For Online Publication

Online Appendices for "Transfers, Diversification and Household Risk Strategies: Can productive safety nets help households manage climatic variability?"

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August 2021

Supplementary information

Appendix A: *Atención a Crisis* interventions, evaluation design and attrition

Interventions

From November 2005 until December 2006, the Ministry of the family in Nicaragua (MIFAMILIA) implemented the *Atención a Crisis* pilot programme in 6 municipalities in the northern part of the country.[1] The municipalities were selected for their extreme levels of poverty and because they had been affected by a severe drought in the previous year. The programme had two objectives. First, it aimed to serve as a short-run safety net by providing cash transfers to reduce the need for adverse coping mechanisms, such as taking children out of school or reducing food consumption. Second, the programme intended to promote long run upward mobility and poverty reduction by enhancing households' asset base and income diversification capacity.

A total of 3002 households were selected to participate in the programme. These households were allocated one of three different packages through a public lottery: (i) A conditional cash transfer (CCT); (ii) A conditional cash transfer plus a scholarship that allowed one of the household members to participate in a vocational training course; and (iii) A conditional cash transfer plus a productive investment grant, aimed at encouraging recipients to start a small non-agricultural activity. Take up was very high (95 %).[2]

All selected beneficiary households received the basic CCT.[3] All households, including those without children, received bi-monthly payments, adding up to a total transfer of US $ 145 during the year of the programme. Households with children between 7 and 15 enrolled in and attending primary school received an additional US $ 90 per household, and an additional US $ 25 per child (with all amounts referring to the total transfer received over the year), conditional on school enrollment and attendance. The overall average transfer for this component was US $ 240 per household. The school enrollment and attendance requirements were carefully monitored by the ministry, through data received from the primary school teachers. The programme was also meant to include a condition that required that households with children

[1] The pilot design built on the already existing and successful conditional cash transfer (CCT) model in Nicaragua *Red de Protección Social,* evaluated by Maluccio and Flores (2005).

[2] The main reason households did not take-up the programme was the fact that some originally eligible households were deemed ineligible by local leaders after the initial assignment. A small number of households had also migrated out of the communities after baseline. To avoid selection bias, we treat all of these households as *eligible.*

[3] While the design of the basic CCT is similar to many other CCTs in Latin America, an important difference is the limited duration of one year. Most other CCTs offer more continuous income support.

under the age of 6 would take these children to health centres for preventive health check-ups. However, due to implementation problems, these visits to the health centres were not monitored by the programme.

In addition to the CCT, one third of the beneficiary households also received a scholarship that allowed one of the adult household members (preferably a member between 15 and 25 years of age) to choose among 17 vocational training courses offered in the municipal headquarters and provided by the National Technological Institute (INATEC).[4] In addition to covering the costs of the training, the programme also compensated the household for lost wages while in training (US $15 per month for 6 months). The scholarship was conditional on regular attendance at the course. The courses aimed at providing participants with new skills for income diversification outside of subsistence farming in a range of occupations such as seamstress, cook, carpenter and handicrafts. A wide set of topics was offered (See Table A.19), including topics traditionally associated with male and female dominated professions. This gave each household ample choice to find a course that best suited the preferences of one its members. While a wide variety of courses was offered, all were organized and delivered by the same organization (INATEC), had approximately similar length (170 hours), were taught by trainers with a similar profile, and were organized at the same time. The course participants were also offered light labour-market and business-skill training workshops organized in their own communities. The direct and indirect costs of the course and complementary skills workshop was 140 US$ per household. The total costs for this package was US $ 470 per household (including the CCT costs).

Finally, another third of the beneficiary households received, in addition to the CCT, a US $ 200 grant for productive investments aimed at encouraging recipients to start a small non-agricultural business activity with the goal of asset creation and income diversification (business examples include corner stores, bakeries, commerce, small-scale livestock). In this context, that amount could cover, for instance, the costs of building an oven and buying baking material, of buying inventory to start a small corner store, or of building a henhouse and acquiring 10 young chicken of an improved breed. It also corresponds to approximately twice the asset value of (the admittedly small) existing non-agricultural businesses in the control group. This grant was conditional on the household developing a business plan, outlining the objectives of the business and proposed investments in new livestock or non-agricultural income-generating activities. Beneficiaries received technical assistance to select an activity and develop a business plan, received a limited number of follow-up visits by a professional during approximately 6 months, and were invited to participate in business-skills training workshops organized in their own communities. The cost for this supplementary technical assistance and training was US$ 40 per household, and was directly paid

[4] www.inatec.edu.ni

to the providers. The total direct and indirect costs for this package was US $ 480 per household (including the CCT costs).

Due to implementation delays, the vocational training courses had not started at the moment the data of the 2006 follow-up survey were collected. They took place in the Fall of 2006. At the time of the 2006 survey, the difference between the vocational training beneficiaries and those of the basic CCT package was hence limited, though they might have had different expectations about future skills, about related future income or expectations about compensation for the time spent in training. The beneficiaries of the productive investment package, on the other hand, had received the largest amount of benefits: at the end of May 2006 they had received $175 to invest in a non-agricultural activity. The remaining $25 was paid on the next payment day (after 2006 survey completion).

All beneficiaries of the *Atención a Crisis* programme, regardless of the treatment they were assigned to, were exposed to repeated information and communication efforts by programme staff during enrollment and payment days. These stressed the importance of varied diets, health, and education, and were meant to change household investment and consumption patterns. As suggested by the name of the programme, households' exposure to drought shocks and the potential role of income diversification was also emphasized. Programme participants were also required to participate in a number of local events and talks ranging from discussions on nutrition practices to workshops on business development and labour market skills.[5] A subset of beneficiary women were selected during the registration assemblies to serve as *promotoras* or leaders of small groups of beneficiary women (approximately 10 per group) in order to further enhance information flows and motivation as well as to encourage compliance with the various programme requirements and conditionalities. Specifically, the *promotoras* were expected to frequently meet with the beneficiaries in their groups to talk about the objectives and the conditionalities of the programme.

Additional information on the RCT design

The programme targeted 6 municipalities in the Northwest of Nicaragua.[6] To stratify, all communities in the six municipalities were grouped in blocks based on microclimates, crop mix, similarity in road access,

[5] All these activities were finalized by the end of 2006. That said, during March and April 2008, more than a year after the various components of the three treatment packages were completed, one additional community workshop was organized in a random subset of communities, during which pedagogical material on commercialization and labour-markets was disseminated. This workshop had no significant average impact, nor did it lead to heterogeneity in impacts on any of the final outcomes studied in this paper.

[6] The budget for the pilot allowed targeting 3000 households for a one-year period, which was much smaller than the population of the 6 municipalities. The programme was therefore allocated randomly. Households were notified that funding of the project implied that the programme would last one year, and would only cover the treatment communities. Households in the control communities did not receive any programme benefits. They were notified that if there was a decision to scale up the programme

and infrastructure. The grouping was based on maps and discussions with municipal technical personnel. Through a lottery, to which the mayors of the municipalities were invited to attend and participate, 44 blocks were selected and half of the communities in each block were randomly assigned to treatment, and the other half to the control. This resulted in 56 intervention and 50 control communities.

Baseline data on household assets and household composition were then used to define programme eligibility, which led to the identification of 3002 households to participate in the programme. This amounts to more than 90 percent of the households in treatment communities. The eligibility criteria were determined using the proxy means methodology developed for the *Red de Protección Social* (see Maluccio and Flores, 2005) and based on the national household data from 2001 (EMNV). Additional discussions with local leaders from each intervention community were conducted to identify possible exclusion or inclusion errors. Based on the discussions with leaders, 3.7 percent of all the households considered were re-assigned from non-eligible to eligible, and 3.7 percent from eligible to non-eligible. To avoid any possible selection bias resulting from the re-assignment by the leaders, the results we present use eligibility by the proxy means as the intent-to-treat (without taking into account the reclassification by the community leaders).

From each eligible household, the female household member who was reported as the primary caregiver was then invited to a registration assembly.[7] During the assemblies, the programme objectives and its various components were explained, women were asked to enrol in the programme, and *promotoras* were selected on a voluntary basis. Among the intent-to-treat households, enrolment in the programme was about 95%.[8] At the end of each assembly, all the beneficiaries participated in a lottery process through which the three packages described above were randomly allocated among the eligible households. Specifically, each beneficiary was asked to randomly draw a ball with 1 of 3 colours from a black, non-transparent bag. For each assembly, the bags contained an equal number of balls of each colour, and the total number of balls matched the total number of beneficiaries in the assembly. At the end of the day, each colour was matched to an intervention package through another lottery attended by all beneficiaries from the community. Hence, at the moment households signed up for the programme, they did not know which of the three interventions

after the initial year, the control communities would be incorporated. People in the treatment communities understood the programme was only to last for a year, and people in the control communities knew that there was a possibility they might receive the programme the next year. They also knew it was likely to depend on the result of the national elections that were to be organized at the end of that year. In that election, the government changed and the programme was not scaled up.

[7] In the few cases where there was no adult female in the household, an adult male was selected as the programme recipient.

[8] Of the 5 percent that did not enrol, the majority are households that had been reclassified by the leaders. The remainder are households that had migrated out of the treatment communities by the start of the programme, and (very few) cases of households that refused the programme.

package they would end up receiving.[9] Take-up of the CCT component was the same for all packages. Take up of the additional packages was also high. Among households enrolled in the programme, 89 percent of the households eligible for the vocational training grant registered and attended the training. Take-up of the productive investment grant among eligible households in the programme was 99.5 percent. About 10 percent of the business development plans was originally rejected by the Ministry of the Family, but these were sent back to the households and with technical assistance virtually all of them developed a new plan (with the few exceptions being households that migrated out after the registration assemblies).

Data were collected at baseline on all households in the treatment communities, and for a random sample of households in the control group. The sample size in the control communities was chosen to be equal to one-third of the population in the treatment, in order to obtain a control group of equal size to each of the treatment groups. The proxy means test used to identify eligible households in the treatment communities was also used to identify households that would have been eligible in the control communities.

Attrition

Attrition can potentially introduce serious biases into the estimation of programme effects. In this study, attrition between the baseline and follow-up surveys was minimal. Only 1.3 percent and 2.4 percent of households interviewed at baseline could not be re-interviewed in 2006 and 2008, respectively. The low attrition rates are a result of repeat visits to recover temporary absence and extensive tracking of migrants. Migrant households were interviewed in their new locations. Given the low attrition rates, baseline characteristics of the full sample of households and those that could be located at follow-up are very similar. Attrition in 2008 is uncorrelated with treatment status (P-value = 0.54). Differences in attrition rates between treatment groups are also very small and not significant (P-value = 0.67). Given that the differences between treatment and control are small and not significant, and given that we control for baseline differences, any resulting selection bias is likely to be small.

[9] Due to the transparency of the process, the lottery process was widely perceived as fair. Participation by the invited beneficiaries to the assemblies and lotteries was near 100%.

Appendix B: Weather data, climatic changes and agronomical droughts

As explained in section 4, the paper considers both rainfall and temperature as potential predictors of agronomic droughts. This follows the empirical literature on climate change providing evidence that high temperature may have strong negative effects on yields (Schlenker and Roberts, 2009). The rainfall and temperature data used in the paper and introduced in section 4 were obtained from a gridded analysis for Nicaragua (Uribe, 2011).[10] The rainfall data are based on a grid of 0.075° (approximately every 8km) and are interpolated from existing weather stations (from the Nicaraguan Institute of Territorial Studies, INETER). Satellite data have a resolution of 0.1875° (one measure approximately every 20km) and are obtained from NARR (the North American Regional Reanalysis).[11] Temperature from the same source have a grid of 0.15° (approximately every 16km). Across the study region, this provides 17 rainfall data nodes and 8 temperature data nodes. Temperature and rainfall are mapped to communities based on the geographical location of the centre of each community.

During focus groups organized before programme design, farmers in the study region reported strong perception that drought shocks had become more frequent since 1998. 1998 is a reference year for the population in the region because it was marked by hurricane Mitch, one of the largest hurricanes to ever hit the area. Farmers also report that changes in weather patterns have been interfering with the agricultural seasons.

Longitudinal rainfall and temperature data confirm these perceptions about weather changes in the study region. Figure A.1 presents the longest rainfall and temperature series available for the region, contrasting patterns from 1979 until 1997 with patterns from 1999 to 2008. It confirms significant changes in rainfall and temperature patterns, including during key months for planting and harvesting of the main crops (maize and beans). (Similar changes are observed when splitting the historical series in the middle to contrast patterns from 1979 to 1994 with patterns from 1995 to 2008, see Figure A.2.[12]) For instance, post-1998, rainfall is lower from April to mid-May, which delays the start of the first agricultural season (traditionally planting for this season starts in May and harvesting occurs in August or September). Rainfall is also lower in November, shortening the second agricultural season (planting for this season starts mid-August and

[10] While there are not enough weather stations in the study region to solely rely on them, this data source has the advantage of combining actual observations from weather stations with satellite information leading to data with a much lower resolution than other commonly used satellite-only based weather data sources. Note also that using NDVI (normalized difference vegetation index) measures (available for smaller grids) is not adequate for our analysis, as vegetation in part reflects farmers' planting decisions which could have been affected by treatment and farmers' plots are often far from their communities.

[11] http://www.emc.ncep.noaa.gov/mmb/rreanl. Interpolation is based on the Cressman method, an iterative process to correct data obtained from low reliability preliminary fields (satellite rainfall) using high-reliability observations (from weather stations) in successively shorter scanning radii around the node of interest.

[12] We exclude 1998 from the post-1994 series in Figure A.2 due to extreme rainfalls associated with Hurricane Mitch.

harvesting in November). As Figure A.1 illustrates, these changes in rainfall patterns have shortened the two crop cycles.[13] In addition, rainfall is more irregular, with a higher incidence of heavy rainfall as well as prolonged dry spells during the cropping seasons. While total rainfall from April to November is not significantly lower (the point estimate is in fact positive, significant at the 10%), the standard deviation of rainfall is higher post 1998 (Table A.2). Total rainfall is significantly lower in April and the difference is large, with rainfall in April in the post-1998 period at one-third of the earlier period's level. Rainfall in November is also lower, though not significantly so (P-value of 0.12).[14]

Sharp changes in temperature are also found and are more uniformly distributed over the year. Minimum, average and maximum temperatures increased post-1998 for almost all months. Maximum temperatures are almost one degree Celsius higher post 1998, and this difference is statistically significant (see Figure A1). (Similar patterns are again observed when comparing temperature pre and post-1994 in Figure A.2). The number of growing degree days (which is a measure of heat exposure widely used to predict crop yield in the agronomical and climate change literature) is also significantly higher. The changes in temperature documented for data from the study region are consistent with those found in a wider set of countries and using longer time series (IPCC 2018; Lobell, Schlenker, and Costa Roberts, 2011). The changes also correspond to broader patterns observed for Central America and have raised concerns for the bean-maize production system (Schmidt, et al., 2012; FAO 2019).

As summarized in section 4 of the paper, our strategy to analyse the impact of weather variability follows the economic literature on climatic changes in developing countries by accounting for both rainfall and temperature patterns during critical periods in the crop growth cycle. We account for the specific patterns of temperature and rainfall changes described above, and their potential consequences given the growth cycles of maize and beans. While there is no consensus among scientists on how exactly different weather variables interact to produce drought conditions, agronomical models provide insights on how the observed changes in rainfall and temperatures affect yields for maize and beans. These models define drought as a function of rainfall and temperatures during critical windows in the crop cycle as water stress can be related both to lack of rainfall and to high temperatures.[15] While maize is relatively tolerant to water stress during the vegetative and ripening periods, the greatest decrease in grain yields is caused by water stress during the flowering period, which occurs 48-60 days after sowing (Urbina, 1991). The cycle for beans is shorter and flowering occurs 31-38 days after sowing.

[13] The period from December to April is too dry for any grain or pulse production.
[14] These patterns carry over when focusing on 2007-2008, the specific period covered by the survey recall period.
[15] The exact relationship is not straightforward as many additional factors affect evapotranspiration and hence yields, including crop attributes, the water holding capacity of the soil, humidity, wind speed, duration of sunshine, radiation, and altitude (Doorenbos and Pruitt, 1975). Agronomists model crop-specific water requirements for each developmental stage (planting, vegetative growth, flowering, yield formation and ripening) and map water deficits into yield losses, for each developmental stage and for each crop.

These critical growth periods help to understand the possible consequences of the climatic changes described above in the context of the study region. For example, Figure A.1 and A.2 show that rainfall in the region follows a bimodal distribution and tends to dip in July before increasing again in August. This midsummer drought, a well-known phenomenon locally referred to as the "*canicula*" (Magana, Amador and Medina, 1999), would typically come after the flowering stage of both maize and beans, with limited damage to crop yields. However, delays in the start of the rains in May, and hence of sowing decisions, imply that the July dry period is more likely to affect crops during critical growth periods (with the flowering stage for maize more likely to occur during the low rainfall period (shift from point A to point B in Figures A.1 and A.2).[16]

We now describe the key weather variables we define based on agronomical models to construct drought shock indices taking into account critical windows in the crop growth cycles.

Based on the insights regarding critical periods for evapotranspiration (see above), we define the length of the longest dry spell as the number of consecutive days without rainfall, with the last day of the spell being in the period between 15 and 60 days after the start of the season for the specific node. This corresponds to crop developmental stages with higher water requirements and yield loss potential (the flowering period for maize and the flowering and yield formation stages for beans). The duration of the longest dry spell is a measure commonly used for the dispersion of rainfall (Tebaldi et al., 2006; Fishman, 2018). The start of the season is defined as the first 5 days with consecutive rain and at least 15 millimetres cumulative rainfall (Doorenbos and Kassam, 1979; Rojas, Rodríguez and Rivas, 2000). For 2008, this date varies between May 23 and June 5 and is on average 10 days later than the pre-1998 start date (and maximum 23 days later).

As the temperature data are measured at a more aggregate level, we cannot link them to the exact start of the rains, and instead consider daily temperatures in June and July. Specifically, following the climate change literature, the number of growing degree days was calculated, and the deviation of the pre-1998 growing degree days is used in order to measure temperature shocks.[17] A second temperature measure is the duration of the longest hot spell in June and July, where a day is defined as hot if the temperature is higher than the pixel-specific median temperature pre-1998. Figure A.1 illustrates changes in temperature patterns pre- and post-1998, and Figure A.2 shows that patterns are similar using an alternative break-down pre and post 1994. (Results are also robust to the use of alternative cut-off years).

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[16] Rojas, Rodríguez and Rivas (2000) suggest that Nicaraguan farmers traditionally use five consecutive rainy days as a rule of thumb to infer when to start sowing.

[17] Because the weather data used in the analysis only covers the period 1979-2008, we cannot use the 1960-1991 average as is commonly done in the climate change literature to proxy for the historical average. We instead use the period 1979-1997 period, also building on farmers' own perception as 1998 being a key year for weather pattern changes.

The first-stage specification presented in section 4 highlights how the various weather variables correlate with the reported drought shocks and yields. [18] Importantly, there is substantial variation in the weather variables across the various micro-climates and 106 communities in the study region (see the standard deviations and range in Table A.3). Altitude, which is measured separately for each community[19], varies between 240 and 1494 meters, leading to differences in local climatic conditions beyond what is captured by the gridded weather measures. Variation in altitude, weather, shock measures and yields also exists when comparing blocks in close proximity to each other. To illustrate this, the additional panels in Table A.3 show large variation in altitude and weather measures in the 3 broad geographical clusters in the study region.

[18] Yields are calculated using the harvested quantity and area planted reported in the survey. When maize or beans were intercropped with other crops, half of the intercropped area was used to approximate the area planted (34% of households have at least one intercropped plot).

[19] Altitude was measured using GPS at a central point in one of the communities in the block. In the household level regression, altitude refers to the altitude of the community where the household resided in 2005.

Appendix C: Robustness and additional results

Alternative specifications an robustness

Table A.9 and Table A.10 show the results of various alternative specifications for per capita consumption, and income. We focus on the results for the 2SLS specification with block fixed effects and standard errors clustered at the community level, and hence compare with the results in columns 2 and 5 of Table 4 for consumption (respectively Table 5 for income). Columns 1 and 2 show results for estimations only controlling for the baseline outcome and altitude. This establishes that the results are not dependent on the controls, as expected given the randomized assignment. In column 3 and 4, the block level average weather shock and yield loss were calculated with all observations in the block except for the data from the household itself. The results are very similar to the earlier findings, consistent with the relatively large number of households per block.

In column 5 and 6, we include interaction effects of baseline consumption with each of the treatments, in addition to the shock interaction effects shown earlier. Baseline consumption was standardized so that the main treatment coefficients show impacts at average level of shocks and baseline consumption. This accounts for any fixed factors affecting consumption that possibly could be correlated with the shock variables. Again, the results are not sensitive to the change in specification, further confirming that the 2008 shock interactions are not driven by heterogeneity along unobserved characteristics. This result is as expected, given that the coefficients on the shock and yield interactions are identified of exogenous and time-variant weather variation.

In the last column, we show results for an alternative specification that replaces the 2SLS with an alternative two-step method to analyse the treatment heterogeneity, similar to the approach used by Giné, et al. (2012). The first-step estimation is done using the community level information for the 50 control communities, regressing average yields on the exogenous weather variables and their interaction with altitude, using the same specification as before (Table 4, column 6).[20] We then use the coefficients of these estimations to obtain predicted yields for the treatment and the control communities, and interact those predicted yields with each of the treatment variables. Standard errors are bootstrapped with 2000 replications to account for the 2-step procedure. In contrast to the main specification, the predicted yield loss variable is no longer defined at the block level and therefore is not by construction orthogonal to treatment. But as the relationships between each of the treatments and predicted yields are very weak (P-values between 0.87 to

[20] A potential drawback of this method is that some of the control communities have only a few observations (households) and as a result the dependent variable used for the predictions can be imprecise. This is particularly a concern for the shock variable because the share of households reporting shocks (a binary variable at the household level) is not necessarily meaningful when averaging over few observations. We therefore focus on yields for this robustness check.

0.95), this approach still provides a useful robustness test. Column 7 shows that this alternative estimation strategy confirms the earlier findings.

Findings are robust to the introduction of sampling weights, see Table A.11. Tables A.12 and A.13 show that results are robust to alternative definitions of weather shocks using 1997, 1996, 1995 or 1994 as cut-off for historical averages instead of 1998.

Overall, the results of the different robustness specifications and placebo tests provide support for the empirical approach. This is consistent with the experimental design, the use of average shock and yield variables that are orthogonal to treatment due to stratification, and the use of exogenous non-auto-correlated weather information for identification.

Impacts on Prices

Differences between treatment and control in the average level of the food and non-food price items are of interest, as they could affect the self-reported measures of consumption and possibly also income (for households involved in commercialization of marketable goods). Prices of the most commonly bought food items (12), and non-food items (10) were collected in a community survey and an index of standardized prices was constructed to analyze the price changes. Table A.15 shows that there are no significant differences in food or non-food prices between treatment and control. Note that the influx of cash in the treatment communities happened two years before the follow-up survey used for the main analysis. By then, potential short-term price effects resulting from the one-year cash transfer programme would have likely tampered out. Hence spillovers through prices do not appear to be driving the consumption (or income) results. Live animals do, however, have slightly higher values in the treatment communities (significant at the 10%), which does not necessarily reflect price inflation as it could also capture the higher quality of the animal stock resulting from investments in improved breeds made with the grant. Importantly, prices of live animals do not factor into the consumption calculations.

A related question is whether shocks might affect the value of livestock or business assets differentially in the treatment communities compared to the control. This could happen for instance if individuals in control communities are more likely to use distress sales of animals to cope with shocks, driving down the prices of those animals. If this was to occur, shocks could induce differences in asset values between treatment and control that could explain part of the estimated differences in the sensitivity of income and consumption to shocks. Considering the prices of food and non-food items as proxy for the value of the business assets (as they are the items that can be commercialized within the communities), as well as the livestock prices, we do not find any evidence that differences in prices between treatment and control vary by the intensity of shocks (Table A.15).

Diversification in non-agricultural activities and local markets

Diversification in non-agricultural activities is only likely to be an effective risk management strategy if the returns to such activities are not equally affected by the same weather shocks as agricultural production. This is less of a concern for the return to wage jobs, as they tend to be outside of the study region and hence involve commuting or migration. But given the strong dependence on agriculture, the potential for income smoothing is a priori less obvious for non-agricultural activities that mostly cater to local demand. Beneficiaries of the productive interventions who diversified into non-agricultural small businesses and mainly supply local markets can suffer from low demand at times of drought. Recall however that there is substantial local variation in shocks. This may enable households to sell their non-agricultural products to people from nearby places less affected by shocks.

We hence hypothesize that the estimate of the interaction effect will be larger when communities in neighbouring blocks have low shock intensity. To test this, we calculated for each block the average estimated shock intensity in the other blocks of the same municipality.[21] We then split the sample based on whether the average shock intensity in the other blocks of the municipality is in the bottom or upper half of the distribution of shock intensity. Table A.18 shows that the consumption and income smoothing results are indeed stronger when neighbouring blocks are less affected by shocks. This suggests that weather variability across communities partly explains why non-agricultural activities are less sensitive to weather shocks and as such can contribute to income and consumption smoothing.

Is there a risk premium at low shock intensity?

Finally, we explore whether there exists an implicit insurance premium. The point estimates in Table 4 suggest that control households have higher consumption than treatment households eligible for the productive investment grant at low shock intensity or yield loss. This would be consistent with households incurring an implicit cost at low shock intensity in order to smooth income at average and high shock intensity. We therefore test whether households benefitting from the grant or training have significantly lower consumption compared to control households at very low shock intensity or yield loss. Note first that the productive investment grant increased average consumption while also reducing consumption

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[21] One municipality for which there is only one block in the sample was grouped together with the neighbouring municipality.

variability. As a result, the overall impact of the productive investment grant is positive for almost the entire range of the shock intensity and yield loss in the data. Even at shock intensities 2 standard deviations lower than average, we find no significant negative impact for the productive investment grant, and only a marginally significant negative impact in one specification for the vocational training package (considering all specifications P-values for $\alpha_i - 2\gamma_i = 0$ for $i=2,3$ range from 0.08 to 0.44). Hence in this context, and given the intervention, consumption smoothing did not come at a clear cost of lower consumption at low shock intensity. By addressing the capital and skill constraints, the interventions likely allowed households to diversify income without resorting to lower-return activities.

Additional references only in Online Appendix

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APPENDIX FIGURES AND TABLES

Figure A.1: Rainfall and Temperature Variation – Pre and Post 1998

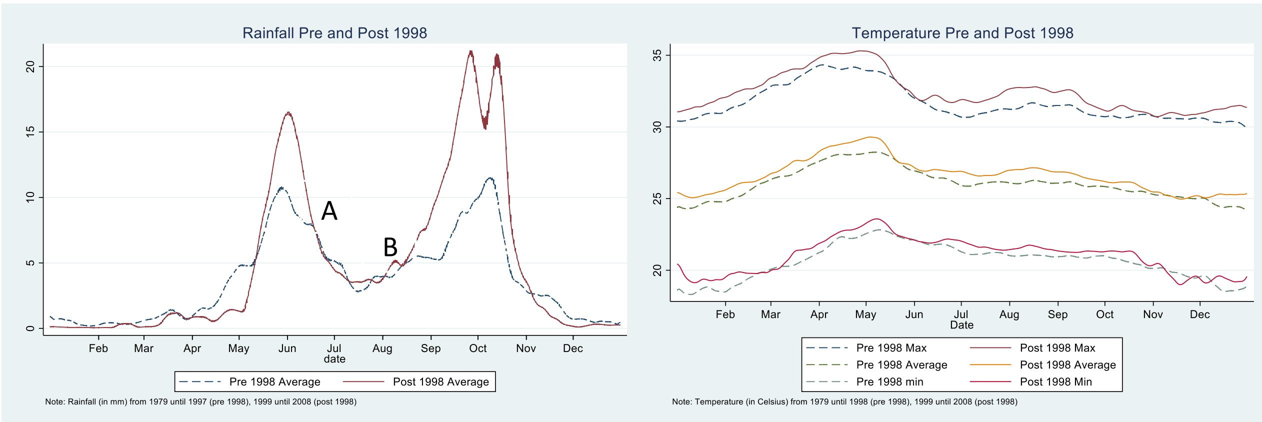
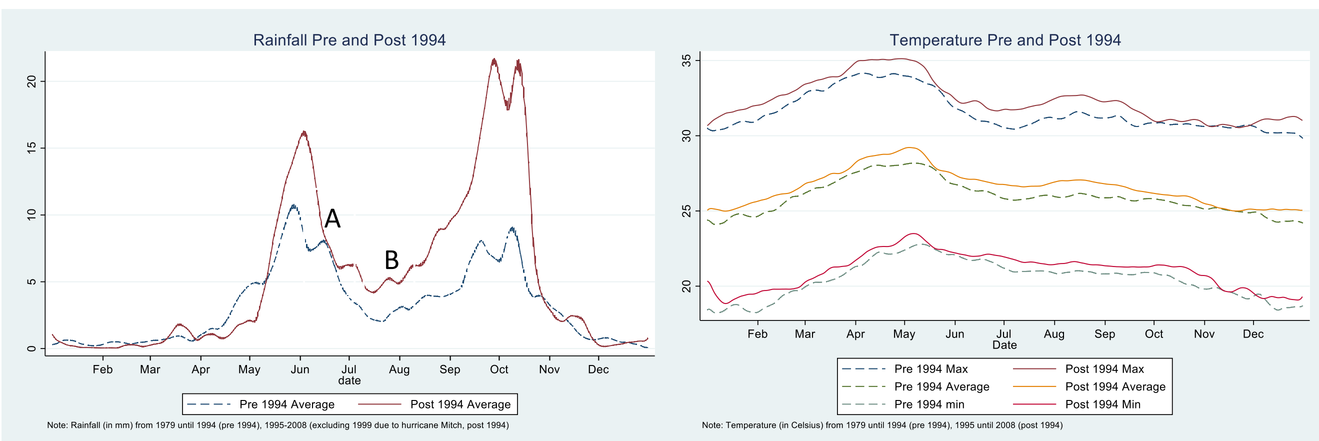


Figure A.2: Rainfall and Temperature Variation – Pre and Post 1994



Source: Authors' display based on data from Uribe (2011).

Table A.1: Baseline characteristics and balance between treatment groups

	Mean control	Mean basic	Mean training	Mean grant	p-value T=C	Exact p-value T=C rand – t	P-value T1=T2=T3	Exact p-value T1=T2=T3 rand – t
N	994	963	971	990				
Age household (hh) head	47.01	46.26	45.26	45.13	0.06*	0.07*	0.16	0.07*
Number of years education hh head	2.58	2.64	2.61	2.74	0.56	0.55	0.6	0.71
Number of years education main beneficiary	3.2	3.22	3.09	3.17	0.84	0.84	0.62	0.82
Average number of years education among all hh members	3.25	3.25	3.15	3.2	0.79	0.78	0.53	0.74
Literate hh head	0.58	0.62	0.6	0.63	0.1	0.11	0.47	0.30
Male hh head	0.81	0.82	0.83	0.84	0.42	0.41	0.15	0.20
Hh size	5.4	5.22	5.32	5.38	0.46	0.44	0.35	0.44
Hh size: 0-5 year olds	0.67	0.62	0.64	0.67	0.52	0.51	0.25	0.32
Hh size: 5-14 year olds	1.52	1.53	1.58	1.57	0.49	0.48	0.69	0.77
Hh size: 15-24 year olds	1.11	1.05	1.07	1.11	0.56	0.57	0.54	0.70
Hh size: 25-64 year olds	1.8	1.77	1.8	1.8	0.78	0.78	0.67	0.83
Hh size: 65 year and older	0.29	0.25	0.21	0.22	0.02**	0.02**	0.3	0.08*
Distance to school (hours)	0.3	0.26	0.27	0.24	0.16	0.17	0.02**	0.01***
Distance to health center (hours)	1.2	1.12	1.14	1.12	0.62	0.79	0.75	0.88
Distance to municipal center (hours)	1.64	1.51	1.51	1.52	0.44	0.55	0.92	0.86
Size of total land owned (manzanas)	4.18	3.67	3.43	3.45	0.25	0.27	0.92	0.78
Share households owning any land	0.68	0.64	0.67	0.65	0.45	0.42	0.46	0.57
Value small livestock (Cordobas)	502	459	443	447	0.3	0.29	0.83	0.70
Value all livestock (Cordobas)	6349	4382	6142	3674	0.15	0.17	0.17	0.02**
Value small livestock sold or self-consumed	376	316	353	401	0.72	0.82	0.58	0.64
Value all livestock sold or self-consumed	1300	1014	1842	829	0.81	0.92	0.26	0.08*
Share hh with agricultural activities	0.9	0.84	0.88	0.87	0.12	0.10	0.14	0.15
Share hh with livestock activities	0.54	0.45	0.47	0.47	0.27	0.21	0.45	0.30
Share hh with agricultural wage work	0.56	0.58	0.6	0.63	0.23	0.23	0.06*	0.09*
Share hh with nonagr. Self-employment: food production	0.07	0.06	0.07	0.07	0.87	0.88	0.56	0.76
Share hh with nonagr. Self-employment: manufacturing	0.03	0.02	0.03	0.03	0.66	0.68	0.16	0.26
Share hh with nonagr. Self-employment: commerce	0.07	0.07	0.08	0.07	0.83	0.83	0.38	0.60
Share hh with nonagr. Self-employment: services	0.05	0.04	0.05	0.05	0.94	0.92	0.2	0.37
Share hh with nonagr. Private sector wage work	0.15	0.16	0.16	0.18	0.41	0.40	0.41	0.49
Share hh with nonagr. Public sector wage work	0.04	0.07	0.05	0.06	0.10*	0.11	0.02**	0.01**
Share hh with at least one member seasonally migrating	0.48	0.45	0.49	0.47	0.71	0.71	0.22	0.38
Total income p.c. (cordobas)	4373	4841	4879	4444	0.32	0.34	0.16	0.26
Food consumption p.c.(cordobas)	3536	3582	3444	3539	0.95	0.95	0.64	0.84
Total consumption p.c.(cordobas)	5292	5572	5322	5454	0.67	0.66	0.43	0.63
Log(total consumption p.c.)	8.35	8.4	8.37	8.37	0.66	0.66	0.49	0.58
Log(food consumption p.c.)	7.93	7.91	7.88	7.85	0.36	0.36	0.61	0.70
Log(total income p.c.)	8.11	8.16	8.15	8.11	0.69	0.68	0.17	0.27
Reported drought in 2005	0.97	0.96	0.96	0.95	0.35	0.34	0.56	0.58
Altitude (meters)	775	815	814	813	0.57	0.20	0.94	0.51

Note: P-values calculated with s.e. clustered at community level. N = 3918, sample used in the estimation, i.e. excluding the 97 baseline households not tracked in 2008, and 5 households for whom consumption data (the main outcome variable) is missing. Exact randomization-t p-values, obtained from 2,000 simulations, accounting for stratified randomization within blocks (Young 2019).

Table A.2: Significant changes in rainfall and temperature patterns

	Pre-1998	Post-1998	Diff.	P-value diff.
Temperature				
Daily max during agricultural seasons- April to Nov. (C°)	31.58	32.35	0.77***	0.00
Daily max during June and July (C°)	31.02	31.82	0.80***	0.00
Degree days in June and July (C°)	1110	1146	36***	0.00
Rainfall				
Total rainfall during agricultural seasons - April to Nov (mm)	1310	1777	467*	0.08
Standard deviation daily rainfall (April-Nov)	12	17	5.06*	0.06
Total rainfall in April (mm)	73	28	-44.33**	0.04
Total rainfall in November (mm)	62	36	-26.76	0.12
Start of rainy season (5 days with 15 mm cumulative rainfall)	136	146	10.17	0.16

Note: N=240 for temperature measures; N=510 for rainfall measures. P-value based on s.e. clustered by year and with node fixed effects. Degree days are calculated as explained in footnote 19. Start of the rainy season is defined as the number of days since Jan 1 when the first period of 5 consecutive days with 15 mm cumulative rainfall occurs.

Table A.3: Variation in weather variables and shock measures

	Mean	sd	min	max
All: 3918 households; 44 blocks				
Altitude	804	308	240	1494
Number of days delay in start rains (compared to pre-1998 median start day)	10	7	-9	23
Longest dry spell: consecutive dry days in 15-60 days after start wet season	5	1	3	7
Degree days in June and July, as deviation from pre-98 average	12	7	-8	29
Longest hot spell: consecutive days in June-July with temperature > median pre-1998 daily temp.	6	1	5	8
Share of households reporting drought shock (first season)	0.35	0.15	0.03	0.69
Share of households reporting drought shock (last 12 months)	0.61	0.15	0.12	0.95
Average Maize Yield (100 kg per manzana)	12.42	4.42	6.19	23.30
Municipality Pueblo Nuevo: 1455 households; 16 blocks				
Altitude	813	181	598	1234
Number of days delay in start rains (compared to pre-1998 median start day)	11	6	-9	16
Longest dry spell: consecutive dry days in 15-60 days after start wet season	4	1	3	7
Degree days in June and July, as deviation from pre-98 average	11	1	10	13
Longest hot spell: consecutive days in June-July with temperature > median pre-1998 daily temp.	6	0	6	6
Share of households reporting drought shock (first season)	0.25	0.10	0.03	0.43
Share of households reporting drought shock (last 12 months)	0.52	0.15	0.12	0.73
Average Maize Yield (100 kg per manzana)	16.96	2.82	13.19	23.30
Municipalities: San Lucas and Las Sabanas: 1254 households; 14 blocks				
Altitude	1034	250	323	1494
Number of days delay in start rains (compared to pre-1998 median start day)	9	7	1	17
Longest dry spell: consecutive dry days in 15-60 days after start wet season	6	1	3	7
Degree days in June and July, as deviation from pre-98 average	7	7	-8	15
Longest hot spell: consecutive days in June-July with temperature > median pre-1998 daily temp.	6	1	6	8
Share of households reporting drought shock (first season)	0.33	0.10	0.12	0.49
Share of households reporting drought shock (last 12 months)	0.61	0.10	0.33	0.75
Average Maize Yield (100 kg per manzana)	10.23	1.80	6.84	14.08
Municipalities: SJ Cusmapa, San Francisco, Cinco Pinos: 1209 households; 14 blocks				
Altitude	555	292	240	1286
Number of days delay in start rains (compared to pre-1998 median start day)	10	7	4	23
Longest dry spell: consecutive dry days in 15-60 days after start wet season	5	0	5	6
Degree days in June and July, as deviation from pre-98 average	19	5	13	29
Longest hot spell: consecutive days in June-July with temperature > median pre-1998 daily temp.	7	1	5	8
Share of households reporting drought shock (first season)	0.50	0.14	0.22	0.69
Share of households reporting drought shock (last 12 months)	0.73	0.14	0.51	0.95
Average Maize Yield (100 kg per manzana)	9.25	1.27	6.19	11.22

Table A.4: Correlation between shocks and consumption/income in control communities

	Log (total consumption p.c.)		Log (total income p.c.)	
Drought shock	-0.097***		-0.126***	
	(0.029)		(0.029)	
Yield loss		-0.048*		-0.073**
		(0.029)		(0.033)

Note: N=994 *** p<0.01, ** p<0.05, * p<0.1; s.e. clustered by community in parentheses, households in the control group only. Drought shock is measured as the normalized share of households reporting drought (in block); Yield loss is measured as normalized block-level average maize yield, multiplied with -1.

Table A.5: Average programme impact on consumption and income

		Log(per capita consumption)		Log(per capita income)	
		(1)	(2)	(3)	(4)
CCT + Grant (T3)	α3	0.083***	0.083***	0.043*	0.043
		(0.023)	(0.029)	(0.025)	(0.030)
CCT + Training (T2)	α2	0.028	0.028	-0.005	-0.005
		(0.022)	(0.027)	(0.024)	(0.026)
CCT (T1)	α1	0.020	0.020	-0.022	-0.022
		(0.024)	(0.027)	(0.024)	(0.026)
Level of clustering		com.	block	com.	block
Block F.E.		Yes	Yes	Yes	Yes
Observations		3,918	3,918	3,892	3,892
R-squared		0.321	0.321	0.273	0.273

Note: *** p<0.01, ** p<0.05, * p<0.1; s.e. in parentheses. All regressions including household level controls (see note in Table 1). Income trimmed for 1% highest outliers.

Table A.6: Exact p-values (from randomization t-test)

	Log (per capita consumption)		Log (per capita income)	
	2SLS	2SLS	2SLS	2SLS
	(1)	(2)	(3)	(4)
CCT + Grant (T3)	0.00	0.00	0.01	0.01
CCT + Training (T2)	0.05	0.02	0.68	0.61
CCT (T1)	0.13	0.04	0.25	0.07
Shock*T3	0.02		0.02	
Shock*T2	0.09		0.02	
Shock*T1	0.96		0.66	
Yield loss*T3		0.01		0.00
Yield loss*T2		0.01		0.00
Yield loss*T1		0.98		0.75
Level of clustering	com.	com.	com.	com.
Block F.E.	Yes	Yes	Yes	Yes
Observations	3918	3918	3918	3918
Randomization t joint test	0.0003	0.0003	0.0008	0.0003

Exact randomization-t p-values, obtained from 2000 simulations, accounting for stratified randomization within blocks (Young 2019). P-values correspond to specifications in columns (2) and (5) in Table 4 (per capita consumption), respectively columns (2) and (5) of Table 5 (per capita income)

Table A.7: Impact of shocks on consumption with different treatments - without block F.E.

		Log(per capita consumption)			Log(per capita consumption)		
		OLS (1)	2SLS (2)	2SLS (3)	OLS (4)	2SLS (5)	2SLS (6)
CCT + Grant (T3)	α3	0.0847***	0.0792***	0.0792***	0.0837***	0.0836***	0.0836***
		(0.025)	(0.027)	(0.028)	(0.026)	(0.027)	(0.028)
CCT + Training (T2)	α2	0.0310	0.0280	0.0280	0.0303	0.0301	0.0301
		(0.028)	(0.029)	(0.026)	(0.028)	(0.029)	(0.027)
CCT (T1)	α1	0.0271	0.0256	0.0256	0.0217	0.0212	0.0212
		(0.027)	(0.029)	(0.025)	(0.028)	(0.030)	(0.025)
Shock	β	-0.075***	-0.114**	-0.114**			
		(0.021)	(0.047)	(0.047)			
Shock*T3	γ3	0.0249	0.106**	0.106*			
		(0.024)	(0.053)	(0.055)			
Shock*T2	γ2	0.0327	0.0791	0.0791			
		(0.030)	(0.053)	(0.047)			
Shock*T1	γ1	-0.0179	0.0102	0.0102			
		(0.031)	(0.054)	(0.048)			
Yield loss	β				-0.0143	-0.0586**	-0.0586**
					(0.020)	(0.028)	(0.028)
Yield loss*T3	γ3				0.0169	0.0970**	0.0970**
					(0.029)	(0.040)	(0.041)
Yield loss*T2	γ2				0.0143	0.0918**	0.0918**
					(0.029)	(0.043)	(0.039)
Yield loss*T1	γ1				-0.0195	0.0208	0.0208
					(0.027)	(0.041)	(0.035)
Level of clustering		com.	com.	block	com.	com.	block
Block F.E.		No	No	No	No	No	No
Observations		3918	3918	3918	3918	3918	3918
R-squared		0.29			0.28		

Note: *** p<0.01, ** p<0.05, * p<0.1; s.e. in parentheses. All regressions including household level controls (see note in Table 1).

Table A.8: Impact of shocks on income with different treatments- without block F.E.

		Log(per capita income)			Log(per capita income)		
		OLS	2SLS	2SLS	OLS	2SLS	2SLS
		(1)	(2)	(3)	(4)	(5)	(6)
CCT + Grant (T3)	α3	0.0559*	0.0486	0.0486	0.0534*	0.0531	0.0531*
		(0.030)	(0.032)	(0.030)	(0.032)	(0.033)	(0.028)
CCT + Training (T2)	α2	0.0086	0.0021	0.0021	0.0051	0.0047	0.0047
		(0.033)	(0.034)	(0.027)	(0.034)	(0.035)	(0.028)
CCT (T1)	α1	-0.0047	-0.0084	-0.0084	-0.0112	-0.0120	-0.0120
		(0.031)	(0.032)	(0.026)	(0.033)	(0.034)	(0.025)
Shock	β	-0.100***	-0.138***	-0.138***			
		(0.023)	(0.050)	(0.049)			
Shock*T3	γ3	0.0142	0.111*	0.111*			
		(0.029)	(0.063)	(0.065)			
Shock*T2	γ2	0.0193	0.100	0.100*			
		(0.035)	(0.063)	(0.053)			
Shock*T1	γ1	-0.0158	0.0286	0.0286			
		(0.032)	(0.058)	(0.051)			
Yield loss	β				-0.0370	-0.0748**	-0.0748**
					(0.023)	(0.037)	(0.031)
Yield loss*T3	γ3				0.0436	0.106**	0.106**
					(0.033)	(0.052)	(0.047)
Yield loss*T2	γ2				0.0212	0.123**	0.123**
					(0.035)	(0.057)	(0.048)
Yield loss*T1	γ1				-0.00767	0.0312	0.0312
					(0.030)	(0.051)	(0.045)
Level of clustering		com.	com.	block	com.	com.	block
Block F.E.		No	No	No	No	No	No
Observations		3892	3892	3892	3892	3892	3892
R-squared		0.24			0.22		

Note: *** p<0.01, ** p<0.05, * p<0.1; s.e. in parentheses. All regressions including household level controls (see note in Table 1). Income trimmed for 1% highest outliers.

Table A.9: Robustness tests - alternative specifications for log(per capita consumption)

	2SLS						
	Without controls		Block level averages calculated excluding household itself		With extra interaction effects for baseline pc cons.		Two- step estimation index based on prediction in control villages only
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CCT + Grant (T3)	0.0710***	0.0789***	0.0853***	0.0847***	0.0774***	0.0840***	0.0866***
	(0.026)	(0.025)	(0.024)	(0.024)	(0.024)	(0.024)	(0.027)
CCT + Training (T2)	0.0231	0.0285	0.0295	0.0289	0.0243	0.0284	0.0302
	(0.024)	(0.025)	(0.022)	(0.023)	(0.022)	(0.023)	(0.028)
CCT (T1)	0.0295	0.0296	0.0222	0.0214	0.0220	0.0209	0.0233
	(0.025)	(0.025)	(0.024)	(0.024)	(0.024)	(0.024)	(0.029)
Shock*T3	0.101**		0.0921***		0.0904**		
	(0.041)		(0.035)		(0.039)		
Shock*T2	0.0655*		0.0601**		0.0576*		
	(0.035)		(0.029)		(0.031)		
Shock*T1	-0.0011		-0.0017		-0.0081		
	(0.037)		(0.031)		(0.034)		
Yield loss*T3		0.0824**		0.0743**		0.0666**	0.0696***
		(0.032)		(0.029)		(0.030)	(0.027)
Yield loss*T2		0.0736**		0.0706**		0.0664**	0.0613**
		(0.031)		(0.028)		(0.028)	(0.028)
Yield loss*T1		0.0050		0.0013		-0.00395	0.0224
		(0.031)		(0.028)		(0.029)	(0.029)

Note: N=3918 *** p<0.01, ** p<0.05, * p<0.1; s.e. in parentheses, clustered at community level. All regressions including block fixed effect. Controls in column 1 and 2 only include altitude and the baseline outcome. In other columns household level controls as in Table 1. In column 5 and 6 regressions include in addition interaction effects of per capita baseline consumption with each of the treatments. Predicted yield loss in column 7 is estimated based on relationship yield and weather variables in the control communities only. Standard errors in column 7 based on 2000 bootstrapped replications.

Table A.10: Robustness tests - alternative specifications for log(per capita income)

	2SLS						
	Without controls		Block level averages calculated excluding each time specific household		With extra interaction effects for baseline pc cons.		Two- step estimation index based on prediction in control villages only
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CCT + Grant (T3)	0.0329	0.0410	0.0458*	0.0452*	0.0361	0.0448*	0.0468*
	(0.028)	(0.027)	(0.026)	(0.025)	(0.027)	(0.025)	(0.027)
CCT + Training (T2)	-0.0110	-0.0029	-0.0022	-0.0030	-0.0091	-0.00141	-0.0021
	(0.028)	(0.028)	(0.025)	(0.025)	(0.026)	(0.026)	(0.027)
CCT (T1)	-0.0096	-0.0071	-0.0185	-0.0194	-0.0220	-0.0203	-0.0181
	(0.027)	(0.027)	(0.025)	(0.025)	(0.026)	(0.026)	(0.029)
Shock*T3	0.104**		0.0994**		0.119**		
	(0.047)		(0.040)		(0.045)		
Shock*T2	0.102**		0.0825**		0.103***		
	(0.046)		(0.035)		(0.038)		
Shock*T1	0.0339		0.0203		0.0310		
	(0.043)		(0.037)		(0.041)		
Yield loss*T3		0.0877**		0.0843**		0.0983***	0.0778***
		(0.037)		(0.032)		(0.034)	(0.029)
Yield loss*T2		0.110***		0.101***		0.119***	0.0762***
		(0.042)		(0.037)		(0.039)	(0.028)
Yield loss*T1		0.0237		0.0139		0.0242	0.033
		(0.036)		(0.032)		(0.034)	(0.029)

Note:N=3918 *** p<0.01, ** p<0.05, * p<0.1; s.e. in parentheses, clustered at community level. Income trimmed for 1% highest outliers. All regressions including block fixed effect. Controls in column 1 and 2 only include altitude and the baseline outcome. In other columns hh level controls as in Table 1. In column 5 and 6 regressions include in addition interaction effects of per capita baseline consumption with each of the treatments. Predicted yield loss in column 7 is estimated based on relationship yield and weather variables in the control communities only. Standard errors in column 7 based on 2000 bootstrapped replications.

Table A.11: Impact of shocks on consumption and income with different treatments – using sampling weights

		Log (per capita consumption)		Log (per capita income)	
		2SLS	2SLS	2SLS	2SLS
		(1)	(2)	(3)	(4)
CCT + Grant (T3)	α3	0.0776***	0.0845***	0.0357	0.0432*
		(0.023)	(0.022)	(0.025)	(0.024)
CCT + Training (T2)	α2	0.0241	0.0284	-0.0103	-0.00403
		(0.021)	(0.021)	(0.024)	(0.024)
CCT (T1)	α1	0.0228	0.0217	-0.0198	-0.0193
		(0.022)	(0.021)	(0.024)	(0.023)
Shock*T3	β	0.0946**		0.101**	
		(0.039)		(0.046)	
Shock*T2	γ3	0.0597**		0.0850**	
		(0.030)		(0.035)	
Shock*T1	γ2	-0.00646		0.0179	
		(0.032)		(0.038)	
Yield loss*T3	γ1		0.0736**		0.0836**
			(0.028)		(0.032)
Yield loss*T2	β		0.0709**		0.101***
			(0.028)		(0.035)
Yield loss*T1	γ3		-0.000825		0.0120
			(0.026)		(0.032)
Observations		3,918	3,918	3,892	3,892

*** p<0.01, ** p<0.05, * p<0.1. ; s.e. in parentheses, clustered by community. All regressions including household level controls and block fixed effects (see note in Table 1). The sample includes three times more households in the treatment than in the control group. With probability weights, observations in the control are over-weighted by a factor three compared to those in the treatment. Specification presented is the equivalent of columns (2) and (5) in Table 4 (per capita consumption), respectively columns (2) and (5) of Table 5 (per capita income).

Table A.12: Impact of shocks with different treatments - robustness to changes in cut-off year for historical averages

	log (total consumption per capita)							
	pre-1997 historical average		pre-1996 historical average		pre-1995 historical average		pre-1994 historical average	
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CCT + Grant (T3)	0.0777***	0.0848***	0.0776***	0.0848***	0.0776***	0.0848***	0.0778***	0.0848***
	(0.024)	(0.024)	(0.025)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)
CCT + Training (T2)	0.0246	0.0290	0.0245	0.0290	0.0245	0.0291	0.0246	0.0291
	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.022)	(0.023)
CCT (T1)	0.0221	0.0215	0.0222	0.0215	0.0226	0.0216	0.0224	0.0216
	(0.025)	(0.024)	(0.025)	(0.024)	(0.025)	(0.024)	(0.024)	(0.024)
Shock*T3	0.0962**		0.0983**		0.0975**		0.0925**	
	(0.042)		(0.042)		(0.044)		(0.044)	
Shock*T2	0.0603*		0.0624*		0.0618*		0.0592*	
	(0.035)		(0.035)		(0.035)		(0.035)	
Shock*T1	-0.00232		-0.00327		-0.00878		-0.00841	
	(0.038)		(0.039)		(0.039)		(0.039)	
Yield loss*T3		0.0775**		0.0778**		0.0790**		0.0784**
		(0.030)		(0.030)		(0.030)		(0.030)
Yield loss*T2		0.0747**		0.0759**		0.0790***		0.0788***
		(0.029)		(0.029)		(0.030)		(0.030)
Yield loss*T1		0.00130		0.00113		0.00141		0.00112
		(0.029)		(0.029)		(0.029)		(0.029)
Level of clustering	com.	com.	com.	com.	com.	com.	com.	com.
Block F.E	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,918	3,918	3,918	3,918	3,918	3,918	3,918	3,918

*** p<0.01, ** p<0.05, * p<0.1. s.e. in parentheses. All regressions including household level controls (see note in Table 1).

Table A.13: Impact of shocks with different treatments - robustness to changes in cut-off year for historical averages

	log (per capita income) pre-1997 historical average		pre-1996 historical average		pre-1995 historical average		pre-1994 historical average	
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CCT + Grant (T3)	0.0371	0.0453*	0.0371	0.0453*	0.0374	0.0453*	0.0380	0.0453*
	(0.027)	(0.025)	(0.027)	(0.025)	(0.027)	(0.025)	(0.026)	(0.025)
CCT + Training (T2)	-0.0096	-0.0028	-0.0099	-0.0028	-0.0101	-0.0028	-0.0101	-0.0028
	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	(0.025)	(0.026)
CCT (T1)	-0.0207	-0.0194	-0.0205	-0.0193	-0.0199	-0.0193	-0.0200	-0.0193
	(0.026)	(0.025)	(0.026)	(0.025)	(0.026)	(0.025)	(0.026)	(0.025)
Shock*T3	0.113**		0.113**		0.108**		0.0967*	
	(0.049)		(0.050)		(0.053)		(0.053)	
Shock*T2	0.0950**		0.0984**		0.0997**		0.0966**	
	(0.041)		(0.042)		(0.044)		(0.044)	
Shock*T1	0.0275		0.0252		0.0162		0.0137	
	(0.044)		(0.045)		(0.046)		(0.045)	
Yield loss*T3		0.0863**		0.0858**		0.0857**		0.0848**
		(0.033)		(0.033)		(0.033)		(0.033)
Yield loss*T2		0.106***		0.107***		0.109***		0.109***
		(0.039)		(0.039)		(0.040)		(0.040)
Yield loss*T1		0.0127		0.0115		0.0097		0.0096
		(0.033)		(0.033)		(0.033)		(0.033)
Level of clustering	com.	com.	com.	com.	com.	com.	com.	com.
Block F.E	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,892	3,892	3,892	3,892	3,892	3,892	3,892	3,892

*** p<0.01, ** p<0.05, * p<0.1. s.e. in parentheses. All regressions including household level controls (see note in Table 1). Income trimmed for 1% highest outliers.

Table A.14: Number of businesses (by type) per community

	Treatment Group			Control Group				
	N	Mean	SD	N	Mean	SD	Difference	t-stat
Local convenience store	55	3.27	2.09	49	2.41	1.82	0.86	**2.24****
Shop (miscellaneous)	55	0.04	0.19	49	0.00	0.00	0.04	1.35
Cereal Trader	55	0.45	0.81	49	0.14	0.50	0.31	**2.32****
Clothes Trader	55	0.36	0.91	49	0.16	0.75	0.20	1.22
Bakery	55	1.44	2.04	49	0.80	1.81	0.64	**1.68***
Butcher's shop	55	0.45	0.79	49	0.24	0.60	0.21	1.51
Sale of other transformed food products	55	0.31	0.81	49	0.47	1.12	-0.16	-0.84
Mechanics shop	55	0.05	0.30	49	0.00	0.00	0.05	1.28
Trader of agricultural inputs	55	0.09	0.35	49	0.08	0.28	0.01	0.15
Hairdresser or beauty shop	55	0.51	1.22	49	0.16	0.55	0.35	**1.83***
Shoe Trader	55	0.16	0.57	49	0.04	0.20	0.12	1.43

*** p<0.01, ** p<0.05, * p<0.1

Table A.15: Community level availability and prices of consumer products

	Availability of products in community			Reported price of products		
	Number food items available	Number non-food items avail.	Number animal types available	Food index	Nonfood index	Animal index
Treatment (T)	0.997*	1.352**	-0.115	0.396	1.033	0.466*
	(0.54)	(0.63)	(0.13)	(0.71)	(0.65)	(0.27)
Shock	-2.010***	-2.739***	0.100	-2.267**	1.128	-0.710**
	(0.74)	(0.91)	(0.11)	(0.89)	(1.01)	(0.33)
Shock*T	-0.588	-0.302	0.185	-0.786	-0.934	0.808
	(0.82)	(1.15)	(0.21)	(0.90)	(1.17)	(0.56)
Mean in control	7.780	6.534	2.673	-0.0202	-0.568	-0.236
Observations	104	104	104	104	104	104

*** p<0.01, ** p<0.05, * p<0.1; Robust standard errors in parentheses, clustered at block level. IV estimates, controlling for altitude in second stage. N =104. Community surveys are missing for 2 communities. Number of food, nonfood and live animals items available is sum from a total of 10, resp. 15, resp 3 commonly consumed items. Standardized prices capture price index of food & nonfood items and live animals.

Table A.16: Impact on log(per capita income) for subgroups of households (by baseline diversification)

	without non-agr. activity		with non-agr. activity		with <= 2 activities		with > 2 activities	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CCT +grant (T3)	0.0563*	0.0687**	0.0083	0.0096	0.0769**	0.0920***	0.0066	0.0027
	(0.029)	(0.028)	(0.041)	(0.040)	(0.034)	(0.032)	(0.030)	(0.031)
CCT + training (T2)	-0.0058	0.00325	-0.0135	-0.0103	-0.0070	-0.0016	-0.0109	-0.0025
	(0.029)	(0.029)	(0.039)	(0.039)	(0.032)	(0.033)	(0.029)	(0.030)
CCT (T1)	0.00342	0.00754	-0.0600	-0.0641*	-0.0018	0.0003	-0.0388	-0.0427
	(0.031)	(0.030)	(0.040)	(0.038)	(0.032)	(0.033)	(0.032)	(0.033)
Shock*T3	0.110**		0.102		0.165***		-0.0369	
	(0.046)		(0.082)		(0.050)		(0.062)	
Shock*T2	0.112***		0.0738		0.0963**		0.0835	
	(0.041)		(0.079)		(0.041)		(0.067)	
Shock*T1	0.0350		-0.130		0.0675		-0.0607	
	(0.042)		(0.089)		(0.042)		(0.063)	
Yield loss*T3		0.108***		0.0461		0.159***		0.0038
		(0.041)		(0.052)		(0.046)		(0.039)
Yield loss*T2		0.142***		0.0274		0.126**		0.0555
		(0.048)		(0.049)		(0.053)		(0.040)
Yield loss*T1		0.0401		-0.0461		0.0609		-0.0417
		(0.044)		(0.049)		(0.047)		(0.038)
Observations	2523	2523	1369	1369	2231	2231	1661	1661

Note: Column 1-4 divides household based on whether they had at least one member working in a non-agricultural activity at baseline; while column 5-8 distinguishes between households with at least 2 versus more than 2 different economic activities.

Table A.17: Time worked (per activity) and migration in response to shocks

	Total Number of Days worked in Activity by Women in the Household							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Non-agr. self-employment		All wage employment		Non-agr. wage employment		Agr. wage employment	
CCT + Grant (T3)	61.27***	60.82***	-20.53***	-20.21***	-11.45**	-11.26**	-9.284***	-9.162***
	(9.17)	(9.53)	(5.07)	(4.89)	(4.38)	(4.31)	(2.70)	(2.71)
CCT + Training (T2)	5.733	4.153	-11.52**	-10.36**	-3.756	-2.980	-7.991***	-7.593***
	(8.31)	(8.44)	(4.68)	(4.55)	(4.13)	(4.13)	(2.62)	(2.62)
CCT (T1)	16.83*	17.22*	-1.397	-0.485	6.159	6.645	-7.929***	-7.480***
	(9.16)	(9.13)	(5.08)	(4.80)	(4.11)	(4.04)	(2.83)	(2.82)
Shock*T3	-7.563		3.985		1.725		2.253	
	(13.8)		(8.15)		(7.39)		(4.54)	
Shock*T2	-22.27		14.71*		9.204		5.656	
	(15.1)		(8.43)		(7.68)		(4.63)	
Shock*T1	3.222		12.12		5.919		6.537	
	(14.5)		(8.90)		(7.28)		(5.08)	
Yield loss*T3		-10.81		8.597		6.658		1.799
		(12.2)		(6.86)		(5.99)		(3.97)
Yield loss*T2		-6.465		14.57**		9.807		4.937
		(11.9)		(6.97)		(6.05)		(4.27)
Yield loss*T1		9.080		11.67		7.363		4.402
		(12.4)		(7.80)		(5.89)		(4.68)
Mean in control	90.09	90.09	64.69	64.69	45.32	45.32	19.36	19.36
Observations	3916	3916	3916	3916	3916	3916	3916	3916

Note: *** p<0.01, ** p<0.05, * p<0.1; s.e. in parentheses, clustered at community level. All regressions including block fixed effect and household level controls as in Table 1.

Table A.18: Impact by shock intensity in other blocks from the same municipality

		Log(total consumption per capita)		Log(per capita income)	
		Low shock intensity in rest muni (1)	High shock intensity in rest muni (2)	Low shock intensity in rest muni (3)	High shock intensity in rest muni (4)
CCT + Grant (T3)	α3	0.152***	0.0277	0.0831*	0.0437
		(0.035)	(0.039)	(0.046)	(0.035)
CCT + Training (T2)	α2	0.115***	-0.0165	0.0697	-0.0091
		(0.032)	(0.039)	(0.055)	(0.042)
CCT (T1)	α1	0.0470	0.0083	-0.0212	0.0098
		(0.029)	(0.037)	(0.047)	(0.041)
Shock*T3	γ3	0.173*	0.104**	0.190	0.0476
		(0.098)	(0.041)	(0.123)	(0.034)
Shock*T2	γ2	0.231**	0.0779*	0.302**	0.0600
		(0.092)	(0.043)	(0.147)	(0.044)
Shock*T1	γ1	0.0199	0.0005	0.0776	-0.0055
		(0.088)	(0.038)	(0.120)	(0.039)
Observations		2031	1887	2022	1870

Note: *** p<0.01, ** p<0.05, * p<0.1. S.e. clustered by community (in parentheses). All regressions include block-level F.E. and household level controls.

Table A.19 Types of available training courses

%	All	Women	Men
Sewing	24	45	2
Construction & masonry	15	0	31
Carpentry/wood work	12	0	25
Computing	12	13	11
Mechanic/electricity	10	0	21
Baking/cooking	10	18	1
Hairdressing& beauty	6	10	2
Poultry raising	3	5	2
Handicraft	3	5	1
Other	4	4	4
Total	100	100	100

Note: Share of participants (respectively women and men) by type of course, based on administrative data.