                  |             | 0.11***        | -0.02  |
| Woman-headed household                       |             | 0.01           | -0.04***|
| [67] [0.01]                                  |             | -0.09***       | -0.03  |
| Household head attended primary and up        |             | 0.02           | -0.08***|
| [67] [0.02]                                  |             | -0.11***       | -0.01  |
| Household head is married                    |             | -0.05*         | 0.07***|
| [67] [0.02]                                  |             | 0.11***        | -0.01  |
| Household head’s age                         |             | 0.55           | 0.10   |
| [67] [0.61]                                  |             | 0.88           | 0.88   |
| Household size                               |             | 1.33           | -0.09  |
| [67] [0.12]                                  |             | 1.58***        | 0.01   |
| Household members ages 0–5                   |             | 0.15           | 1.83***|
| [67] [0.05]                                  |             | 0.17**         | 0.11*  |
| Household members ages 6–17                  |             | -0.03          | -0.09  |
| [67] [0.07]                                  |             | 1.26***        | 0.00   |
| Variable                     | Benign Nonbeneficiary | Benign Nonbeneficiary | T-test | T-test | T-test | T-test |
|------------------------------|-----------------------|-----------------------|--------|--------|--------|--------|
|                              | (1)                   | (2)                   | (3)    | (4)    | (1) - (2) | (1) - (3) | (2) - (4) | (3) - (4) |
| Food FDPs                   | 1000                  | 0.29                  | 980    | 0.27   | 682     | 0.29    | 688     | 0.25    | 0.02    | 0.01    | 0.02    | 0.03 |
| Cash FDPs                   | 1000                  | 0.29                  | 980    | 0.27   | 682     | 0.29    | 688     | 0.25    | 0.02    | 0.01    | 0.02    | 0.03 |
| Number of refrigerators     | 1000                  | 0.07                  | 980    | 0.07   | 682     | 0.06    | 688     | 0.08    | 0.01    | 0.02    | -0.01   | -0.02 |
| Standardised wealth index   | 1000                  | 0.07                  | 980    | -0.02  | 682     | 0.00    | 688     | -0.01   | 0.10    | 0.07    | -0.01   | 0.01 |

Notes: Food distribution points (FDPs) represent a cluster-level of randomisation. T-tests include controls on the randomisation stratum (governorate). The total value of livestock and the value of agricultural assets are in US dollars. At baseline, US$1 = YER 214. Standard errors in parenthesis are clustered at the FDP level. *p < .1; **p < .05; ***p < .01.
characteristic of beneficiaries differs significantly by modality at the 5 per cent level. However, the probability of khat production is higher among cash recipients, as is the total value of agricultural assets, and the difference is marginally significant. Furthermore, despite the transfer timing differences, livestock holdings by food and cash beneficiaries appear similar.

The average reported livestock holdings are greater among the beneficiary group than among the nonbeneficiaries. The direction of the difference is the same in the cash and food modalities, though the split is slightly larger in the food group, especially in the case of poultry. Based on the aggregation of tropical livestock units, beneficiaries hold the equivalent of one cow and two goats or sheep, while nonbeneficiaries have the equivalent of one cow (in food FDPs) or one cow and one sheep or goat (in cash FDPs).

More closely reflecting the targeting criteria, beneficiary households are larger and less likely to be headed by an individual who has completed primary school. However, nonbeneficiaries and beneficiaries have similar scores on a standardised wealth index based on asset ownership (see Table 1, last row) and are less likely to be woman-headed. Relative to beneficiaries, off-farm wage work is slightly more common among nonbeneficiaries, among whom 46 per cent to 50 per cent of households include a wage labourer. Rates of child work are also substantially higher among beneficiaries (21 per cent to 23 per cent) relative to nonbeneficiaries (12 per cent to 14 per cent).

5. Results

5.1. Crop choice

The first set of results gauges the relative and absolute impact of the transfers on crop choice. These estimates are restricted to the sample that reports owning or operating land at baseline. The first row

| Outcome          | Grows any crop | Grows a cash crop | Grows khat | Grows wheat | Grows only sorghum |
|------------------|----------------|-------------------|------------|-------------|-------------------|
| RDiD             | 0.02           | 0.02              | 0.02       | 0.01        | 0.01              |
|                  | (0.01)*        | (0.01)*           | (0.01)**   | (0.01)**    | (0.01)            |
| N                | 2,360          | 2,360             | 2,360      | 2,360       | 2,290             |
| Westfall-Young   | 0.107          | 0.107             | 0.028      | 0.099       | 0.336             |
| p-value          |                |                   |            |             |                   |
| ADD: food        |                |                   |            |             |                   |
|                  | 0.01           | 0.03              | 0.03       | −0.00       | −0.02             |
|                  | (0.01)         | (0.01)**          | (0.01)**   | (0.01)      | (0.01)*           |
| N                | 2,013          | 2,013             | 2,013      | 2,013       | 1,963             |
| Westfall-Young   | 0.508          | 0.038             | 0.038      | 0.846       | 0.118             |
| p-value          |                |                   |            |             |                   |
| ADD: cash        |                |                   |            |             |                   |
|                  | −0.01          | −0.01             | −0.01      | −0.02       | −0.02             |
|                  | (0.01)*        | (0.01)            | (0.01)     | (0.01)**    | (0.01)            |
| N                | 1,858          | 1,858             | 1,858      | 1,858       | 1,790             |
| Westfall-Young   | 0.151          | 0.393             | 0.262      | 0.113       | 0.223             |
| p-value          |                |                   |            |             |                   |
| DDD              | 0.02           | 0.04              | 0.04       | 0.01        | −0.00             |
|                  | (0.01)**       | (0.01)**          | (0.02)**   | (0.01)      | (0.02)            |
| N                | 3,871          | 3,871             | 3,871      | 3,871       | 3,753             |
| Westfall-Young   | 0.082          | 0.045             | 0.011      | 0.273       | 0.838             |
| p-value          |                |                   |            |             |                   |

Notes: Westfall-Young p-values are listed below the number of observations (N). The calculations are based on 1,200 replications. RDiD estimates control for governorate fixed effects. All other estimates control for subdistrict (uzla) fixed effects. All estimates are restricted to those who own or operate land. Cash crops include any noncereals or pulses. Estimates for the sorghum only regressions are restricted to the sample that grows any crops. Control variables include household size and baseline values of the following: gender, educational attainment, and marital status of the household head and a standardised asset index. Standard errors in parenthesis are clustered at the FDP level. *p < .1; **p < .05; ***p < .01.
in Table 2 contains estimates of the RDiD, that is, the impact of food relative to cash on the dependent variable given in the column header. Relative to the cash treatment group, beneficiaries in food clusters were 1 percentage point more likely to cultivate any type of crop on their land.

To test whether the food transfer affected the choice of crops, the analysis examines the probability of growing any type of cash crop, particularly khat (which is widely transacted), wheat (a higher-value cereal), or a sorghum monocrop (the most conservative portfolio). Relative to assignment to a cash transfer, assignment to a food transfer raised the likelihood of cash crop production by 2 percentage points (9 per cent), the likelihood of khat production by 2 percentage points (12.5 per cent), and the likelihood of wheat production by 1 percentage point (20 per cent). These estimates are all significant at the 5 per cent level, and multiple comparison–adjusted p-values range from .03 (khat) to .10. In contrast, no significant difference was found in growing sorghum alone.

The absolute impacts of both food and cash transfers on crop choice are, respectively, in the rows marked ADD in Table 3. These results are taken from difference in differences regressions estimated only on the FDPs assigned to a particular modality (cash or food), where the control group consists of nonbeneficiaries living in the same subdistrict. The estimates suggest that the positive relative impact of food transfers on crop choice is driven by a rise (relative to the controls) in cash crop adoption between baseline and end line, as well as a small decline in the cash group. The impact estimates suggest that food transfers caused a 2.7 percentage point (17 per cent) increase in the likelihood of khat production, and the effect was significant at the 5 per cent level. Cash and food beneficiaries reduced the likelihood they would grow only sorghum by the same magnitude.

The DDD estimates towards the bottom of Table 2 combine the RDiD and ADD strategies in one regression for the entire sample. As suggested by the previous estimates, the change among food beneficiaries relative to the controls between baseline and end line exceeded the change among cash beneficiaries for cash crops and khat adoption. While the Westfall-Young p-values fluctuate between significance at conventional levels or slightly above, a closer examination of the data reveals that the results are driven by a small, but clear pattern of increased cash cropping among food beneficiaries between the survey rounds. For example, the food beneficiaries account for 62 per cent of the net

### Table 3. Impact of food and cash transfers on crop choice: estimates with matched beneficiary and nonbeneficiary samples

| Outcome                  | Grows any crop | Grows a cash crop | Grows khat | Grows wheat | Grows only sorghum |
|--------------------------|----------------|-------------------|------------|-------------|-------------------|
| ADD: food                | −0.00          | 0.02              | 0.03       | 0.00        | −0.02             |
|                          | (0.01)         | (0.01)**          | (0.01)**   | (0.00)      | (0.01)**          |
| N                        | 1,961          | 1,961             | 1,961      | 1,961       | 1,912             |
| ADD: cash                | −0.02          | −0.03             | −0.02      | −0.01       | −0.01             |
|                          | (0.01)**       | (0.02)            | (0.01)*    | (0.01)**    | (0.01)            |
| N                        | 1,804          | 1,804             | 1,804      | 1,804       | 1,739             |
| DDD                      | 0.02           | 0.05              | 0.05       | 0.02        | −0.01             |
|                          | (0.01)*        | (0.02)**          | (0.02)**   | (0.01)**    | (0.02)            |
| N                        | 3,765          | 3,765             | 3,765      | 3,765       | 3,651             |

Notes: N = number of observations. All estimates control for uzla fixed effects. All estimates are restricted to those who own or operate land. Cash crops include any noncereals or pulses. Estimates for the sorghum only regressions are restricted to the sample that grows any crop. Estimates are obtained using regression adjustment after weighting the nonbeneficiary sample by kernel matching on the propensity score. The matching algorithm uses a bandwidth of .004 and a tricube kernel. The propensity score is estimated using a logit model. Matching variables are household size, numbers of children attending or not attending school, housing characteristics (floor material, water source), characteristics of the household head (gender, literacy, marital status), asset ownership (televisions, phones, sewing machines), and governorate of residence. Standard errors in parenthesis are clustered at the FDP level. *p < .1; **p < .05; ***p < .01.
growth in the extensive margin of khat production between rounds. Matching results (see Table 3) are consistent with this pattern; they indicate an even larger DDD estimate of 5 percentage points.

Taken together, these estimates support the hypothesis that food transfers serve to alleviate risk constraints to the adoption of higher-value, nonfood crops. As a perennial crop, the increase in khat growth represents a significant shift in future production strategies induced by the food transfers. However, the small magnitude of the changes suggests that the transfers alleviated the risk constraint to cash crop adoption among only a small share of households. This may be because of insufficient transfer size; the presence of other binding constraints, such as lack of credit or labour market concerns (khat is labour-intensive at harvest); or the lack of a binding risk constraint among the majority of beneficiaries. Furthermore, khat production was not balanced at baseline, suggesting that regression-to-the-mean may partly explain the increase.

5.2. Livestock

Though food transfers appeared to boost cash crop production, particularly in relation to cash transfers, the opposite holds true in the case of livestock (Table 4). Cash beneficiaries increased their total livestock units by 0.12 (15 per cent), the equivalent of a sheep or goat. No overall change among beneficiaries was detected in food FDPs, and negative and significant impacts were found in the case of poultry and beehives. Positive livestock changes among cash beneficiaries were driven primarily by small ruminants, camels and donkeys, and poultry; conventional and Westfall-Young p-values were less than .025. The DDD indicates that the relatively large impacts of cash transfers are

| Outcome | Cattle | Sheep and goats | Camels and donkeys | Poultry | Beehives | Tropical livestock units |
|---------|--------|----------------|--------------------|---------|----------|--------------------------|
| RDiD | −0.04 | −0.61 | −0.03 | −0.24 | −0.06 | −0.12 |
| N     | 3,960 | 3,960 | 3,960 | 3,960 | 3,960 | 3,960 |
| Westfall-Young p-value | 0.041 | 0.036 | 0.041 | 0.036 | 0.041 | 0.036 |
| ADD: food | −0.00 | −0.23 | 0.03 | −0.32 | −0.09 | −0.01 |
| N     | 3,364 | 3,364 | 3,364 | 3,364 | 3,364 | 3,364 |
| Westfall-Young p-value | 0.058 | 0.035 | 0.058 | 0.035 | 0.058 | 0.035 |
| ADD: cash | 0.05 | 0.30 | 0.08 | 0.30 | −0.02 | 0.13 |
| N     | 3,336 | 3,336 | 3,336 | 3,336 | 3,336 | 3,336 |
| Westfall-Young p-value | 0.223 | 0.205 | 0.223 | 0.205 | 0.223 | 0.205 |
| DDD | −0.05 | −0.53 | −0.05 | −0.62 | −0.07 | −0.13 |
| N     | 6,700 | 6,700 | 6,700 | 6,700 | 6,700 | 6,700 |
| Westfall-Young p-value | 0.326 | 0.183 | 0.326 | 0.183 | 0.326 | 0.183 |

Notes: Westfall-Young p-values are listed below the number of observations (N). The calculations are based on 1,200 replications. RDiD estimates control for governorate fixed effects. All other estimates control for subdistrict (uzla) fixed effects. Dependent variables in all columns, except the final column, are the number of animals. Control variables include household size and baseline values of the following: gender, educational attainment, and marital status of the household head and a standardised asset index. Standard errors in parenthesis are clustered at the FDP level. *p < .1; **p < .05; ***p < .01.
highest in the case of tropical livestock units and poultry; the size of the latter estimate represents nearly 100 per cent of the baseline mean (though this is less than one chicken). The magnitude of the modality difference in tropical livestock units is approximately equivalent to one sheep or goat. The DDD estimate in the matched estimate is similar in magnitude, but less precisely estimated (Table 5).

5.3. Agricultural investment

Another set of estimates considers the impacts of transfers on the ownership of agricultural assets (Table 6). The RDID estimates indicate that the impact of cash transfers exceeded the impact of food transfers in several asset categories, but the only significant difference was in large tools used in agriculture. The relative impact on total value is higher in the cash group, but the point estimate is imprecisely calculated. The null difference is driven largely by the fact that food transfers and cash transfers both appeared to raise the number of small agricultural tools owned by households by between 0.30 and 0.36, respectively, against a baseline mean of 2.30 (14–16 per cent). By comparison, the Zambia Child Grant Programme reviewed by Daidone et al. (2019) that most successfully increased agricultural assets, increased axe and hoe holdings by 13 per cent and 20 per cent, respectively (American Institutes for Research [AIR], 2013). However, only the cash transfer significantly increased the ownership of large tools, more than doubling the average number of large tools, albeit through an absolute change of only .06. The total value of assets was not significantly affected by either transfer.

The change in the extensive margin of agricultural expenditure and debt expenditure was relatively larger in the cash treatment than in the food treatment (Table 7). However, the individual impacts of either modality were null (debt) or negative and marginally significant. No effect was found on the intensive margin for either modality.

During the end line survey, households were also asked about any investments they had made in land. Table 8 presents the results of the regressions, which rely exclusively on end line data because the dependent variable represents a change between survey rounds. The first row (SD, single difference) estimates the relative effect of food transfers to cash transfers for the beneficiary sample only. Relative to the cash group, food beneficiaries appeared to cultivate slightly less land. However, the result disappears if nonrecipients are included as a control group (Table 8, row EDD). Under this end line double difference specification, cash beneficiaries are 3 percentage points more likely than food recipients to have invested in an irrigation system.

Table 5. Impact of food and cash transfers on number of livestock: estimates with matched beneficiary and nonbeneficiary samples

| Outcome | Cattle | Sheep and goats | Camels and donkeys | Poultry | Beehives | Tropical livestock units |
|---------|--------|----------------|-------------------|---------|---------|--------------------------|
| ADD: food | -0.02 | -0.20 | 0.02 | -0.43 | -0.08 | -0.02 |
|          | (0.04) | (0.31) | (0.05) | (0.13)** | (0.03)** | (0.06) |
| N | 3,332 | 3,332 | 3,332 | 3,332 | 3,332 | 3,332 |
| ADD: cash | 0.02 | 0.30 | 0.09 | 0.24 | -0.06 | 0.11 |
|          | (0.06) | (0.24) | (0.05)* | (0.17) | (0.05) | (0.08) |
| N | 3,290 | 3,290 | 3,290 | 3,290 | 3,290 | 3,290 |
| DDD | -0.04 | -0.50 | -0.07 | -0.67 | -0.01 | -0.14 |
|          | (0.07) | (0.40) | (0.07) | (0.21)** | (0.06) | (0.10) |
| N | 6,622 | 6,622 | 6,622 | 6,622 | 6,622 | 6,622 |

Notes: All estimates control for uzla fixed effects. The dependent variables in all columns, except the final column, are the number of animals. Estimates are obtained using regression adjustment after weighting the nonbeneficiary sample by kernel matching on the propensity score. The matching algorithm uses a bandwidth of .004 and a tricube kernel. The propensity score is estimated using a logit model. Matching variables are household size, numbers of children attending or not attending school, housing characteristics (floor material, water source), characteristics of the household head (gender, literacy, marital status), asset ownership (televisions, phones, sewing machines), and governorate of residence. Standard errors in parenthesis are clustered at the FDP level. *p < .1; **p < .05; ***p < .01.
5.4. Off-farm labour

The study finds little to no relative difference in impacts on off-farm labour or child labour by modality (Table 9). However, both food and cash beneficiaries were more likely to work for a wage, and both treatments raised the hours worked off-farm by over an hour per worker (nearly 25 per cent). In addition, the extensive margin of child labour declined in both food and cash households by similar magnitudes (4 and 3 percentage points, respectively), though only the estimate on the former is significant. As a result, the support is weak for the theory that food transfers differentially alleviated a risk constraint that caused households to overinvest labour in agricultural activities.

While both transfers appeared to raise off-farm labour participation, there is reason to be cautious in interpreting this finding. Labour outcomes carry more potential threats to the parallel trend assumption. If the seasonal demand for labour differs in occupations more likely to be filled by beneficiaries, the positive transfer effects in the ADD estimations may simply reflect a differential change in labour market conditions among beneficiaries. In addition, the timing of the baseline survey, which occurred prior to the beginning of the school year among many beneficiaries, but after the beginning of the school year among some nonbeneficiaries, raises similar cautions. The estimates therefore cannot distinguish between the impact of the transfer and the fact that the opportunity cost of child labour climbed at a higher rate among beneficiaries between rounds.
6. Discussion and conclusion

Two related issues have risen to prominence in the development literature: the emergence of nonfood transfers, especially cash, as a means to increase food security and the potential long-term productive

| Outcome          | Ag expenditure | Any ag expenditure | Any debt expenditure | Debt expenditure |
|------------------|----------------|--------------------|----------------------|------------------|
| RDiD             | −1.53          | −0.03              | −0.05                | −4.76            |
|                  | (1.00)         | (0.01)**           | (0.02)**             | (3.51)           |
| N                | 3,960          | 3,960              | 3,959                | 3,959            |
| Westfall-Young p-value | 0.072         | 0.020              | 0.017                | 0.072            |
| ADD: food        | −1.85          | −0.03              | 0.00                 | −3.10            |
|                  | (0.96)*        | (0.01)*            | (0.02)               | (3.39)           |
| N                | 3,364          | 3,364              | 3,364                | 3,364            |
| Westfall-Young p-value | 0.036         | 0.036              | 0.762                | 0.326            |
| ADD: cash        | −0.51          | −0.02              | 0.03                 | 0.03             |
|                  | (0.52)         | (0.01)*            | (0.02)               | (2.46)           |
| N                | 3,336          | 3,336              | 3,335                | 3,335            |
| Westfall-Young p-value | 0.315         | 0.052              | 0.156                | 0.991            |
| DDD              | −1.34          | −0.01              | −0.02                | −3.11            |
|                  | (1.08)         | (0.02)             | (0.03)               | (4.17)           |
| N                | 6,700          | 6,700              | 6,699                | 6,699            |
| Westfall-Young p-value | 0.226         | 0.543              | 0.543                | 0.543            |

Notes: Westfall-Young p-values are listed below the number of observations (N). The calculations are based on 1,200 replications. RDiD estimates control for governorate fixed effects. All other estimates control for subdistrict (uzla) fixed effects. Expenditures are in US dollars. Agricultural expenditure includes equipment, inputs, and veterinary services, but excludes labour and livestock purchases. Control variables include household size and baseline values of the following: gender, educational attainment, and marital status of the household head and a standardised asset index. Standard errors in parenthesis are clustered at the FDP level. *p < .1; **p < .05; ***p < .01.

| Outcome          | Investment in any plot between rounds | Changed irrigation system | Change in size of plot, square meters |
|------------------|---------------------------------------|---------------------------|-------------------------------------|
| SD               | 0.01                                  | −0.01                     | −1.22                               |
|                  | (0.03)                                | (0.01)                    | (0.72)*                             |
| N                | 1,203                                 | 1,124                     | 1,122                               |
| Westfall-Young p-value | .572                                   | .523                      | .217                                |
| EDD              | 0.02                                  | −0.03                     | −0.01                               |
|                  | (0.04)                                | (0.01)**                  | (0.68)                              |
| N                | 1,968                                 | 1,848                     | 1,844                               |
| Westfall-Young p-value | .774                                   | .008                      | .997                                |

Notes: Westfall-Young p-values are listed below the number of observations (N). The calculations are based on 1,200 replications. Dependent variables are taken in end line only and represent reported changes between baseline and end line. The SD estimates reflect single difference specifications that measure the relative impact of food to cash for beneficiaries only. The end line double difference (EDD) estimates difference difference out the nonbeneficiaries within each subdistrict. Control variables include household size and baseline values of the following: gender, educational attainment, and marital status of the household head and a standardised asset index. Standard errors in parenthesis are clustered at the FDP level. *p < .1; **p < .05; ***p < .01.
impacts of transfers to the poor. The current study examines both elements in the context of an emergency safety net transfer programme implemented by WFP in Yemen.

Beneficiaries who received food transfers adopted cash crops, particularly khat, at a higher rate relative to their nonbeneficiary neighbours. No such pattern occurred among cash recipients. However, relative to both food beneficiaries and nonrecipients, cash recipients had more livestock and were more likely to make changes in their irrigation systems. Both transfers appeared to raise the number of farm tools owned and widen both the extensive and intensive margins of off-farm labour participation.

The differences between the productive effects of food transfers and cash transfers are consistent with theoretical models of agricultural households facing risk and liquidity constraints on investment. Food transfers act as insurance against food price volatility and thus encourage nonfood production. Cash transfers provide liquidity to purchase productive assets such as livestock.

While the scope of the productive impacts of transfers is modest, the magnitude of some effects is nontrivial in comparison with the transfer size. The cash transfer, valued at a total of nearly US$150, raised livestock holdings by the equivalent of a small ruminant or a dozen chickens, with an estimated value of up to US$60. The impact on total livestock holdings was nearly identical to the corresponding outcome of the Zambia Child Grant Programme, which provided US$11 per month over a longer, two-year period. The fact that as much as 40 per cent of the transfer value remained with Yemeni households after the end of an emergency safety net programme in a crisis setting should serve to refute the notion that transfer impacts are completely ephemeral. Food transfers

Table 9. Impact of food and cash transfers on labour

| Outcome | Anyone in household worked for a wage | Anyone in household worked in a household business | Number earning wage (primary) | Number in business (primary) | Hours worked off-farm per worker | Any child worked |
|---------|---------------------------------------|--------------------------------------------------|-----------------------------|----------------------------|-------------------------------|-----------------|
| RDiD    | -0.01                                 | -0.01                                            | 0.01                        | 0.01                       | 0.15                          | -0.03           |
|         | (0.04)                                | (0.03)                                           | (0.06)                      | (0.05)                     | (0.43)                        | (0.02)          |
| N       | 3.960                                 | 3.960                                            | 3.960                       | 3.960                      | 3.960                         | 3.960           |
| Westfall-Young p-value | 0.978 | 0.976                  | 0.978                       | 0.978                      | 0.976                         | 0.274           |
| ADD: Food | 0.13 (0.04)**                         | -0.06 (0.03)                                    | 0.26 (0.06)**               | -0.06 (0.05)               | 1.46 (0.48)**                 | -0.04           |
| N       | 3.364                                 | 3.364                                            | 3.364                       | 3.364                      | 3.364                         | 3.364           |
| Westfall-Young p-value | 0.000 | 0.001                  | 0.000                       | 0.053                      | 0.000                         | 0.017           |
| ADD: Cash | 0.06 (0.03)**                         | 0.00 (0.03)                                     | 0.15 (0.07)**               | 0.00 (0.05)                | 1.24 (0.44)**                 | -0.03           |
| N       | 3.336                                 | 3.336                                            | 3.336                       | 3.336                      | 3.336                         | 3.336           |
| Westfall-Young p-value | 0.009 | 0.951                  | 0.008                       | 0.951                      | 0.000                         | 0.232           |
| DDD     | 0.06 (0.05)                           | -0.07 (0.04)                                    | 0.11 (0.09)                 | -0.06 (0.07)               | 0.22 (0.65)                   | -0.01           |
| N       | 6,700                                 | 6,700                                            | 6,700                       | 6,700                      | 6,700                         | 6,700           |
| Westfall-Young p-value | 0.237 | 0.132 | 0.267 | 0.489 | 0.872 | 0.872 |

Notes: Westfall-Young p-values are listed below the number of observations (N). The calculations are based on 1,200 replications. RDiD estimates control for governorate fixed effects. All other estimates control for subdistrict (uzla) fixed effects. Business activity excludes on-farm work. Columns 3 and 4 count only those who report their primary jobs as wage earning or business. Child is defined as any household member age under 14. Control variables include household size and baseline values of the following: gender, educational attainment, and marital status of the household head and a standardised asset index. Standard errors in parenthesis are clustered at the FDP level. *p < .1; **p < .05; ***p < .01.
similarly appear to provide some measure of sustained benefit in the form of future dividends from perennial khat production, albeit among a small share of the sample.\textsuperscript{22}

Nonetheless, as in many of the studies summarised in Daidone et al. (2019), there is no evidence that the transfers dramatically altered the productive potential of recipient households. The cash-cropping results, while intriguing, are based on only a fraction of the beneficiaries adopting and an outcome that was not balanced at baseline, suggesting that regression-to-the-mean cannot be excluded.

The significantly larger livestock holdings of the cash group cannot necessarily be interpreted as direct evidence of higher productive investment. Economists have long noted that, in the absence of formal financial institutions, livestock investments commonly function as a low-risk savings instrument rather than as an investment with an expected positive return (Anagol, Etang, & Karlan, 2017; Pica-Ciamarra, Tasciotti, Otte, & Zezza, 2011). Formal banking is rare in rural Yemen, and cash recipients may plausibly have used livestock as a savings vehicle (Sawada & Zhang, 2012).

Furthermore, the differential timing of the first transfer could lead to an underestimation of the impacts of food transfers, especially on livestock, for several reasons. Thus, the baseline occurred prior to the first cash transfer, but not the first food transfer. However, the balance at baseline between treatment groups in the livestock variables does not indicate that food transfers led to high initial animal investment. It is also possible that, because the initial food transfer occurred shortly before the seasonal animal price peak, investment in livestock among beneficiaries was lower than it otherwise would have been if all three food transfers had occurred outside the peak season, as they did in the case of the cash transfers.

Other important limitations likewise prevent more definitive conclusions on the relative and absolute productive impacts of the transfer programmes. Because of the short duration of the transfers, the final round of data collection for the study occurred before harvest. It was therefore not possible to gauge the effects on measures of agricultural production, such as revenue, yield, or profit. The study was also constrained in reliably measuring the effects on child outcomes, such as time use, labour, and education. The difficulty stems from the timing of the baseline survey, which occurred prior to the beginning of the school year among much of the beneficiary sample. Disentangling the seasonal and transfer impacts of changes in child time use was thus not possible.

Other caveats apply, as well. The estimates rely heavily on the assumption of equivalent changes between baseline and end line among nonbeneficiaries. The short period of time (seven months) that elapsed between surveys increases confidence in the parallel trends assumption, but differing time trends cannot be ruled out altogether. In addition, if nonbeneficiaries experience positive (negative) spillovers from the transfers, the effects estimated here may be under- (over)estimated. The possibility also cannot be dismissed that differences in the timing of the transfers by modality may play a role in driving the differences in outcomes by treatment arm.

How should practitioners in the humanitarian sector view these results? A primary contribution of this report is the spotlight it provides on the role of expectations in the productive potential of assistance, especially in crisis settings. In these settings, present needs are often combined with substantial future uncertainty. Investment decisions are predicated not merely on expectations about individual shocks, but also on market conditions more broadly. Given the low capital requirements necessary to initiate khat production, the role of risk portfolios in moderating transfer impacts, even independent of liquidity, may be stronger in Yemen than alternative venues. Combined with a more volatile environment, the productive potential of humanitarian transfers is likely to depend closely on context, even relative to social safety nets in noncrisis settings.

The modest size of the effects measured here, as well as the modality sensitivity, underlines the difficulty of assessing the productive benefits of humanitarian interventions, at least in the short term. At the same time, the evidence indicates that, in some cases, recipients adjust the risk profile of their asset holdings and production activities. This suggests that humanitarian transfers cannot be dismissed as completely orthogonal to development objectives.

A secondary contribution of this report is to highlight the importance of considering a counterfactual other than the complete absence of assistance in evaluating transfer programmes,
especially in crisis settings where help is clearly needed. While some have criticised pure control
groups in randomised controlled trials in development settings on ethical grounds, the concern here is
related to a point raised by cash transfer advocates concerning the usefulness of benchmarking
(Blattman & Niehaus, 2014). The pure control is a low bar in such humanitarian interventions,
where the marginal benefit of assistance should be high. Evaluations of single treatments, even cash,
can be difficult to interpret in these settings without a benchmark alternative intervention, particularly
in the case of long-term outcomes.

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Notes

1. The amount in 2018 US dollars includes spending on emergency operations and protracted relief and recovery operations
between 2005 and 2018. The total is calculated from WFP annual performance reports.
2. See, for example, evaluations of social cash transfer schemes in Kenya and Malawi (Asfaw, Davis, Dewbre, Handa, &
Winters, 2014; Boone et al., 2013). The focus here is on productive impacts among treated individuals, though local
economy effects may potentially be significant (Taylor & Filipski, 2014).
3. Hoddinott et al. (2014) report that cash recipients spent relatively more on input use during one growing season in Niger.
4. The precise value of each transfer at market exchange rates at the time of the first transfer was US$49.07.
5. Barrett (1996, 2008) also highlights the role of price risk in cropping decisions, and the empirical significance of price risk
is noted by Cadot, Dutoit, and Olarreaga (2006) and Minten, Randrianarison, and Swinnen (2009).
6. A WFP (2013) assessment of food security in Yemen since 2011 concludes that Yemeni households ‘are heavily vulnerable
to market shocks and volatility of prices, which are becoming highly prevalent in the country in recent years’ (p. 21).
7. The emergency safety net initiative was one component of a larger, two-year protracted relief and recovery operation, an
administrative category WFP reserves for postdisaster relief and stabilisation programmes.
8. In fact, 136 FDPs were randomly assigned, but data collection was mistakenly undertaken in an FDP outside the
randomisation protocol because it shared the same name as another FDP.
9. It has not been possible to determine if the original proxy-means test classified beneficiaries according to whether they
belonged to group A or group B.
10. Beneficiaries had a 25-day window to pick up cash transfers from local post office branches; so, the exact timing of receipt
varied by household.
11. Because of regional differences in agroclimatic conditions, the last food transfer among some households in some areas may
have occurred following sowing. See Yemen Food Security Information System (FSIS) Development Programme (2014).
12. In contrast, Schwab (2019), who uses the same dataset, excludes the baseline data from impact estimates of food
consumption, an outcome that relies on a seven-day recall period.
13. In the ideal case, the use of cluster-specific fixed effects would provide consistent estimation under slightly less restrictive assumptions. However, as described in the next section, some FDPs did not contain sufficient numbers of noneligible households. In such instances, additional households from FDPs within the same subdistrict were drawn as replacements.

14. A similar approach is taken by Asfaw et al. (2014) in their analysis of the productive impacts of a cash transfer programme in Kenya. As with the inverse probability weighted regression adjustment technique, the use of the kernel weights provides a doubly robust estimation property (Hsu, He, Li, Long, & Friese, 2016).

15. The kmatch command in Stata is used to identify the optimal bandwidth. While there is considerable debate about bandwidth selection for kernel matching, Huber, Lechner, and Wunsch (2013) find the sensitivity of the estimator low across reasonably chosen values.

16. Matching results yield slightly larger treatment estimates for most outcomes.

17. Also excluded were households in which there was incomplete data for key sections and group C households that self-reported transfer eligibility. The resulting sample consists of 19 FDPs (of 136) with fewer than 15 beneficiary households; 15 of these 19 had 14 beneficiary households. In addition, 63 FDPs had fewer than 11 nonbeneficiaries; 45 had 10, and 10 had 9.

18. Conversion rates are as follows: cows (.7), bulls and oxen (1), sheep and goats (.1), camels (1), donkeys (.7), and poultry (.01).

19. The simulations in Jones et al. (2018) indicate that the resampling method preserves power more effectively than methods such as the Bonferroni adjustment.

20. Matching results suggest that the increase among cash beneficiaries lagged the food group in both outcomes (Appendix A, Table A4).

21. Because of an unexpected delay in acquiring sampling lists for group C, the baseline survey was delayed among these households by one to two weeks. Over this short period, however, the school year began.

22. Quantifying the value of the dividends using the study data is challenging, though a rough estimate would suggest a value of approximately US$80 per year per adopting household, or a treatment effect of US$14 per year. This is based on revenues estimated by the Ministry of Agriculture and Irrigation, Yemen (MAI, 2011), at US$9,000 per hectare, gross margins estimated by Kennedy (2012) and Ward and Gatter (2000) at 40 per cent, and a 50 per cent utilisation rate of an average parcel size for adopted khat of .039 hectares. However, in the absence of exact crop area data and given the widely varying estimates of revenue and margins across sources, the estimate of the value of dividends should be viewed with caution.

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## Appendix A. The results of kernel-weighted matching regressions

### Table A1. Impact of food and cash transfers on agricultural assets: matched

| Outcome | Ploughs | Small tools, such as hoes | Large tools, such as pumps, carts | Hand mills | Knapsack sprayer | Tractors | Total value of agricultural assets |
|---------|---------|----------------------------|----------------------------------|------------|-----------------|----------|-----------------------------------|
| ADD: food | 0.06 | 0.28 | -0.01 | 0.03 | 0.01 | -0.01 | -59.56 |
| N | 3,332 | 3,332 | 3,332 | 3,332 | 3,332 | 3,332 | 3,332 |
| ADD: cash | 0.03 | 0.29 | 0.04 | 0.02 | -0.01 | -0.00 | 6.50 |
| N | 3,290 | 3,290 | 3,290 | 3,290 | 3,290 | 3,290 | 3,290 |
| DDD | 0.03 | -0.01 | -0.05 | 0.01 | 0.02 | -0.00 | -66.09 |
| N | 6,622 | 6,622 | 6,622 | 6,622 | 6,622 | 6,622 | 6,622 |

**Notes:** All estimates control for uzla fixed effects. In columns 1–6, the dependent variable is the number of items. The value of agricultural assets is the self-reported replacement value and given in US dollars. Estimates obtained using regression adjustment after weighting non-beneficiary sample by kernel matching on the propensity score. The matching algorithm uses a bandwidth of .004 and a tricube kernel. The propensity score is estimated using a logit model. The matching variables are household size, numbers of children attending or not attending school, housing characteristics (floor material, water source), characteristics of the household head (gender, literacy, marital status), asset ownership (televisions, phones, sewing machines), and governorate of residence. Standard errors in parenthesis are clustered at the FDP level. *p < .1; **p < .05; ***p < .01.

### Table A2. Impact of food and cash transfers on investment: matched

| Outcome | Ag expenditure | Any ag expenditure | Any debt expenditure | Debt expenditure |
|---------|----------------|--------------------|----------------------|------------------|
| ADD: food | -1.74 | -0.01 | -0.02 | -5.62 |
| N | 3,332 | 3,332 | 3,332 | 3,332 |
| ADD: cash | -0.55 | -0.01 | 0.04 | 2.88 |
| N | 3,290 | 3,290 | 3,289 | 3,289 |
| DDD | -1.19 | -0.00 | -0.05 | -8.49 |
| N | 6,622 | 6,622 | 6,621 | 6,621 |

**Notes:** All estimates control for uzla fixed effects. Expenditures in US dollars. Agricultural expenditure includes equipment, inputs, and veterinary services, but excludes labour and livestock purchases. Estimates obtained using regression adjustment after weighting non-beneficiary sample by kernel matching on the propensity score. The matching algorithm uses a bandwidth of .004 and a tricube kernel. The propensity score is estimated using a logit model. The matching variables are household size, numbers of children attending or not attending school, housing characteristics (floor material, water source), characteristics of the household head (gender, literacy, marital status), asset ownership (televisions, phones, sewing machines), and governorate of residence. Standard errors in parenthesis are clustered at the FDP level. *p < .1; **p < .05; ***p < .01.
### Table A3. Impact of food and cash transfers on land investment: matched

| Outcome | Investment in any plot between rounds | Changed irrigation system | Change in size of plot, square meters |
|---------|--------------------------------------|---------------------------|--------------------------------------|
| EDD     | 0.01                                 | −0.01                     | −1.22                                |
| N       | (0.03)                               | (0.01)                    | (0.72)*                               |
| N       | 1,203                                | 1,124                      | 1,122                                 |

Notes: The dependent variables are taken in end line only and represent reported changes between baseline and end line. The end line double difference (EDD) estimates difference out the nonbeneficiaries within each subdistrict. The matching algorithm uses a bandwidth of .004 and a tricube kernel. The propensity score is estimated using a logit model. The matching variables are household size, numbers of children attending or not attending school, housing characteristics (floor material, water source), characteristics of the household head (gender, literacy, marital status), asset ownership (televisions, phones, sewing machines), and governorate of residence. Standard errors in parenthesis are clustered at the FDP level. *p < .1; **p < .05; ***p < .01.

### Table A4. Impact of food and cash transfers on labour: matched

| Outcome | Anyone in household worked for a wage | Anyone in household worked in a household business | Number earning wage (primary) | Number in business (primary) | Hours worked off-farm per worker | Any child worked |
|---------|--------------------------------------|--------------------------------------------------|-------------------------------|-------------------------------|---------------------------------|-----------------|
| ADD: food | 0.16                                | −0.09                                            | 0.31                          | −0.10                         | 1.26                            | 0.03            |
| N       | (0.04)***                            | (0.03)**                                         | (0.08)***                     | (0.05)**                      | (0.50)**                        | (0.03)          |
| ADD: cash| 0.03                                | −0.01                                            | 0.07                          | −0.02                         | 0.69                            | 0.04            |
| N       | (0.04)                               | (0.04)                                           | (0.10)                        | (0.06)                        | (0.54)                          | (0.03)          |
| DDD     | 0.12                                | −0.07                                            | 0.24                          | −0.09                         | 0.58                            | −0.00           |
| N       | (0.06)**                             | (0.05)                                           | (0.13)*                       | (0.08)                        | (0.73)                          | (0.04)          |
| N       | 6,622                                | 6,622                                            | 6,622                         | 6,622                         | 6,622                           | 6,622           |

Notes: All estimates control for uezla fixed effects. Business activity excludes on-farm work. Columns 3 and 4 count only those who report their primary jobs as wage earning or business. Child is defined as any household member age under 14. Estimates obtained using regression adjustment after weighting non-beneficiary sample by kernel matching on the propensity score. The matching algorithm uses a bandwidth of .004 and a tricube kernel. The propensity score is estimated using a logit model. The matching variables are household size, numbers of children attending or not attending school, housing characteristics (floor material, water source), characteristics of the household head (gender, literacy, marital status), asset ownership (televisions, phones, sewing machines), and governorate of residence. Standard errors in parenthesis are clustered at the FDP level. *p < .1; **p < .05; ***p < .01.
Table A5. Household fixed effects estimates, key outcome variables

| Outcome | Grows khat | Poultry | Tropical livestock units | Ag expenditure | Small tools, such as hoes | Hours worked off-farm per worker |
|---------|------------|---------|--------------------------|----------------|---------------------------|--------------------------------|
| RDiD    | 0.02       | -0.24   | -0.12                    | -1.53          | -0.07                     | 0.15                           |
|         | (0.01)**   | (0.17)  | (0.06)*                   | (1.00)         | (0.14)                    | (0.43)                         |
| N       | 2,360      | 3,960   | 3,960                     | 3,960          | 3,960                     | 3,960                          |
| ADD: food | 0.02       | -0.32   | -0.01                     | -1.85          | 0.30                      | 1.46                           |
|         | (0.01)**   | (0.12)  | (0.05)                    | (0.95)*        | (0.12)**                   | (0.48)**                       |
| N       | 1,948      | 3,364   | 3,364                     | 3,364          | 3,364                     | 3,364                          |
| ADD: cash | -0.01      | 0.30    | 0.13                      | -0.51          | 0.36                      | 1.24                           |
|         | (0.01)     | (0.15)* | (0.05)**                   | (0.52)         | (0.13)**                   | (0.44)**                       |
| N       | 1,764      | 3,336   | 3,336                     | 3,336          | 3,336                     | 3,336                          |
| DDD     | 0.03       | -0.62   | -0.14                     | -1.34          | -0.06                     | 0.22                           |
|         | (0.01)**   | (0.19)  | (0.08)*                   | (1.08)         | (0.18)                    | (0.64)                         |
| N       | 3,712      | 6,700   | 6,700                     | 6,700          | 6,700                     | 6,700                          |

Notes: RDiD estimates control for governorate fixed effects. All other estimates control for household fixed effects. See outcome variable definitions in Table 5 and Appendix A, Tables A1–A4. Control variables include household size and baseline values of the following: gender, educational attainment, and marital status of the household head and a standardised asset index. Standard errors in parenthesis are clustered at the FDP level. See the online Supplementary Materials for an additional explanatory note. *p < .1; **p < .05; ***p < .01.