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Gustav Agneman

Paolo Falco

Exaud Joel

Onesmo Selejio

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University of Copenhagen

Faculty of Social Sciences

Department of Economics

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Does Scarcity Reduce Cooperation?
Experimental Evidence from Rural Tanzania*

Gustav Agneman[1], Paolo Falco[1], Exaud Joel[2], and Onesmo Selejio[2]

[1]Department of Economics, University of Copenhagen
[2]Department of Economics, University of Dar Es Salaam

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Abstract

Cooperation is essential to reap efficiency gains from specialization, not least in poor communities where economic transactions often are informal. Yet, cooperation might be more difficult to sustain under scarcity, since defecting from a cooperative equilibrium can yield safe, short-run benefits. In this study, we investigate how scarcity affects cooperation by leveraging exogenous variation in economic conditions induced by the Msimu harvest in rural Tanzania. We document significant changes in food consumption between the pre- and post-harvest period, and show that lean season scarcity reduces socially efficient but personally risky investments in a framed Investment Game. This can contribute to what is commonly referred to as a behavioral poverty trap.

Keywords: scarcity, cooperation, field experiment
JEL Codes: C71, C93, D91

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1 Introduction

Many economic transactions rest on mutual trust and cooperation, and self-enforced compliance is thus essential for the functioning of markets. Countries, organisations, and communities with higher levels of trust have recurrently been shown to attain better economic results (e.g., Algan and Cahuc 2010; Bohnet, Herrmann, and Zeckhauser 2010; Knack and Keefer 1997; La Porta et al. 1997). However, cooperative equilibria are inherently unstable, since defection can yield safe and short-run private benefits (Dal Bó and Fréchette 2011). This is particularly a problem in developing countries where contracts are hard to enforce and informality is widespread. In order to better understand obstacles to economic development, we therefore ought to map factors that underpin or undermine economic cooperation.

In this paper, we ask whether adverse economic conditions, and in particular the experience of food scarcity, can lead to a breakdown in cooperation. We hypothesize that people invest less in cooperative solutions when resources are scarce, since scarcity increases the relative cost of defection by others. As a consequence, agents may forego investment opportunities that are both individually profitable and socially efficient.

Our study takes place in the poverty-stricken region Singida, Tanzania, where we document significant variation in food scarcity between the pre-harvest (early May) and the post-harvest (mid-July) period. We exploit this exogenous variation in food supply to study how scarcity impacts farmers' willingness to engage in cooperative behaviour, by measuring cooperation both before and after the harvest through a lab-in-the-field experiment. Investing is socially efficient and potentially profitable from the investor's perspective, but the outcome is uncertain as it rests on reciprocation from another agent.

We find that scarcity depresses cooperation. Before the harvest, when farmers face greater food shortages, they invest significantly less compared to after the harvest. The reduced form impact is significant both in a between-subject design (different participants before and after the harvest) and a within-subject design (the same subjects participating twice). Intuitively, the effects are substantially larger for relatively poorer farmers, who experience greater scarcity in the pre-harvest period. We further corroborate the interpretation of the effect as one driven by food scarcity by means of an instrumental variable approach.

Our study extends a growing literature on the relationship between poverty and economic behavior, which encompasses studies on e.g. self-control (Banerjee and Mullainathan 2010), risk-aversion (Yesuf and Bluffstone 2009 and Blalock, Just, and Simon 2007), and borrowing choices (Shah, Mullainathan, and Shafir 2012 and Agarwal, Skiba, and Tobacman 2009). In particular, we contribute to the emergent literature concerned with the *causal* effect of scarcity on economic behaviors (e.g., Miguel 2005; Shah, Mullainathan, and Shafir 2012; Haushofer, Schunk, and Fehr 2013; Prediger, Vollan, and Herrmann 2014; Shah, Shafir, and Mullainathan 2015; Carvalho, Meier, and Wang 2016; Lichand et al. 2020). Our identification strategy builds on the seminal study by Mani et al. (2013), who exploit the timing of sugar cane harvests in India to investigate how scarcity influences cognitive abilities.

A few studies have previously investigated links between seasonal scarcity and adverse behavior in the context of Tanzania (most notably the study by Miguel (2005) on witch-hunts)). Closely related with the present study, Hadley, Mulder, and Fitzherbert (2007) find that "instrumental social support" – meaning economic support in case of need – associates negatively and strongly with incidences of food scarcity in South-western Tanzania. They draw the conclusion that social support determines food scarcity. While a lack of cooperation could aggravate food scarcity, our findings suggest that the impact also runs in the opposite direction: scarcity depresses cooperation.

We differ from previous studies on scarcity and economic behavior in a number of important respects. First, by investigating the influence of scarcity on potentially *self-serving* cooperation, our conceptualization of cooperation contrasts with studies measuring behavior in, e.g., one-shot prisoner's dilemmas (Boonmanunt and Meier 2020) and joy-of-destruction games (Prediger, Vollan, and Herrmann 2014). Cooperating in a one-shot prisoner's dilemmas can be interpreted as an act of altruism, since defecting is invariably personally profitable. In the real world, decisions on whether to cooperate or not depend crucially on potential personal gains from successful cooperation. The sequential way in which senders and receivers interact in the Investment Game allows us to capture cooperation motivated also by personal interest; cooperation in our study is a risky but potentially profitable option.[1]

1. Indeed, altruistic motives are not a dominant predictor of behavior in the Investment Game (Brülhart

Second, we distinguish our work from previous research by focusing on food scarcity as opposed to scarcity of financial resources (Mani et al. 2013; Aksoy and Palma 2019; Boonmanunt and Meier 2020). In e.g. Mani et al. (2013), the sampled farmers are able to smooth food consumption and are not eating less prior to the harvest. In our context, a substantial proportion of the farmers do not accumulate any savings, and are forced to reduce food consumption in the lean period. While food and financial scarcity are correlated, food scarcity is a more severe form of deprivation and can be expected to trigger larger behavioral changes (Schofield 2014). Our results confirm this hypothesis. To the best of our knowledge, we are the first to document how food scarcity depresses socially efficient investment.

Third, by instrumenting scarcity using the post-harvest shock in food supply as an instrument, we go further than studies focusing exclusively on the reduced form impact of the harvest (Mani et al. 2013; Bartos 2016; Aksoy and Palma 2019; Boonmanunt and Meier 2020). Using a two-stage least squares approach, we are able to document that scarcity is indeed the mediating channel depressing cooperation in the lean period.

The paper is structured as follows. In Section 2, we discuss relevant features of the Singida region, the empirical context of the present study. Section 3 outlines our experimental design and in Section 4 we present the main findings. We discuss the implications of the findings in Section 5.

2 Empirical setting: the region of Singida

The study was conducted in Singida, a poverty-stricken region in central Tanzania with a diverse population. In our sample, the Nyaturu (36%), Sukuma (25%), and Gogo (23%) constitute the main ethnic groups, 63% adhere to Christianity, whereas 26% are Muslims. The region is semi-arid and the economy heavily centered around agricultural production. Food crops are the dominant products: 9 out of 10 participants in our sample grow maize, 1 in 5 grows sorghum, and 1 in 5 grows millet. Sweet potatoes and sunflower seeds, which are sometimes used for food consumption and sometimes as cash crops, are cultivated by 15% and 40% of the farmers, respectively. While the timing of the harvest varies somewhat

and Usunier 2012).

between crops, the main harvesting period is between May and June.

The harvest constitutes the main source of income and food for the farmers of Singida; in our sample, 88.1% of the respondents report that (at least) some of their income comes from farming. Hence, consumption can vary significantly between the lean pre-harvest period and the abundant post-harvest period (as we later show in Section 4.1). The variation is accentuated by major obstacles to consumption smoothing, such as credit constraints and limited access to saving mechanisms. Poor farmers – like the participants in our study – tend to lack reliable storage opportunities, both in terms of food (Parfitt, Barthel, and Macnaughton 2010) and in terms of cash (Aryeetey 1997). Saving is risky due to a weak justice system (Bates 1987). Lastly, present bias may further enhance seasonal fluctuations in food availability (Laajaj 2017), as a preference for immediate consumption may contribute to depleting surpluses, especially among people who can barely satisfy their basic needs.

3 Experimental design

Our analysis is centered around an Investment Game (Berg, Dickhaut, and McCabe 1995), which we conduct before and after the yearly harvest, with participants from two distinct sets of randomly selected villages in the region of Singida. In this section, we outline the Investment Game, introduce two experimental manipulations, and discuss our sampling strategy.

3.1 The Investment Game

We conduct an Investment Game à la Berg, Dickhaut, and McCabe (1995). The game has two players (A and B) who are anonymous to each other (they never meet and their decisions are only reported to the other player after the game is concluded). Player A begins the game with a certain endowment and chooses how much to invest in a common project with Player B. The amount s/he invests is then tripled and Player B gets to split the income from the investment between the two players. For simplicity, Player A could choose to invest all, half, or none of the initial endowment.

To facilitate understanding, the game was framed as a situation familiar to farmers: Player A had to decide how much to invest in seeds that would result in a harvest worth

three times the investment. The initial endowment Player A was given amounted to 4,000 Tanzanian Shillings, roughly corresponding to a day's worth of the minimum wage in the agricultural sector in Tanzania (De Blasis 2020). S/he was informed that Player B would decide how the income from the harvest would be split between the two players. The payoffs were paid in cash at the end of the day, after the game and an accompanying survey were completed. The rules of the game were explained carefully by means of examples and visual aids. The full script and the visual aids are shown in Appendix B. In Figure 1 we depict the sequencing of the game.

Figure 1: Decision tree

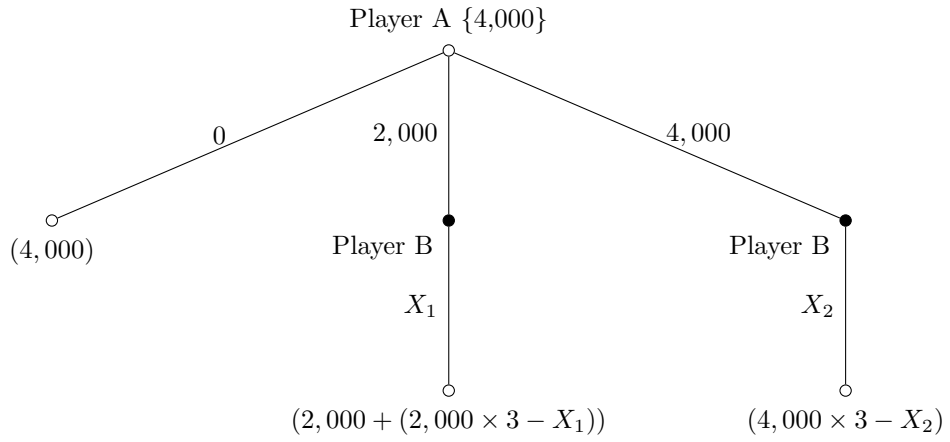


Figure 1 displays the decision tree and thereby the information set of Player A when making the initial investment (or not). The amount in curly brackets refer to the initial endowment of Player A. The amounts in parentheses indicate the potential payoffs of Player A. X_1 and X_2 denote the sum that Player B decides to keep for herself, respectively in the scenarios when 2,000 and 4,000 was invested by Player A. X_1 is bounded between 0 and 6,000, whereas X_2 is bounded between 0 and 12,000.

Based on these rules, Player A was asked to indicate how much s/he wanted to invest. Player B, on the other hand, was asked to indicate how much s/he would give back to Player A for each level of investment Player A could have made (the actual choice made by Player A was not revealed until after the game and the ensuing interview was concluded). In order to minimize experimenter demand effects that might be caused by the presence of interviewers, participants were asked to make their choice in a private space by indicating their decision on a sheet. They were then asked to fold the answer sheet and hand it back to the enumerator (who did not look at their answer until later).

3.2 Manipulations

The primary focus of this study is how cooperation depends on participants' current food situation. We hypothesize that food scarcity hampers respondents' ability to choose the socially efficient option of investing, by leading them to prefer a safe option (not investing). We rely on the seasonal variation in food scarcity induced by the harvest to identify the causal effect of food scarcity on investment. In addition, we embed two experimental treatments in the Investment Game: (a) a prime that makes scarcity particularly salient prior to the game; (b) an ingroup/outgroup manipulation.

3.2.1 Scarcity prime

A growing literature has documented the psychological impacts of poverty on decision-making (Shah, Shafir, and Mullainathan 2015; Lichand et al. 2020). At least to some extent, it is the awareness of trade-offs (e.g. between risk and reward) – what Mullainathan and Shafir (2013) label a scarcity mindset – which influences behavior. In our context, this means that in addition to scarcity influencing behavior directly, when a current state of scarcity is made salient it should depress investment *further*. To trigger this mechanism, we asked respondents a series of questions about their current food consumption (we detail the questions in Figure A2 in the Appendix). Half of our respondents (primed) are asked those questions before they play the Investment Game. The other half (control) answers those questions after they play the game.

3.2.2 Ingroup vs Outgroup

Our second experimental manipulation is employed to test whether scarcity is more damaging for cooperation with people who are more socially distant. This may be the case, for instance, if social proximity makes reciprocity easier to sustain. We test this proposition by randomly varying the counterpart that respondents face in the Investment Game (i.e., Player B) between an ingroup and an outgroup member. Specifically, while half of the participants are told that Player B is another (anonymous) person from their own village, the rest are told that Player B is from another part of Tanzania. The ingroup/outgroup manipulation

Table 1: Distribution of subjects across treatments

	Pre-harvest		Post-harvest	
	Ingroup	Outgroup	Ingroup	Outgroup
Scarcity Prime	45	39	51	40
No prime	38	45	45	60

Table 1 displays the number of participants per treatment arm.

is embedded in the game instructions outlined in Appendix B.2. The pre- and post-harvest sampling in conjunction with the two experimental manipulations gives rise to a 2x2x2 design that we summarise in Table 1.

3.3 Timing of the survey

The timing of the survey was chosen with respect to the Msimu harvest, from which farmers in Singida derive most of their food and income. We conducted the first round of surveying just prior to the harvest, in early May, while the second round was conducted at a time when most of the gains from the harvest had been realized, in mid-July.

3.4 Sampling

Our study was conducted in two districts within the region of Singida, namely Ikungi and Manyoni.[2] We randomly selected 12 "wards" (administrative units consisting of several villages) – 6 from each district – for the first wave of surveying.[3] From each ward, we randomly selected one village, such that the sample of the first wave consisted of 12 villages. In the second wave, we randomly selected 8 of the wards from the first round and drew new villages from each of these wards. By sampling villages from the same wards in both survey rounds, we ensure that villages in the pre- and post-harvest wave are as similar as possible. In addition, we re-visited the remaining 4 villages from the first wave and interviewed the same subjects a second time. This allows for an additional within-subject analysis. Finally,

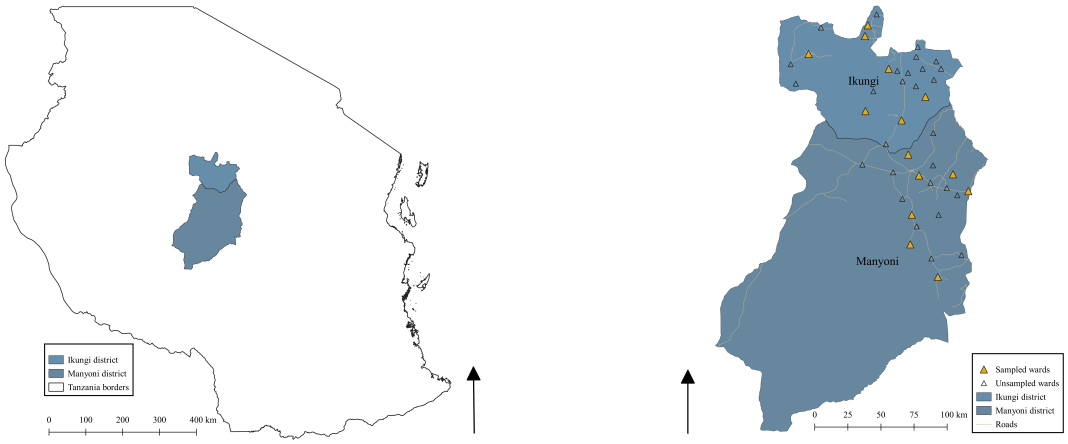
2. For logistical reasons and budget limitations, we could not cover the entire region and chose two large districts that were suitable for the present study, due to the high degree of agricultural reliance in conjunction with relatively high levels of poverty.

3. We excluded a number of wards from the randomization due to infrastructural constraints (some wards were temporarily inaccessible by car).

to increase statistical power, in the second wave we also included two new villages from randomly selected wards that were not part of the first round.

In total, we visited 22 unique villages, 4 of which were sampled twice. The sampled villages and wards are detailed in Table A1 in Appendix A. Panel (b) of Figure 2 maps the sampled and unsampled wards.

Figure 2: The empirical setting



(a) Sampled districts **(b)** Sampled wards

In each village, we randomly selected households by means of a random walk sampling methodology, and invited one (randomly chosen) adult per household to take part in the survey. The number of people interviewed in each village ranges between 28 and 32. In this paper, we restrict our analysis to participants who obtained at least some income from the harvest, and the final sample thus consists of 363 subjects in the role of Player A (whose investment decision is our primary focus). In Table 2, we document that the random selection of villages and households was successful in attaining balance between the pre- and post-harvest round across a large range of covariates.

Table 2: Covariates balance between the pre- and the post-harvest sample

	Pre-harvest			Post-harvest			
	N	Mean	S.d.	N	Mean	S.d.	Difference
Woman	167	0.44	0.50	196	0.46	0.50	0.021
Age	167	42.92	14.72	196	41.65	13.76	-1.274
Years in village	167	23.13	15.97	196	26.06	18.02	2.924
Non-farm earnings	167	0.10	0.30	196	0.13	0.33	0.026
Post-primary education	167	0.11	0.31	196	0.14	0.35	0.030
Literacy	167	0.84	0.36	196	0.87	0.34	0.023
Muslim	167	0.30	0.46	196	0.22	0.42	-0.075
Christian	167	0.58	0.49	196	0.66	0.47	0.082
Nyaturu	167	0.37	0.48	196	0.36	0.48	-0.008
Sukuma	167	0.25	0.44	196	0.25	0.43	-0.001
Gogo	167	0.21	0.41	196	0.24	0.43	0.035
Head of household	167	0.71	0.45	196	0.64	0.48	-0.075
Married	167	0.83	0.37	196	0.82	0.38	-0.011
Owns cattle	167	0.53	0.50	196	0.51	0.50	-0.028
Owns chickens	167	0.77	0.42	196	0.74	0.44	-0.033
Owns goats	167	0.46	0.50	196	0.42	0.50	-0.032
Maize cropping	167	0.90	0.30	196	0.86	0.35	-0.047
Sunflower seed cropping	167	0.38	0.49	196	0.44	0.50	0.067
Sorghum cropping	167	0.20	0.40	196	0.22	0.42	0.021
Millet cropping	167	0.18	0.39	196	0.19	0.39	0.009
Owns tractor	167	0.01	0.11	196	0.00	0.00	-0.012
Owns plough	167	0.47	0.50	196	0.44	0.50	-0.028
Using fertilizer	167	0.10	0.30	196	0.12	0.33	0.021
Rain irrigation	167	0.99	0.08	196	0.99	0.07	0.001
Recent family death	167	0.02	0.13	196	0.02	0.14	0.002
Recent property theft	167	0.05	0.23	196	0.07	0.26	0.018
Receives financial/food support	167	0.13	0.33	196	0.08	0.27	-0.044
Has outstanding loan	167	0.24	0.43	196	0.21	0.41	-0.025

Table 2 shows descriptive statistics on a range of relevant covariates for the pre- and post-harvest sample. The Difference column displays coefficients and corresponding significance levels from simple a regression with post-harvest treatment as the sole regressor and robust standard errors. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4 Results

In this section, we present the results of our analysis. First, we document large variation in food scarcity between the pre- and post-harvest period. Second, we present evidence of a significant change in cooperative behavior between the two periods. Third, we estimate a causal impact of food scarcity on cooperative behavior by instrumenting the level of scarcity with an dummy variable indicating whether the Investment Game was played in the lean- or

abundant period. Fourth, we show that the results are robust to accounting for a broad set of potential confounders. Fifth, we document the impact of the two experimental manipulations embedded in the Investment Game. Finally, we show that cooperation on average paid off.

4.1 The harvest changes scarcity levels

The first step in our analysis is to investigate whether reliance on a yearly harvest leads to fluctuations in food scarcity among the farmers in our sample. We find a substantial effect of the harvest on levels of food scarcity. Figure 3 plots histograms of how frequently people did not have sufficient food in the month prior to the survey. It shows a clear shift in the distribution with the share of people declaring food shortages falling significantly after the harvest. While 7 out of 10 households reported some degree of food scarcity before the harvest, only 3 out of 10 did so after the harvest.

Figure 3: Effect of harvest on scarcity

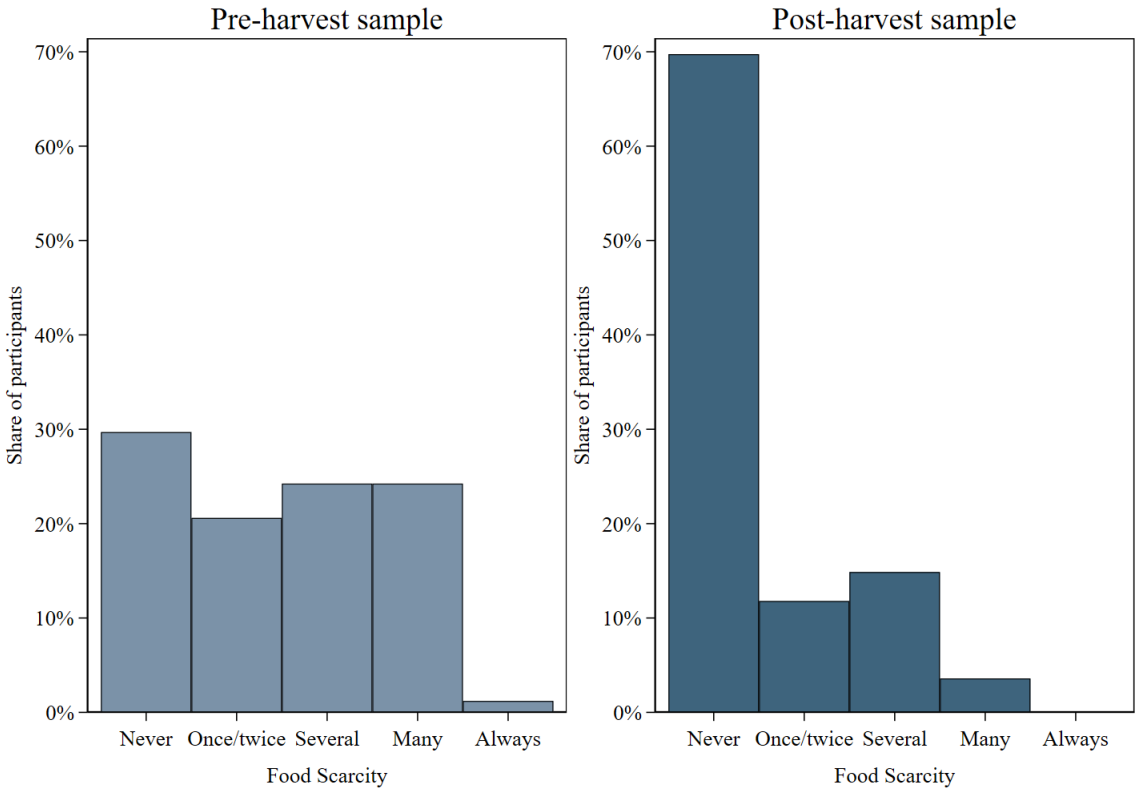


Figure 3 displays the change in food scarcity from round 1 to round 2. Food scarcity is measured as the response to the following question: "Over the past month, how often, if ever, have you or anyone in your family gone without enough food to eat?".

In Table A3 in Appendix C.3, we show that the shift is both statistically significant and economically meaningful. Scarcity decreased in the post-harvest period by more than four fifths of a standard deviation. The results are robust to using alternative measures of food scarcity, namely the number of days with fewer meals than normal over the past month (see Figure A4 in the Appendix C.1).

4.2 Cooperation is lower before the harvest

Having established a link between the harvest and food scarcity, we can now investigate how this exogenous source of variation affects investment behavior. We estimate the impact for four different samples. The Full sample, which includes all farmers in our sample; the Limited sample, from which we exclude the post-harvest observations on participants that also took part in the first round[4]; the Within sample, where we focus on individuals who participated twice (and can therefore include individual-level fixed effects); and finally the Village sample, which reports the effect of the harvest on average village-level investment. In Table 3 we report the results.

Table 3: Effect of the harvest on investment

Dep. Var.:	Investment in the Investment Game			
Sample:	Full	Limited	Within	Village
	(1)	(2)	(3)	(4)
Post-harvest Treatment	258.8**	218.6*	583.3**	259.7**
	(120.8)	(122.2)	(265.2)	(122.1)
Constant	2802.4***	2802.4***	3708.3***	2799.7***
	(105.1)	(105.3)	(336.9)	(104.0)
Observations	363	310	106	26
R-squared	0.0112	0.00762	0.550	0.167
Dep. Var. Mean	2942.1	2903.2	2849.1	2939.6
Individual F.E.	NO	NO	YES	NO

Cluster-robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3 displays OLS regression estimates of the effect of the harvest on investment in the Investment Game. Individual F.E. indicates Individual Fixed Effects. All specifications report cluster-robust standard errors at the village-round level.

Regardless of the specification, the results show that cooperation is significantly

4. The rationale for this specification is to ensure that learning effects – which may affect behavior of participants that participated twice – do not influence the findings.

lower in the lean period that precedes the harvest. For the full sample presented in column 1, we document an increase in investment amounting to almost 10% of the baseline investment level after the harvest. The effect is somewhat smaller and less precisely estimated when we restrict the analysis to the limited sample, but the effect remains significant at the 10% level. In column 3, we zoom in on farmers who participated twice and estimate a diff-in-diff model with individual fixed effects. Once again, the results show a large and positive impact of the harvest on investment decisions. Lastly, in column 4 we report the impact of the harvest on average investment at the village level. By studying the effect at this level of aggregation, we ensure that the results are not sensitive to intra-group correlations in investment behavior (Angrist and Pischke 2008).[5] The positive impact of the harvest is statistically significant also in this sample.

Finally, we show that the harvest induced a more significant reduction in food scarcity – and a larger increase in investment – among relatively poorer participants (as measured by a self-reported evaluation[6]). In Figure 4, we show that while relatively poor participants are much more likely to experience scarcity before the harvest, these differences are largely levelled out by the harvest. Correspondingly, relatively poor farmers increase their investment levels substantially more compared to the relatively well-off in the post-harvest period.

5. The main regressions report clustered standard errors at the village-round level for this reason, but group averages are somewhat more reliable when the number of clusters is relatively small (Angrist and Pischke 2008).

6. The survey item read "How rich or poor is your household in comparison with other households in the village? " (Much poorer; A little poorer; Same; A little richer; Much richer).

Figure 4: Heterogeneous effect of the harvest on food scarcity and investment

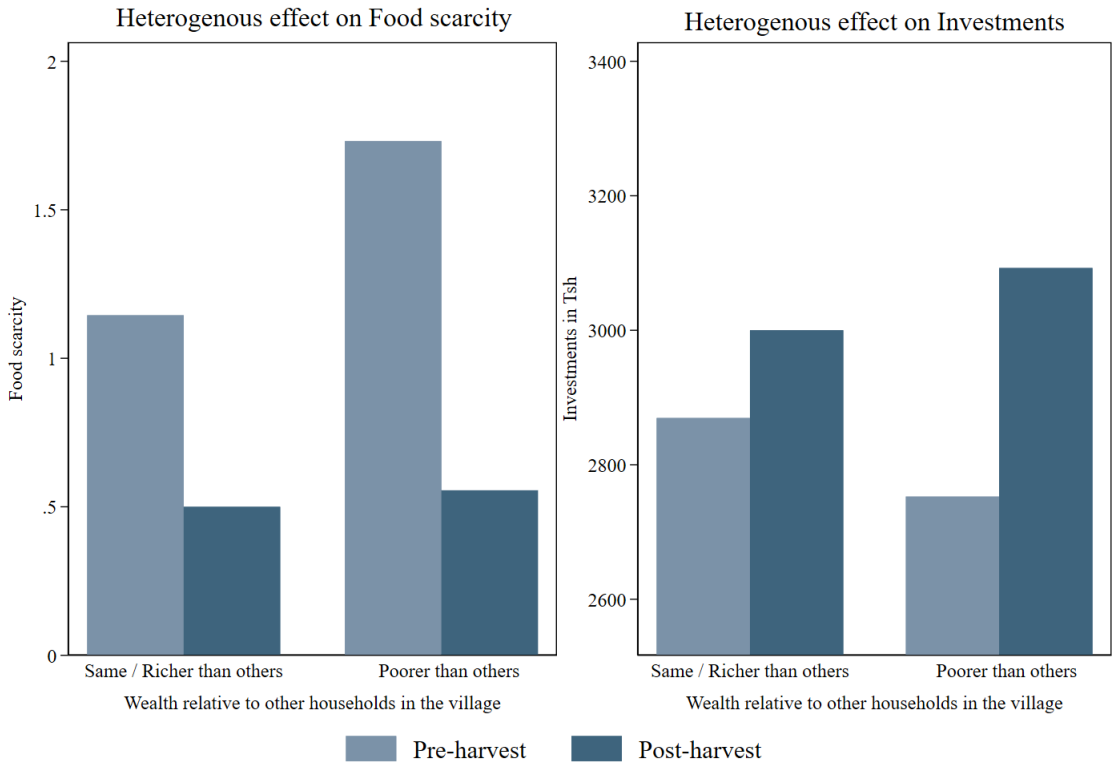


Figure 4 shows how the harvest changed differently both the level of scarcity and investment as a function of relative poverty. Food scarcity ranges from 0 (no food scarcity in the past month) to 4 (constant food scarcity in the past month).

4.3 Food scarcity is associated with lower levels of cooperation

The underlying assumption so far has been that the harvest shifted food scarcity and therefore also the level of cooperation. This causal chain requires that food scarcity link negatively with investment levels. Instead of assuming this linkage, we can document it. In Figure 5, we plot average investment in each village against the average level of food scarcity in the pre- (light blue) and post-harvest (dark blue) sample. At the village level, the negative correlation between experienced scarcity and cooperation is strong and statistically significant (N=26, coefficient=-361, p-value=0.001, linear regression with robust standard errors). The figure also confirms that the harvest significantly decreases food scarcity, as documented in Section 4.1 (N=26, coefficient=-0.816, p-value<0.001, linear regression with robust standard errors), and increases average investment levels (as shown in column 4 of Table 3). In the

Appendix Section C.2 (Table A2), we also document the negative association between food scarcity and investment levels at the individual level.

Figure 5: Village-level food scarcity and investment (pre- vs post-harvest sample)

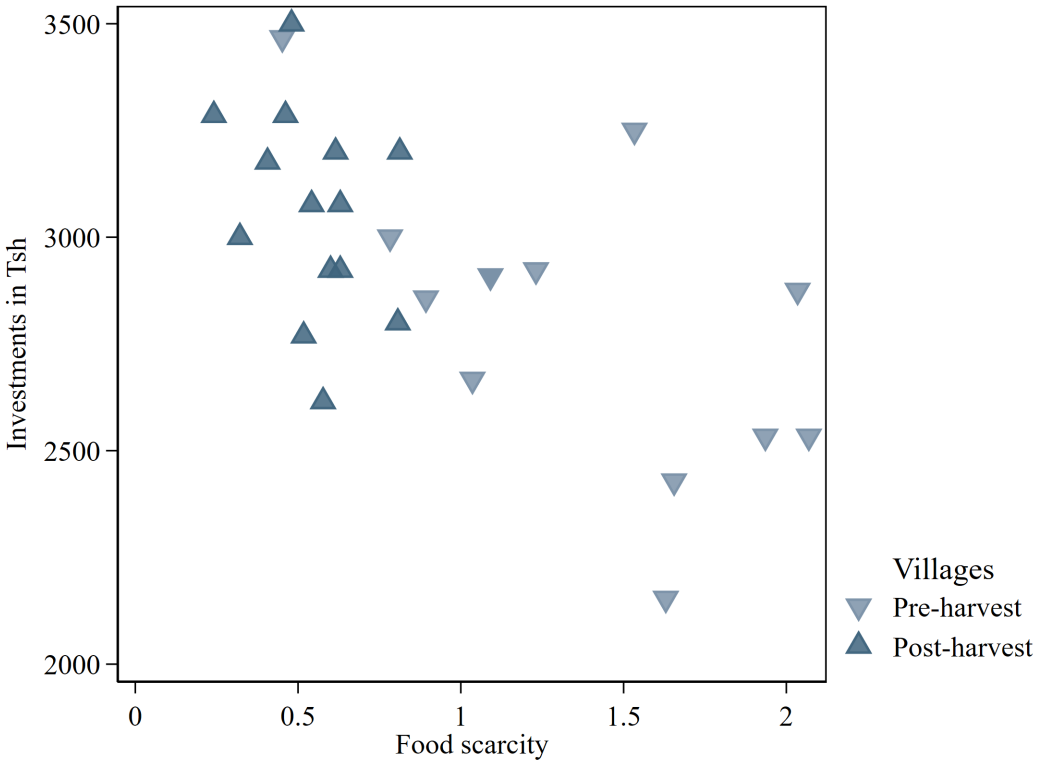


Figure 5 shows the correlation between village level food scarcity and investment. Moreover, the figure displays how both the level of scarcity and investment levels changed with the harvest. Food scarcity ranges from 0 (no food scarcity in the past month) to 4 (constant food scarcity in the past month).

A mere correlation between food scarcity and investment does not, however, prove that a lack of food *causes* lower investment levels. Next, we complete the analysis by investigating the causal impact of food scarcity on cooperation.

4.4 The causal impact of scarcity on cooperation

We estimate the direct impact of food scarcity on cooperation by means of a standard two-stage least squares approach, exploiting the harvest as an instrument for food scarcity. For this strategy to be valid, we need the harvest to have had substantial influence on the levels of food scarcity. This was demonstrated in Section 4.1. Moreover, we need our pre- and post-harvest samples to be similar in all respects that matter for cooperation *except* for

food scarcity. Though we cannot be certain that such a restriction is fulfilled, we can use the information contained in the survey to alleviate concerns that either sampling error or unaccounted seasonal shocks might threaten the causal interpretation of our results. First, we showed in Table 2 that the two samples are strongly balanced across a large set of covariates. In addition, we show in Section 4.5 that while we observe seasonality in other domains besides food scarcity (e.g., festive events and weather shocks), these factors do not confound our analysis.

The results from the two-stage least squares regressions are reported in Table 4. We display estimates for the Full-, Limited-, Within-, and Village-sample. In Panel A, we show that the harvest is a first-order predictor of food scarcity. The associated F-values range between 26 and 35, which is evidence of a strong first stage. In Panel B, we outline the second stage estimates. The results show that scarcity significantly reduces cooperative behavior. The economic significance is substantial. Since scarcity is measured on a scale from 0 to 4, the linear estimates imply that going from no to constant scarcity would decrease investment levels from 3209 Tsh to 2105 Tsh, on average. Just like in the reduced form results in Table 3, the effect is even larger for the difference-in-difference estimation on the within-subject sample presented in column 3.

Table 4: Effect of food scarcity on investment

Panel A: First Stage				
Dep. Var.:	Food scarcity			
Sample:	Full	Limited	Within	Village
	(1)	(2)	(3)	(4)
Post-harvest Treatment	-0.937***	-0.907***	-1.125***	-0.920***
	(0.160)	(0.163)	(0.211)	(0.157)
Constant	1.473***	1.473***	1.063***	1.459***
	(0.156)	(0.156)	(0.125)	(0.152)
Observations	363	310	106	26
R-squared	0.169	0.152	0.687	0.621
Dep. Var. Mean	0.967	1.055	1.038	0.964
F-value	34.86	33.27	28.34	26.85
Individual F.E.	NO	NO	YES	NO
Panel B: Second Stage				
Dep. Var.:	Investment in the Investment Game			
Sample:	Full	Limited	Within	Village
	(1)	(2)	(3)	(4)
Food scarcity	-276.1**	-241.1**	-518.5***	-318.3***
	(124.0)	(114.9)	(161.0)	(122.8)
Constant	3209.2***	3157.5***	4259.3***	3233.2***
	(114.3)	(109.1)	(200.2)	(111.7)
Observations	363	310	106	26
Dep. Var. Mean	2942.1	2903.2	2849.1	2939.6
Individual F.E.	NO	NO	YES	NO

Cluster-robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4 displays instrumental variable regression estimates of the effect of food scarcity on investment in the Investment Game. Food scarcity is operated as a continuous variable ranging from 0 (no food scarcity in the past month) to 4 (constant food scarcity in the past month) and is instrumented by a dummy for participating in the Investment Game after the harvest. Individual F.E. indicates Individual Fixed Effects. All specifications report standard errors clustered at the level of wards.

4.5 Addressing potential confounders

In this subsection we address concerns that time-varying factors other than food scarcity may have influenced our findings. Based on the existing literature and on the specific context of our study, we identified four key factors which varied between the pre- and post-harvest season (see Figure A3 in Appendix C.1) and may have influenced changes in cooperative behavior. First, the harvest relaxes financial constraints as well as constraints on the availability of food (Aksoy and Palma 2019). Many farmers grow cash crops and one may hypothesize that it is the greater availability of money, rather than increased abundance of food, that changes people's decisions in the game. Second, more resources – and a lower workload –

could improve people's cognitive abilities, as shown by Mani et al. (2013), and this may in turn affect behavior in the game by simply improving understanding. Third, the pre- and post-harvest periods coincide with social events such as weddings and festivities, as well as Ramadan. Since festivities may change behavior for reasons unrelated to food scarcity, in what follows we control for these events and study whether this changes our estimates. Finally, seasonal variation in other kinds of adverse shocks may also influence the results. Our study took place at the onset of the Covid-19 pandemic, and we therefore test whether worries about the virus may have influenced investment behavior differentially across the two survey rounds. We also test whether other shocks such as extreme weather events played a role.

Table 5: Addressing potential confounders

Dep. Var.:	Investment in the Investment Game							
Alternative explanation:	Financial scarcity (1)	Financial security (2)	Work load (3)	Cognitive ability (4)	Ramadan effect (5)	Covid-19 worry (6)	Festive events (7)	Adverse events (8)
Post-harvest Treatment	252.9**	259.0**	264.8**	266.8**	300.5*	283.4**	211.6*	269.0**
	(119.7)	(125.7)	(120.2)	(126.9)	(151.3)	(124.9)	(117.2)	(116.2)
Financial scarcity	-14.86							
	(55.84)							
Savings		0.0726						
		(0.0596)						
Current Loans		280.7*						
		(157.3)						
Work load			13.92					
			(24.08)					
Correct RM				17.81				
				(29.33)				
Muslim					167.9			
					(146.5)			
Muslim × Post-harvest Treatment					-129.6			
					(250.6)			
Covid-19 worry						82.47**		
						(36.63)		
Other celebrations							-291.1	
							(209.3)	
Religious celebrations							-150.0	
							(199.0)	
Wedding							84.31	
							(179.9)	
Lost livestock								-27.09
								(173.9)
Property theft								-90.35
								(225.9)
Family death								1075.9***
								(136.6)
Family illness								68.75
								(191.7)
Extreme weather								17.75
								(131.0)
Constant	2832.8***	2730.6***	2711.2***	2737.1***	2752.1***	2530.5***	3278.2***	2709.2***
	(153.5)	(120.5)	(180.0)	(169.8)	(122.6)	(169.1)	(494.5)	(309.5)
Observations	363	363	363	363	363	360	314	363
R-squared	0.0114	0.0215	0.0121	0.0120	0.0132	0.0218	0.0223	0.0268
Dep. Var. Mean	2942.1	2942.1		2942.1	2942.1	2938.9	2955.4	2942.1

Cluster-robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5 displays OLS regression estimates of the effect of the Post-harvest treatment on investment in the Investment Game. All specifications report cluster-robust standard errors at the village-round level.

Table 5 shows that the range of hypothesized confounders had little or no impact on the baseline results. In Appendix C.5, we further corroborate these insights by adding a large battery of controls (Table A5) and documenting the stability of the effect of the harvest, as well as of food scarcity, on investment. Moreover, since assignment into the pre- and post-harvest sample was random by nature, we can study the effect by means of randomization inference. In Figure A6, we show that the effect of the post-harvest treatment does not rely on the distributional assumptions invoked in OLS regressions; the effect is estimated at the same level of statistical significance also when using randomization inference. While it is impossible to ensure that all the potential confounders are accounted for, the stability of the post-harvest effect across specifications is reassuring. In the following section, we further strengthen the interpretation of the scarcity effect by presenting results from our experimental manipulations.

4.6 Experimental manipulations

Next, we use our experimental manipulations to explore two channels that may play an important role in aggravating the effect of food scarcity on cooperation. First, we study whether the effect becomes stronger when scarcity is more salient in respondents' minds. Second, we investigate whether scarcity is more harmful for cooperation with people who are not from the same village and hence typically fall outside the participant's network of support.

4.6.1 Perceived scarcity

According to the work by Shah, Mullainathan, and Shafir (2012) and Shah, Shafir, and Mullainathan (2015), the psychology of scarcity is not only driven by the actual state of scarcity; rather, a scarcity mind-set can be activated or deactivated dependent on the current *saliency* of scarcity. As a consequence, we should expect that shifting attention towards present scarcity should lower cooperation further. To test this proposition, we experimentally exposed a subset of participants' to a scarcity prime which intended to make the state of scarcity more salient. The prime was a survey section asking respondents questions about

consumption, relative wealth, and food shortages they may have recently experienced. Half of the respondents played the Investment Game *after* answering these questions, whereas the other half played *before* being exposed to them.

In Table 6, we study the effect of food scarcity under the different experimental manipulations. In the full sample (column 1), we document a negative and significant relationship between scarcity and investments. When we restrict the sample to participants that were subject to the scarcity prime (column 2), the effect is substantially larger in magnitude, indicating that food scarcity matters especially when participants are primed on their current levels of consumption. In columns 3 and 4 we show that the interaction effect between food scarcity and the scarcity prime is negative but statistically insignificant. In conclusion, our findings indicate that priming participants on their current levels of consumption can aggravate the effect of food scarcity on investments, but the effect of the experimental manipulation is not estimated with sufficient precision.

Table 6: The moderating effects of the Scarcity- and Ingroup primes

Dep. Var.:	Investment in the Investment Game						
Manipulation:		Scarcity prime			Outgroup prime		
Sample::	Full	Prime	Full	Full	Outgroup	Full	Full
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Food scarcity	-138.4**	-214.0**	-63.98	-45.35	-179.8*	-89.55	-88.10
	(61.07)	(85.19)	(76.36)	(79.25)	(96.26)	(69.67)	(73.65)
Scarcity prime			90.05	102.6			
			(131.0)	(131.0)			
Scarcity prime			-150.0	-172.1			
× Food scarcity			(103.4)	(102.6)			
Outgroup prime						51.99	17.12
						(140.1)	(132.8)
Outgroup prime						-90.22	-77.59
× Food scarcity						(121.1)	(121.4)
Constant	3075.9***	3129.0***	3039.0***	3553.3***	3100.8***	3048.8***	3579.4***
	(69.57)	(84.77)	(103.6)	(386.8)	(90.22)	(105.7)	(386.5)
Observations	363	174	363	363	183	363	363
R-squared	0.0166	0.0390	0.0220	0.0498	0.0282	0.0186	0.0447
Dep. Var. Mean	2942.1	2896.6	2942.1	2942.1	2918.0	2942.1	2942.1
Controls	No	No	No	Yes	No	No	Yes

Cluster-robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6 displays OLS regression estimates of the effect of the Scaricty and Ingroup primes on investment in the Investment Game. Food scarcity ranges from 0 (no food scarcity in the past month) to 4 (constant food scarcity in the past month). Controls includes the following variables: (1) Age, (2) Years in Village, (3) Gender, (4) Tribe fixed effects, and (5) Religion fixed effects. All specifications report cluster-robust standard errors at the village-round level.

4.6.2 Ingroup differentiation

Finally, we study how the effect of scarcity on cooperation varies depending on the identity of the second player. Previous research has suggested that resource scarcity can enhance group differentiation and animosity (e.g. Krosch and Amodio 2014), and recent evidence points to the conclusion that scarcity could exacerbate the negative effects of diversity on cooperation (Schaub, Gereke, and Baldassarri 2020). In our context, such a mechanism would lead to food scarcity having a stronger negative effect on cooperation when the second player is from the outgroup compared to when the second player is part of the ingroup. To investigate this, we experimentally varied the identity of the second player between someone from *the local village* and from *another part of Tanzania*.[7]

We find only suggestive evidence that scarcity is more damaging for cooperation towards outgroup members. In column 5 of Table 6, we show that food scarcity is associated with *lower* investment levels when the second player is from the outgroup relative to the baseline sample (column 1). Put simply, participants that experience scarcity send less money on average, but the reduction is *larger* when they are matched with an outgroup member. To investigate whether the difference is statistically significant, we re-run the analysis over the entire sample and add an interaction term between the outgroup prime and being exposed to scarcity (column 6 and 7 of Table 6). While the interaction term is negative (indicating that people are less cooperative with outgroup members), it is imprecisely estimated and we cannot conclude that scarcity is more damaging for cooperation towards outgroup members.

In Appendix C.4, we also investigate how trust in the ingroup and outgroup, respectively, influences investment levels in the two experimental treatments. As expected, higher self-reported trust in the ingroup is associated with higher investment when the subjects are paired with an ingroup member. Similarly, higher outgroup trust increases investment when subjects are paired with an outgroup member. We next consider a measure of parochial trust, which we define as trust in the ingroup minus trust in the outgroup (see Figure A5), and introduce it in an interaction term with the ingroup treatment. We find that respondents who declare trusting ingroup members more than outgroup members are more cooperative

7. Since networks of support are often built within a village, this strategy captures a salient ingroup vs outgroup distinction.

with ingroup members in the game, and vice versa.

4.7 Does cooperation pay off?

Throughout the analysis, we have considered higher investment in the game as a positive result since it is the socially efficient option (the total payoff triples when invested). To conclude the results section, we investigate whether cooperation is also privately profitable for investors. Upon deciding how much to invest, Player A faces the risk that Player B may send back less than the invested amount. The degree to which the investment pays off, therefore, is conditional on reciprocation.

In Figure 6, we show the distribution of amounts returned by Player Bs when Player A invests 2,000 and 4,000 Tsh, respectively. The choices of Player Bs were elicited by means of the strategy method, meaning that participants did not know the actual sum invested but made conditional choices for the different possible scenarios.

Figure 6: Return on investment

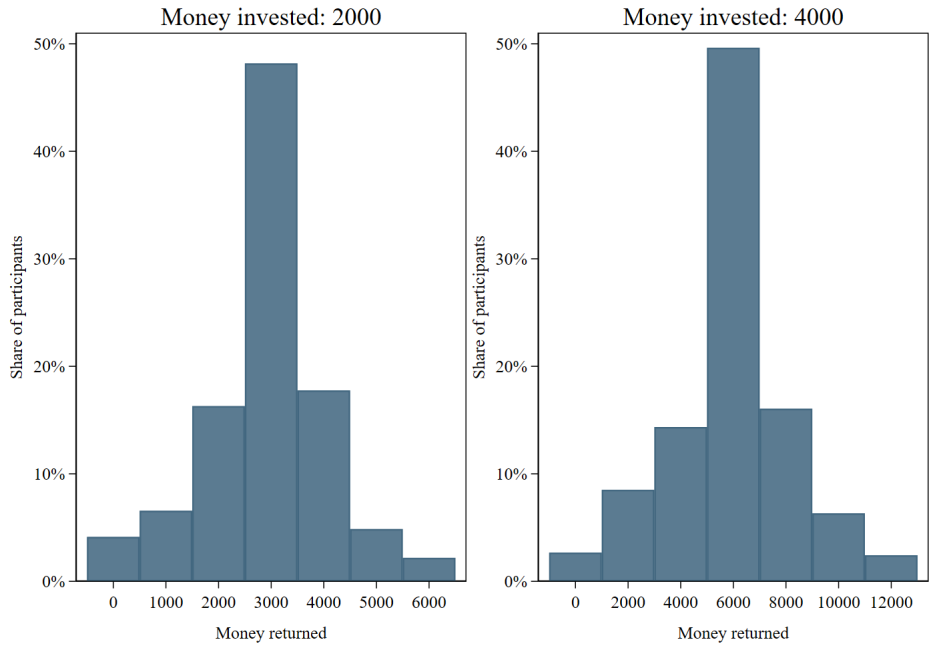


Figure 6 displays the distribution of money sent back by Player B for investments by Player A of 2,000 Tsh and 4,000 Tsh, respectively.

Figure 6 confirms that investing did pay off in expectation. For Player A, the decision to keep the money, e.g. not to invest, would result in a secure payoff of 4,000

Tsh. If half instead was invested, the expected payoff would be 4,922 Tsh (the 2,000 the participant did not invest, plus an average expected return of 2,922 Tsh). If all 4,000 Tsh were invested, the participant would in expectation receive a payoff of 5,931 Tsh. However, investing entailed risks, since Player B in some cases decided to send back less than the initial investment.

5 Discussion

The present study has shown that scarcity of food can depress socially efficient cooperation. Prior to the harvest – in a state of scarcity – farmers were less likely to make an investment that could benefit both themselves and another participant in the economic experiment. In line with Mullainathan and Shafir (2013), we hypothesize that this pattern is due to safer but low yielding options (not investing) becoming relatively more attractive in times of scarcity. The effect was lower realized payoffs of both senders and receivers in the lean season relative to the abundant season. The harvest served as a great (albeit temporary) leveler between rich and poor, both in terms of food consumption and in terms of investment behavior. In fact, after the harvest, the relatively poorer farmers were no less likely to invest.

Our findings bear important insights for both researchers and policy makers. Communal cooperation is essential for the efficient functioning of local economies, not least in rural developing contexts which lack strong formal institutions. Cooperation is conducive to economic growth, but may also be a by-product of improved economic conditions, in that economic slack enables people to afford the risks that cooperative behavior entails. This study supports the latter channel and is the first one, to the best of our knowledge, that documents a causal link between food scarcity and cooperation. If a shortage of food brakes down local networks of cooperation, this means that scarcity, even if temporary, can induce more scarcity in the future. By uncovering the detrimental impacts that deprivation can have on agents' willingness to invest, we make an important contribution to our understanding of behavioral poverty traps.

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Appendix

A Sampling strategy

In order to reduce idiosyncratic variation due to sampling error, we visited 12 villages from 12 different wards (a ward is a political unit consisting of several villages) in the first wave, and 14 villages in 14 different wards (12 of which were the same as in the preceding surveying wave) in the second wave. The 12 wards in the pre-harvest wave (6 from the Manyoni district and 6 from the Ikungi district, respectively) were selected by means of simple randomization from the universe of relevant and accessible wards in Ikungi (23 wards) and Manyoni (20 wards). 1 village was sampled from each of the selected wards and the resulting 12 villages constituted the sample of the first wave. In the second wave, we randomly selected 8 of the wards from the first wave and drew new villages to survey. This way, we ensured that the villages in the pre- and post-harvest samples were as similar as possible. Moreover, in order to allow for a within-subject analysis, we revisited the same villages in the remaining 4 wards and re-interviewed the same participants from the first round. Lastly, we complemented the second round with two randomly selected villages from wards that were not included in the first sample. The sampled wards and villages are shown in Table A1.

Table A1: Sample of villages and wards in the first and the second round

District	Ward	Village round 1	Village round 2
Ikungi	Sepuka	Musimi	Musimi
Ikungi	Iglansoni	Mnyange	Mnyange
Ikungi	Ighombwe	Ighombwe	Msosa
Ikungi	Ihanja	Ihanja	Chungu
Ikungi	Issuna	Tumaini	Ng'ongosoro
Ikungi	Mang'onyi	Mang'onyi	Sambaru
Ikungi	Mtunduru	–	Mtunduru
Manyoni	Kintinku	Kintinku	Kintinku
Manyoni	Sasilo	Chisingisa	Chisingisa
Manyoni	Chikola	Itetema	Winamila
Manyoni	Isseke	Igwamadete	Isseke
Manyoni	Mkwese	Kinyika	Mitoo
Manyoni	Muhalala	Kapiti	Muhalala
Manyoni	Makutopora	–	Mbwasa

Table A1 displays the sampled villages, as well as the wards and districts from which they are drawn.

B Experimental procedure

B.1 Location of the experiment and introduction

Enumerators visited participants in their homes, and found suitable locations for the interviews in the vicinity (a quiet place where the respondent could answer the questions without being disturbed or influenced by other family members). The interviews were conducted on tablets using KoBo, a survey software. Participants were informed that the survey was part of an international research project, but not about the research focus. Moreover, they were told that the survey included three games which would determine the payoffs they received. In total, participants could earn a minimum of 1,000 Tsh ($\approx$ 0.44 USD) and a maximum of 31,000 Tsh ($\approx$ 13.5 USD). The analysis in this game is focused entirely on the Investment Game.

B.2 Game instructions

The Investment Game was explained to respondents using the following script. The game was played at the beginning of a questionnaire (after some basic questions on demographic characteristics), except for the group that received our random prime. In that case, the game instructions followed a module with questions aimed at capturing scarcity of food and income.

Player A instructions: In this game, you are paired with another respondent from *YOUR VILLAGE / ANOTHER PART OF TANZANIA*. You will not know who this player is, and he/she will not know who you are, except that you are from the *SAME VILLAGE / ANOTHER PART OF TANZANIA*. We will simply call him or her Player B. You begin the game with 4000 Tsh, which are yours. You own a farm together with player B, who begins the game with 0 Tsh.

You have to decide how much money to spend on seeds. The seeds you will buy will be planted and produce a harvest. The harvest will be sold by Player B, who will decide how to divide the money between the two of you. You have the following three options:

(1) You buy 4 000 Tsh worth of seeds. This investment yields 12 000 Tsh when the harvest is sold. Player B then decides how these 12 000 are divided between the two of you. Player B can take as much from this sum as he/she wants, and what is left will be yours.

(2) You keep 2 000 Tsh and buy 2 000 Tsh worth of seeds. This investment yields 6 000 Tsh when the harvest is sold. Player B then decides how these 6 000 are divided between the two of you. Player B can take as much from this as he/she wants, and what is left will be yours. You will at a minimum receive the 2 000 you kept.

(3) You keep all 4 000 Tsh and do not buy any seeds. With no investment, Player B doesn't receive any money. You will receive the 4 000 that you kept.

Let's try to think of some examples:

- If you decide to buy 4,000 worth of seeds, how much does the investment yield?
- If you decide to buy 4,000 worth of seeds and Player B keeps 6 000 Tsh, how much do you get?
- If you decide to buy 4,000 worth of seeds and Player B keeps all the money obtained from selling the harvest, how much do you get?
- If you decide to buy 2,000 worth of seeds, how much does the investment yield?
- If you decide to buy 2,000 worth of seeds and Player B keeps 2 000 Tsh, how much do you get?
- If you decide to buy 2,000 worth of seeds and Player B keeps all the money obtained from selling the harvest, how much do you get?
- If you keep 4 000 Tsh and do not buy any seeds, how much do you get?
- If you keep 4 000 Tsh and do not buy any seeds, how much does Player B get?

Now - please make your decision. Would you like to invest 4 000 (Option 1), invest 2 000 and keep 2000 (Option 2), or keep your 4 000 Tsh and not invest (Option 3)?

Player B instructions: In this game, you are paired with another respondent from *YOUR VILLAGE / ANOTHER PART OF TANZANIA*. You will not know who this player is, and he/she will not know who you are, except that you are from the *SAME VILLAGE / ANOTHER PART OF TANZANIA*. We will simply call him or her Player A. You begin the game with 0 Tsh. You own a farm together with player A, who begins the game with 4 000 Tsh. Player A had to make a decision on how much money to spend on seeds by picking one of the following options:

(1) Buy 4 000 Tsh worth of seeds. If Player A chose this option, the investment would yield 12 000 Tsh when the harvest was sold. You decide how these 12 000 are divided between the two of you. Player A knew that you can decide to take as much from this sum as you want, and what is left will belong to him/her.

(2) Keep 2 000 Tsh and buy 2 000 Tsh worth of seeds. If Player A chose this option, the investment would yield 6 000 Tsh when the harvest was sold. You decide how these 6 000 are divided between the two of you. Player A knew that you can decide to take as much from this sum as you want, and what is left will belong to him/her (on top of the 2 000 he/she decided to keep).

(3) Keep all 4,000 Tsh for himself/herself, and not buy any seeds. If Player A chose this option, he/she knew that would receive 4 000, and that you would not receive any money.

Let's try to think of some examples:

- If Player A decided to buy 4 000 Tsh worth of seeds, how much did the investment yield?
- If Player A decided to buy 4 000 Tsh worth of seeds, and the harvest yielded 12 000, how much does Player A get if you keep 4 000 Tsh?
- If Player A decided to buy 2 000 Tsh worth of seeds, and the harvest yielded 6 000, how much does Player A get if you keep 2 000 Tsh?
- If Player A decided to buy 2 000 Tsh worth of seeds, how much did the investment yield?
- If Player A decided to buy 4 000 Tsh worth of seeds, and the harvest yielded 12 000, how much does Player A get if you keep 8 000 Tsh?
- If Player A decided to buy 2 000 Tsh worth of seeds, and the harvest yielded 6 000, how much does Player A get if you keep 4 000 Tsh?
- If Player A decided not to buy any seeds and keep all the 4,000 for himself/herself, how much do you get?

How would you divide the money from selling the harvest between the two of you, if Player A chose to buy 4 000 Tsh worth of seeds, which yielded 12 000?

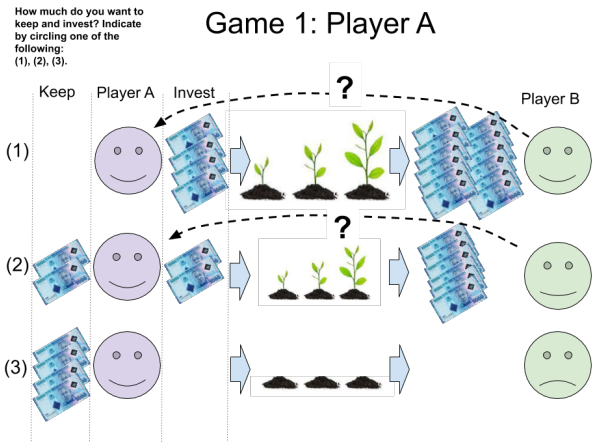
How would you divide the money from selling the harvest between the two of you, if Player A chose to buy 2 000 Tsh worth of seeds, which yielded 6 000?

B.3 Visual aids

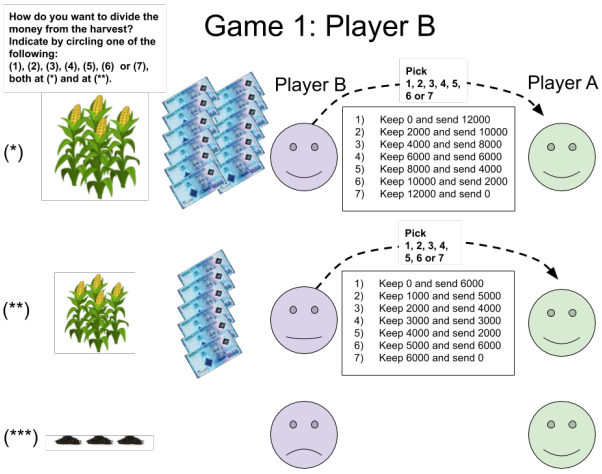
The game was explained by means of the visual aid shown in Figure A1. A copy of the visual aid was handed to the respondent and it also served the purpose of an answer sheet. Respondents were instructed to go to a private space and to make their decision by circling their preferred option. When this was done, they were told to fold the paper before returning it. The enumerator would then save the sheet, but not look at it in the presence of the participant.

Figure A1: Visual Assistance Investment Game

(a) Game Sheet Player A



(b) Game Sheet Player B



The survey also contained a Dictator Game and a Dice Game (to measure honesty). This paper focuses only on the Investment Game.

Figure A2: Questions contained in the Scarcity prime

- Over the past month, how often, if ever, have you or anyone in your family gone without any money left?
- Over the past month, how often, if ever, have you or anyone in your family gone without enough food to eat?
- Over the past month, how often, if ever, have you or anyone in your family gone without enough clean water for home use?
- Which of these periods is normally the worst for you in terms of food?
- Which of these periods is normally the worst for you in terms of net income (the food/cash you have after covering all your expenses)?
- How many meals does your household usually have per day?
- In the past 30 days has your household ever had fewer meals than this usual number?
- If Yes, how many days?
- In the past week how many days did the household consume meat or fish?
- How rich or poor is your household in comparison with other households in the village?

Figure A2 displays the survey items which constitute the scarcity prime.

B.4 Pre-registration and pilot study

The project was pre-registered in the American Economic Association registry for randomized controlled trials (ID: *AEARCTR-0005794*). The underlying power analysis was based on a pilot study conducted in 2 villages that were not part of the study sample.

C Results

C.1 Seasonal variation

Figure A3: Seasonal variation

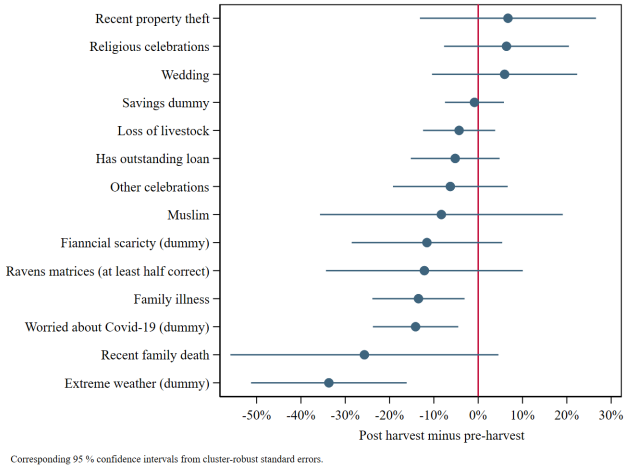


Figure A3 shows a number of potentially confounding factors that vary across the pre- and post-harvest samples. The confidence intervals are computed based on standard errors clustered at the village-round level.

Figure A4: Farmers have fewer meals than normally before the harvest

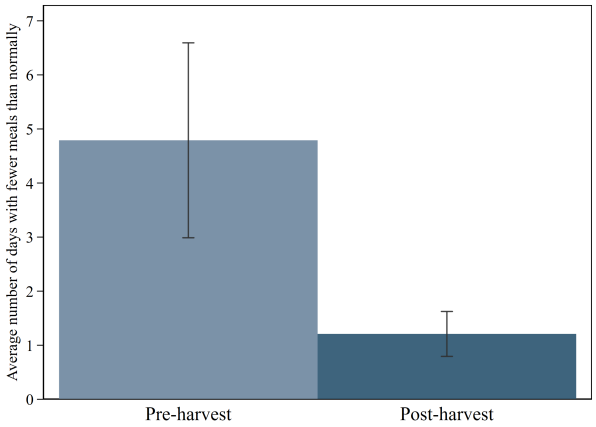


Figure A4 shows the average number of days over the previous month when the respondent's household had *fewer* meals than normal, before and after the harvest. The exact question was: "In the past 30 days has your household ever had fewer meals than this usual number? If Yes, how many days?". The confidence intervals are computed based on standard errors clustered at the village-round level.

C.2 Does food or financial scarcity matter?

In Table A2, we report regression estimates where investment is the dependent variable and food scarcity, as well as financial scarcity, the regressors. The results document a significant negative correlation between food scarcity and investment. In other words, participants that experience *more* food scarcity invest *less*. Conversely, there is no link between financial scarcity and investment. While the sign is negative, the estimated effects are both small in magnitude and statistically insignificant. This difference attests to the notion that food scarcity is a more severe form of scarcity (as per the discussion in Section 1 and in Schofield 2014).

Table A2: Correlations between scarcity and cooperation

Dep. Var.:	Investment			
	OLS (1)	OLS (2)	OLS (3)	OLS (4)
Food scarcity	-138.4**	-131.2**		
	(60.30)	(62.03)		
Financial scarcity			-33.14	-5.972
			(54.30)	(55.07)
Constant	3075.9***	3606.9***	3002.9***	3510.1***
	(75.28)	(373.4)	(110.1)	(387.9)
Observations	363	363	363	363
R-squared	0.0166	0.0429	0.00102	0.0287
Dep. Var. Mean	2942.1	2942.1	2942.1	2942.1
Controls	No	Yes	No	Yes

Cluster-robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A2 displays OLS regression estimates of Food scarcity and Financial scarcity, respectively, on investment in the Investment Game. Food and Financial scarcity range from 0 (no scarcity in the past month) to 4 (constant scarcity in the past month). The wording of the Financial scarcity survey item was: "Over the past month, how often, if ever, have you or anyone in your family gone without any money left?". Controls include the following variables: (1) Age, (2) Years in Village, (3) Gender, (4) Tribe fixed effects, and (5) Religion fixed effects. All specifications report cluster-robust standard errors at the village-round level.

C.3 First stage results

Table A3: Effect of the Harvest on Scarcity

Dep. Var.:	Food scarcity			Financial scarcity		
	Ologit (1)	OLS (2)	OLS (3)	Ologit (4)	OLS (5)	OLS (6)
Post-harvest Treatment	-1.631***	-0.920***	-0.932***	-0.606***	-0.393***	-0.394***
	(0.209)	(0.111)	(0.110)	(0.189)	(0.121)	(0.118)
Constant		1.456***	1.260***		2.041***	1.502***
		(0.0915)	(0.333)		(0.0849)	(0.350)
Observations	365	365	365	365	365	365
R-squared	–	0.164	0.217	–	0.0281	0.103
Dep. Var. Mean	0.962	0.962	0.962	1.830	1.830	1.830
Controls	No	No	Yes	No	No	Yes

Cluster-robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A3 displays Ologit and OLS regression estimates of the effect of the harvest on a measure of food and financial scarcity. Food and Financial scarcity range from 0 (no scarcity in the past month) to 4 (constant scarcity in the past month). The wording of the Financial scarcity survey item was: "Over the past month, how often, if ever, have you or anyone in your family gone without any money left?". Controls include the following variables: (1) Age, (2) Years in Village, (3) Gender, (4) Tribe fixed effects, and (5) Religion fixed effects. All specifications report cluster-robust standard errors at the village-round level.

C.4 Additional results

Figure A5: Parochial trust

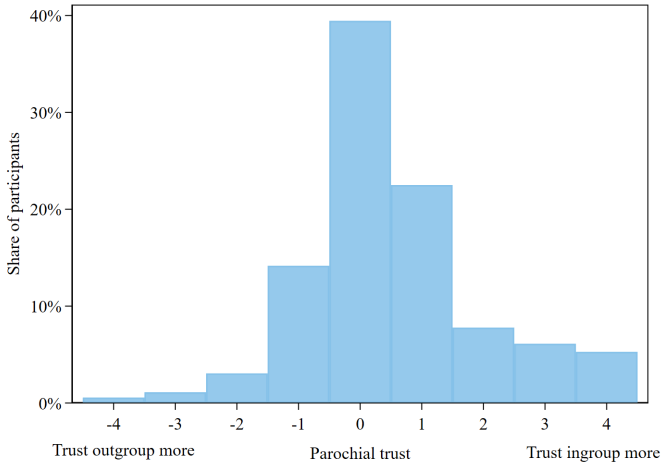


Figure A5 shows the distribution of parochial trust. Parochial trust is defined as trust in people from the village (a scale from 1 to 5) minus trust in people from other parts of Tanzania (also a scale from 1 to 5). In other words, positive parochial trust means that participants trust the ingroup more than the outgroup, and a negative number indicates the reverse.

Table A4: The association between trust and investment

Dep. Var.:	Investment in the Investment Game			
Sample:	Ingroup prime	Outgroup prime	Full	Full
	(1)	(2)	(3)	(4)
Ingroup trust	174.5***			
	(39.45)			
Outgroup trust		137.7**		
		(64.62)		
Ingroup prime			-75.50	-48.42
			(139.5)	(131.2)
Parochial trust			-147.7**	-137.7**
			(59.14)	(63.54)
Ingroup prime			246.0***	245.0***
× Parochial trust			(71.50)	(75.84)
Constant	2375.2***	2535.7***	2979.4***	3533.4***
	(135.5)	(231.2)	(100.8)	(375.3)
Observations	180	183	363	363
R-squared	0.0390	0.0191	0.0221	0.0499
Dep. Var. Mean	2966.7	2918.0	2942.1	2942.1
Controls	No	No	No	Yes

Cluster-robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A4 displays OLS regression estimates of the association between trust and investment. Ingroup trust is defined as trust in people from the village (a scale from 1 to 5), whereas outgroup trust as trust in people from other parts of Tanzania (also a scale from 1 to 5). Controls include the following variables: (1) Age, (2) Years in Village, (3) Gender, (4) Tribe fixed effects, and (5) Religion fixed effects. All specifications report cluster-robust standard errors at the village-round level.

C.5 Robustness checks

Table A5: Effect of scarcity on cooperation: additional controls table

Dep. Var.:	Investment in the Investment Game					
	OLS (1)	OLS (2)	OLS (3)	OLS (4)	OLS (5)	OLS (6)
Post-harvest Treatment	234.6**	244.4**	240.5**			
	(102.3)	(90.36)	(99.31)			
Food scarcity				-121.3*	-118.6*	-133.0**
				(64.56)	(61.75)	(57.90)
Constant	3112.3***	3634.5***	4932.9***	3355.0***	3865.2***	5237.2***
	(115.4)	(332.2)	(789.5)	(88.99)	(324.2)	(796.2)
Observations	363	363	363	363	363	363
R-squared	0.0317	0.0637	0.117	0.0351	0.0658	0.121
Dep. Var. Mean	2942.1	2942.1	2942.1	2942.1	2942.1	2942.1
Ward F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Religion F.E.	No	Yes	Yes	No	Yes	Yes
Ethnic group F.E.	No	Yes	Yes	No	Yes	Yes
Age, Woman, Years in village	No	Yes	Yes	No	Yes	Yes
Education F.E.	No	No	Yes	No	No	Yes
Employment F.E.	No	No	Yes	No	No	Yes
HH head, HH adults, HH children	No	No	Yes	No	No	Yes

Cluster-robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Columns 1-3 of Table A5 display OLS regression estimates of the effect of the harvest on investment when subsequently adding a large battery of control variables. Similarly, columns 4-6 show the robustness of the relationship between food scarcity and investment levels. Food scarcity ranges from 0 (no scarcity in the past month) to 4 (constant scarcity in the past month). All specifications report cluster-robust standard errors at the village-round level.

Figure A6: Randomization inference

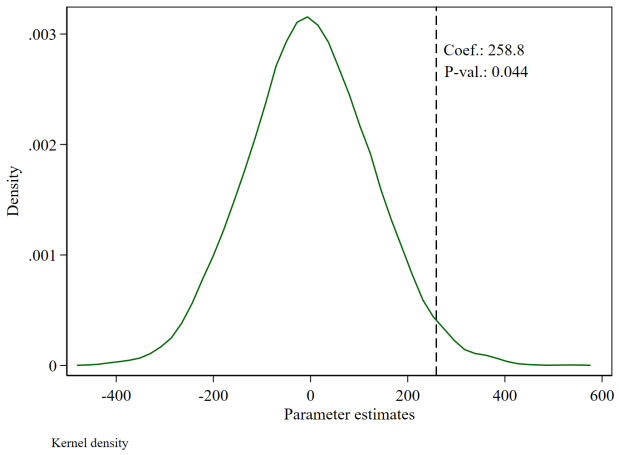


Figure A6 displays a kernel density from Randomization Inference estimations. The kernel is a distribution of post-harvest-betas obtained from 10,000 permutations of fictional treatment status. The vertical line shows the estimated effect of the actual treatment assignment, and the corresponding p-value indicates the probability that such an extreme value would be estimated by chance.