

dominant, pointing to budget set expansions and unambiguous welfare improvements. However, decreases in harvest season consumption have ambiguous welfare implications. They are consistent with dominant substitution effects but also with budget set contractions.

Unfortunately, due to a mis-communication, TLM assigned the wrong treatment for nine villages. To address this, we report our main results using only the intended assignment. We also report estimates for each NGO separately in the appendix (Tables A5 and A6). These estimates by NGO remain internally valid since each NGO managed two districts and random assignment was stratified by district. We believe the mis-assignment error is orthogonal to unobserved village characteristics. The assignment was performed by the authors who were based in the United States at the time of assignment. The treatment assignment was sent via email but one NGO mistakenly used the treatment assignment from an older email. When we estimate treatment effects by NGO, the results tend to be more significant for Alfa Omega villages than for TLM villages. This suggests our results are not driven by mis-assignment as there was no mis-assignment in Alfa Omega villages.

7 Results

We present our main results in Section 7.1, discuss robustness checks in 7.2, describe mechanisms in 7.3, and provide cost benefit calculations in 7.4.

7.1 Main results

Columns 1-3 of Table 2 report IV estimates for the storage treatment compared to the control group. Each pair of cells in this table reports an IV estimate of β_1 in equation 6 and its standard error. We report results using all post treatment seasons (column 1), lean seasons only (column 2) and harvest seasons only (column 3). Similarly, we report results for credit compared to the control group in columns 5 to 7. Columns 4 and 8, labeled N(All), report sample sizes for IV regressions using all seasons. We first discuss the impacts of storage and credit on consumption and reported income (Panel A). This is our main result. We then discuss effects on seasonal differences in consumption and income (Panel B), effects on food shortages (Panel C) and on health (Panel D).

The main result is an increase in the *Consumption and Income Index* by 0.246 units for storage (Panel A, column 1) and by 0.267 units in the harvest season for credit (column 7). For storage, the treatment effects are similar for both lean (0.188) and harvest seasons (0.277).³³ As discussed in Section 6, these increases, particularly in

Substitution effects are always positive for lean season consumption and negative for harvest season consumption. But income effects depend on whether goods are normal or inferior.

³³The harvest season effect is significant at the 5% level, but the lean season effect is not statistically significant. This is probably because, for storage, we have two post-treatment harvest season surveys

the harvest season, are consistent with dominant income effects coming from budget set expansions.

For storage, the increase in the *Consumption and Income Index* is driven by a 31.1% and a 33.2% increase in non-food expenditure in the lean and harvest seasons, respectively.³⁴ The most responsive expenditure margins are personal consumption goods. For credit, the increase in the *Consumption and Income Index* is driven by increases in reported income (66.2% in the harvest season).³⁵ As we do not observe decreases in consumption, the higher reported income is consistent with increases in the consumption of other goods not measured by us (this could include other food items, such as meat and seafood, or other non-food items).

We estimate precise zero effects on staple food consumption. The effect on calories consumed from staples is 1.4% (for storage) and 6% (for credit). When we repeat the regression in levels scaled to per capita per day units, we estimate a decrease of 4.484 calories per capita per day (for storage) and an increase of 124.4 calories (for credit). This is not due to a lack of variation in calories consumed. The control group has a baseline mean of 1360 calories per capita per day and a standard deviation of 853 calories (Table 1).

Given that the policy reduced the relative cost of lean season consumption, substitution effects should increase staple consumption in the lean season. However, we do not detect this increase. Moreover, transaction costs (which are likely to be significant for rural households) should bias us towards finding effects on staple consumption (relative to other goods), since our programs focus on staples, instead of vouchers or cash. This makes the null effects on staples more striking. We cannot rule out increases in other food items, including some sources of protein, due to data limitations. However, we did collect data on a few other food items (fruits, beans and cassava) and did not detect any changes on their consumption patterns.

As shown in Figure 2, the null treatment effects along the staple food margin are consistent with the marginal utility of staples diminishing more rapidly than marginal utilities of other forms of consumption. In our model, the generalized utility function is agnostic on this, but more specific functional form assumptions (such as quasilinear utility, a reasonable conjecture in this setting) could explain this pattern. These results suggest the average household could be close to staple food satiation. This would be consistent with the types of food preferences observed in Banerjee and Duflo (2007)

(rounds 4 and 6) but only one for the lean season (round 5).

³⁴This increase is large compared to the value of the storage equipment households received for free. Most households in the storage treatment received storage equipment valued between 47,000 Rp and 250,000 Rp. In each of the three post treatment survey rounds for storage, total non-food expenditure (per month per household) increased by 55,000 Rp, 76,000 Rp and 76,000 Rp, respectively. The overall cost-effectiveness, of course, depends on how we annualize these effects on monthly expenditures. We discuss this in Section 7.4.

³⁵The effect on reported income is mostly driven by increases in income from sales of harvest output rather than wages, remittances or gifts. This is consistent with the model. Credit offers a cheaper way to fund lean season consumption. If the household chooses not to raise lean season consumption (as in this case), it is now able to sell more of its harvest output to fund other forms of consumption.

and Jensen and Miller (2008). Now that we have discussed level effects, we turn to seasonal differences.

Panel B shows that credit has seasonal smoothing effects but storage does not. For storage, the effects on the *Seasonal Gap Index* are relatively precise zero effects (the 95% confidence interval ranges from -0.178 to 0.124 standardized units). For credit, the effect on the *Seasonal Gap Index* is statistically insignificant, but the absolute seasonal gap in the *log of monthly non-food expenditure items* declines by 0.16 units.³⁶ The mean seasonal gap in monthly non-food expenditure items for the control group in the baseline is 10,406 Rp. When we estimate treatment effects by survey rounds, we find that most of the decline occurs in the first cycle (|round 2-round 3|) and appears to be driven by decreases in harvest season consumption (round 2) and increases in lean season consumption (round 3). This is consistent with our discussion in Section 3.3 that explains features of the credit program that insure participants against harvest risk and storage risk, which could explain why credit appears to have stronger seasonal smoothing effects than storage. Turning to the *Food Shortage Index* in Panel C, we see that the effects are largely negative, but statistically insignificant.

Finally, Panel D reports health effects. For storage, the health effects are close to zero with relatively narrow confidence intervals (the 95% confidence interval ranges from -0.146 to 0.145 standardized units, Panel D, column 1). For credit, we find insignificant effects on health when we pool both seasons. Reported health is better in the lean season (the *Health Index* is 0.188 higher though this is not significant) but is worse in the harvest season (the *Health Index* is lower by 0.330 units). This is driven by a 10.5% higher likelihood of households reporting a difficulty to meet health expenditure payments, 0.185 more sick days per capita per month and a 0.6% higher likelihood that a household member reported any sickness in a month. While the deterioration in health in the harvest season is a concern, it is reassuring that the magnitudes are not large and that the overall health effects (using all seasons) are insignificant.

In summary, both storage and credit led to sizeable increases in the *Consumption and Income Index*, driven by increases in non-food expenditure and reported income but with zero effects on staple consumption. Credit had some seasonal smoothing effects (driven by smaller seasonal differences in monthly non-food expenditure items). But there was also moderately worse reported health in the harvest season, with no effects on overall health when we pool both seasons. Storage had zero seasonal smoothing and health effects. The effects on food shortages are inconclusive because the standard errors are too large.

7.2 Robustness checks

Table 3 reports robustness checks. Column 1 reports the main IV results of Table 2. Column 2 controls for the value of the dependent variable in the baseline. Column

³⁶When calculating seasonal differences, we only include differences in monthly non-food expenditure items (rent, utilities, health bills and personal consumption items).

3 adds baseline values for all household characteristics reported in Panel F of Table 1. These two specifications are included because we might be concerned that pre-determined differences shown in the balance checks reported in Table 1 are driving the treatment effect estimates. Column 4 reports OLS estimates. Columns 5 to 8 report similar robustness checks for credit.³⁷ For all specifications, we only report results that pool all seasons (instead of one table for each specification). The results for lean and harvest season surveys are broadly similar.

For both treatments, the results are robust across all specifications. The estimates for staple consumption remain close to zero and the consumption effects remain large for storage. For credit, the effect on income remains high for the harvest season (not reported). The OLS estimates are about half of the IV estimates (in line with take up rates that are around 40% for both treatments). Importantly, the results are robust to controlling for baseline differences (columns 2, 3, 6 and 7), suggesting the baseline differences reported in Table 1 are most likely due to sampling error, and that treatment versus control differences in post treatment outcomes are not caused by observed baseline differences.

7.3 Mechanisms

Other budget set effects

The main mechanism by which both programs expand budget sets is through the raising of the harvest-to-lean MRT. In the theory, the budget constraint (equation 2) included only agricultural endowments and assumed away other sources of revenue that could give rise to income effects, including wages and private transfers (gifts and remittances). We explore these potential mechanisms in Table 4.

We see that neither program affected other budget set factors, providing further support that the income effects above are directly due to the programs' effect on MRT. One concern is that the null staple effects might arise because our transfers are exactly offset or crowded out by other transfers. If this is true, then we should see decreases in the receipt of private transfers (gifts and remittances). Table 4 shows that the treatments did not affect these transfers (columns 1 and 2) nor did it affect wage income (column 3). Another concern is that staple consumption might have increased at the household level but not at the per capita level if household size increased. Column 4 shows that this is not the case.

Evidence of savings constraints loosening under storage

Further analysis suggests that the main mechanism behind the effects of storage on consumption is an alleviation of the savings constraint, as discussed in the model. We

³⁷We also tried estimating specifications with household fixed effects and testing for differences between treatment and control groups but the standard errors were large. Since treatment was randomly assigned at the village level, the household fixed effect specification that uses within household variation also loses much of the useful between-village variation.

have two pieces of suggestive evidence. First, we conducted a heterogeneous treatment effects analysis for households that are ex ante savings constrained versus households that are not. As discussed in Section 3.2, we expect stronger effects for households with below median retention rates (our proxy for households who are more likely savings constrained) because income effects are driven by expansions in the budget set. The magnitude of this expansion depends on differences between the baseline retention rates and $\bar{\gamma}$ (the retention rate under the new storage technology), where the improvement will be more significant for households with lower baseline retention rates. Indeed, Table A4 in the appendix shows that the effect is mostly concentrated amongst households who are ex ante savings constrained (the interaction terms with indicators for low-retention-rate households are statistically significant).³⁸ We explain the heterogeneous treatment effect regressions in the appendix.

Second, we investigate another proxy for savings constraints—the need to contribute to neighbors’ festival expenditures. Storage participants could circumvent this constraint by committing to store harvest for the lean season. To test this, we calculate the share of a household’s annual festival expenditures that is used for neighbors’ festivities. We find that storage participants report a 9% reduction in this share for all villages (though this is not significant) and a 22.2% reduction in Alfa Omega villages (1% sig.). This reduction for Alfa Omega villages is consistent with the mechanism described above, where commitment (formal or informal) associated with storage raised storage retention rates, γ .

7.4 Cost benefit analysis

We calculate the benefits-to-program cost ratio, which provides one way to compare our programs to others. Our preferred estimate for the numerator (benefits) is the annualized effect on consumption and income levels. This misses other effects (such as food shortages, health and seasonal smoothing effects) that are harder to monetize without estimating household preferences. However, it has the advantage of being transparent and comparable to other papers. For the denominator (program costs), our preferred estimate includes the average procurement costs per household (326,366 Rp for storage and 727,488 Rp for credit, as discussed in Section 4).

To calculate annualized benefits for storage, we use the result that storage had statistically significant effects on $\ln(\text{Non-food expenditures})$ in both harvest and lean seasons (Table 2, Panel A). We repeated the exercise using monthly non-food expenditure levels for households (this includes observations with zero non-food expenditures, which is more conservative). The IV estimate of the treatment effect on monthly non-food expenditures for households is 70,000 Rp.³⁹ The annualized benefit, then, is (70,000

³⁸To construct baseline retention rates, we need pre-treatment data for both harvest and lean seasons (round 2 and round 3 for storage). We cannot construct baseline retention rates for credit since there is no pre-treatment harvest data.

³⁹For the cost-effectiveness calculations, we use effects on consumption and income at the household level because the cost measures are calculated at the household level (we take total program costs divided

Rp)*2 because expenditures increased statistically significantly for both harvest and lean season surveys, suggesting that, at minimum, the treatment effect led to improvements in two months per year.

Therefore, the benefit-to-cost ratio for storage, using annualized benefits and average procurement costs, is 43% (=140,000 Rp/326,366 Rp). This measure implies that improvements in monthly non-food expenditures would cover the upfront cost of the program used to purchase the storage equipment within 2.3 years.

For credit, the benefit-to-cost ratio is 53%. Credit had a statistically significant effect on $\ln(\text{Reported income})$ in the harvest season. The IV estimate of the treatment effect on quarterly household income is 389,000 Rp. Therefore, the benefit-to-cost ratio is 53% (=389,000/727,488), assuming the effect on income lasts only one quarter. This measure implies that improvements in quarterly household income would cover the upfront cost of the program used to purchase the seed capital within 1.9 years (calculated as 727,488/389,000).

A critical parameter is how sustainable our treatment effects are. The longer the benefits persist, the more we can amortize the upfront procurement costs, which would increase the benefit-to-cost ratios. One limitation of our study is that we only have surveys over a three-year span. Within our study period, our estimates suggest largely positive effects for each round of survey post treatment (but the standard errors are large if we do not pool the post treatment surveys). Moreover, the persistently high repayment rates (even when there were widespread harvest failures) suggest that the credit program can be sustainable over multiple years. Therefore, we make the conservative assumption that our programs' benefits persist for two years (because we only surveyed households for 2 years, post treatment).⁴⁰ If we use annuitized procurement costs in the denominator, the benefit-to-cost ratios are 74% for storage and 93% for credit.

We benchmark these estimates against those for Raskin, a large rice subsidy program in Indonesia (discussed in Section 2). Tabor (2005) estimates that the transfer benefit per unit cost for Raskin is 52% for targeted beneficiaries. This assumes a leakage rate of 16%. However, the The World Bank (2005) estimates that only 18% of the Raskin budget translates into a subsidy for poor households, suggesting a higher leakage rate. With a higher leakage rate, the benefit-to-cost ratio for Raskin would be lower than 52% because fewer benefits are reaching the targeted beneficiaries (the numerator is lower).

We also compared our estimates to other in-kind and cash transfer programs. Hodinott, Skoufias, and Washburn (2000) report that consumption for Mexican households receiving *Oportunidades* benefits valued at 197 pesos per month increased by 151 pesos, translating to a benefit-to-cost ratio of 77%. Importantly, rice subsidies,

by total number of participants, which is the total number of households since each household can only have one participant).

⁴⁰We calculated this by annuitizing the procurement costs reported above using a discount rate of 10% (a standard assumption in the literature). The annuitized procurement costs for storage and for credit were 188,049 Rp and 419,172 Rp per household, respectively.

cash and in-kind transfers are financed by per-period costs (equivalent to the cost of the transfers) while our programs are financed from one-time costs to procure seed capital and storage equipment, which can be amortized over time if benefits are persistent.

In summary, our benefit-to-cost estimates for storage and credit are 43% and 53% respectively. These numbers are comparable to the 52% estimate for Raskin and the 77% estimate for Oportunidades, except, the denominator of our benefit-to-cost ratios include one-time procurement costs. Amortizing procurement costs over 2 years (a conservative assumption) increases our benefit-to-cost ratios to 74% for storage and 93% for credit.⁴¹

8 Conclusion

This paper focuses on the problem of seasonal food security for rural agricultural households. We use a simple consumption-savings model to frame the problem. Farmers with seasonal incomes must rely on savings or credit technologies to transfer assets across seasons. Under savings constraints (in kind and in cash) and credit constraints, the opportunity cost of lean season consumption is high. We describe this as a case of seasonal frictions, which are encapsulated by a harvest-to-lean season MRT of food that is smaller than one.

As described in Section 1, there are a number of potential ways to help households smooth consumption in the face of seasonal frictions. We propose and test two programs designed to raise the harvest-to-lean MRT, thereby subsidizing lean season consumption. By allowing households to either save more effectively (food storage) or borrow cheaply (food credit), the programs aimed to expand budget sets and improve the rate at which harvest season assets could be converted into lean season consumption. In this sense, our solutions can be viewed as addressing the basic problem of households lacking access to high MRT technologies for transferring food across seasons.

Our evaluation indicates improvements in economic well-being that are consistent with positive income effects arising from expanded budget sets. Both storage and credit led to increases in non-food consumption or reported income but had zero effects on staple consumption. Storage had no seasonal smoothing effects but credit did, though, under credit, health in the harvest season deteriorated moderately. Since the programs

⁴¹These ignore the annual implementation costs (mainly used to pay facilitators) discussed in Section 4. The annual implementation costs that are recurring include 254,803 Rp for storage and 242,861 Rp for credit. In practice, in the long run, these implementation costs would not be so high for storage once communities learn to use the storage equipment and for credit, the programs were designed so they could be easily added as a component of a national women's microcredit program (mentioned in Section 4.2). To be comprehensive, we also provide calculations that include implementation costs as well. Without amortization, if we include one-time procurement costs and annual implementation costs in the denominator, the benefit-to-cost ratios are 24% for storage ($= \frac{140,000}{326,366+254,803}$) and 40% for credit. If we use annuitized procurement costs instead, the benefit-to-cost ratios are 32% for storage ($= \frac{140,000}{188,049+254,803}$) and 59% for credit (where the denominator includes the annuitized procurement costs and the annual implementation costs).

incur front-loaded costs and have recurring financial benefits, our cost-benefit analysis argues that they provide a cost-effective way to help farmers adapt to seasonality.

The food storage and food credit programs, when modified with caution, could inform food policy elsewhere. Rudimentary food storage technologies are prevalent in several agrarian economies, and the introduction of improved storage (used directly for storage programs or indirectly for credit programs, as discussed in Sections 3.2 and 4.1) could similarly expand budget sets for other poor households. Our research comes with some caveats and suggestions for ongoing investigation.

First, unlike regular subsidies on staples, these programs are of less immediate value to non-farming households whose incomes are not seasonal and not in kind. Unless such households could replicate the behavior of farming households by conducting basic transactions using staples, they cannot take advantage of the lean season subsidy implicit in storage and credit. This is because our programs have no direct effects on prices.

Second, our programs are expected to have persistent effects from the initial investments in storage equipment and seed capital. Since we have data spanning only three years, we are unable to measure persistence over a longer term. It is important to note that our cost structure is fundamentally different from that of regular price subsidies which incur recurring costs. As a result, a longer-term analysis would be expected to raise the implied cost-effectiveness of the programs.

Third, given the limited scale of our programs, we do not observe general equilibrium effects. A sufficiently large expansion of the programs should ultimately reduce the staple supply in the harvest season and raise the staple supply in the lean season. This will translate into a drop in lean season staple prices and a rise in harvest season staple prices. While these general equilibrium effects arise out of improved storage or credit markets, welfare effects for some households will be ambiguous. For example, consider a household that had access to a high-returns storage technology prior to the program and therefore did not experience a direct expansion of its budget set through food credit or food storage. In the short run, such a household will be unaffected by the programs. However, as a result of general equilibrium effects, since staples are expected to get cheaper in the lean season, lean season non-food consumption will get more expensive (relative to staples). If the household has a preference for lean season non-food consumption (that it funds through saved staples), it will be made worse off.

Fourth, we cannot rule out program effects on some forms of non-staple food consumption. In particular, recall that the credit program finds a rise in income with no discernible changes in consumption. Presumably the additional income translates into either forms of consumption that we do not measure (such as meat) or savings. It would be instructive to better understand where these changes lie.

Finally, it is interesting that the positive consumption and income effects of our programs are stronger in the harvest season. This is particularly noteworthy for credit, as it suggests households on average are not over-borrowing in a way that leaves them with little to consume after repayments in the harvest. It would be useful to learn how these results depend on time preferences or social or spousal pressures to share. For instance,

do time-inconsistent agents borrow more in the lean season and save less in the harvest season? Existing theoretical and empirical work suggests that the impacts of savings and credit depend on time preferences in nuanced and sometimes unexpected ways.⁴² Given the encouraging results from our program evaluation, modified designs based on the preferences and other characteristics of target populations have the potential to substantially raise consumption and welfare.

⁴²See Ashraf, Karlan, and Yin (2006); Basu (2014)

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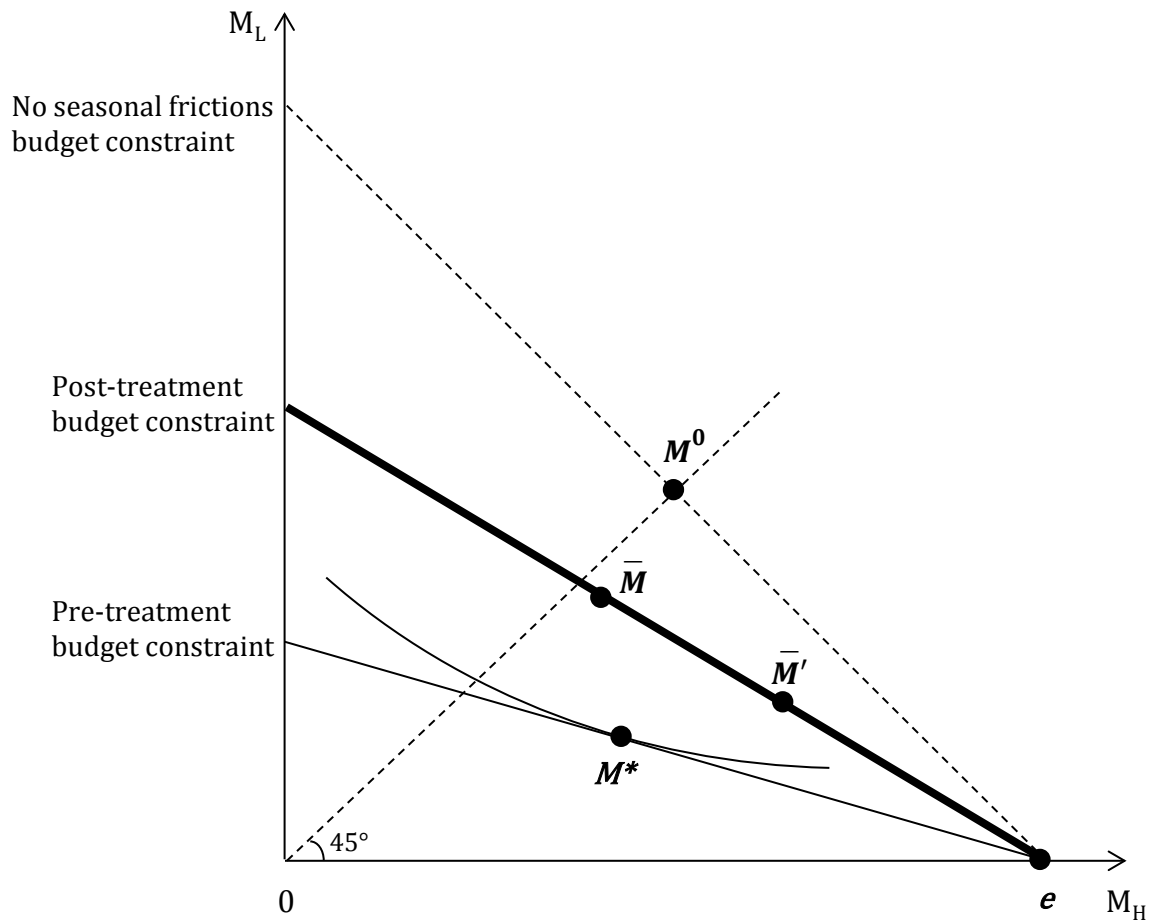


Figure 1: The inter-seasonal asset allocation problem. Assets (in staple units) allocated to harvest season consumption are on the x-axis and assets allocated to lean season consumption are on the y-axis, e is the endowment. M^0 indicates the allocation if there are no seasonal frictions and utility functions are identical across seasons. M^* is a hypothetical allocation under seasonal frictions. Possible post-treatment allocations are \bar{M} (if substitution effects dominate) and \bar{M}' (if income effects dominate).

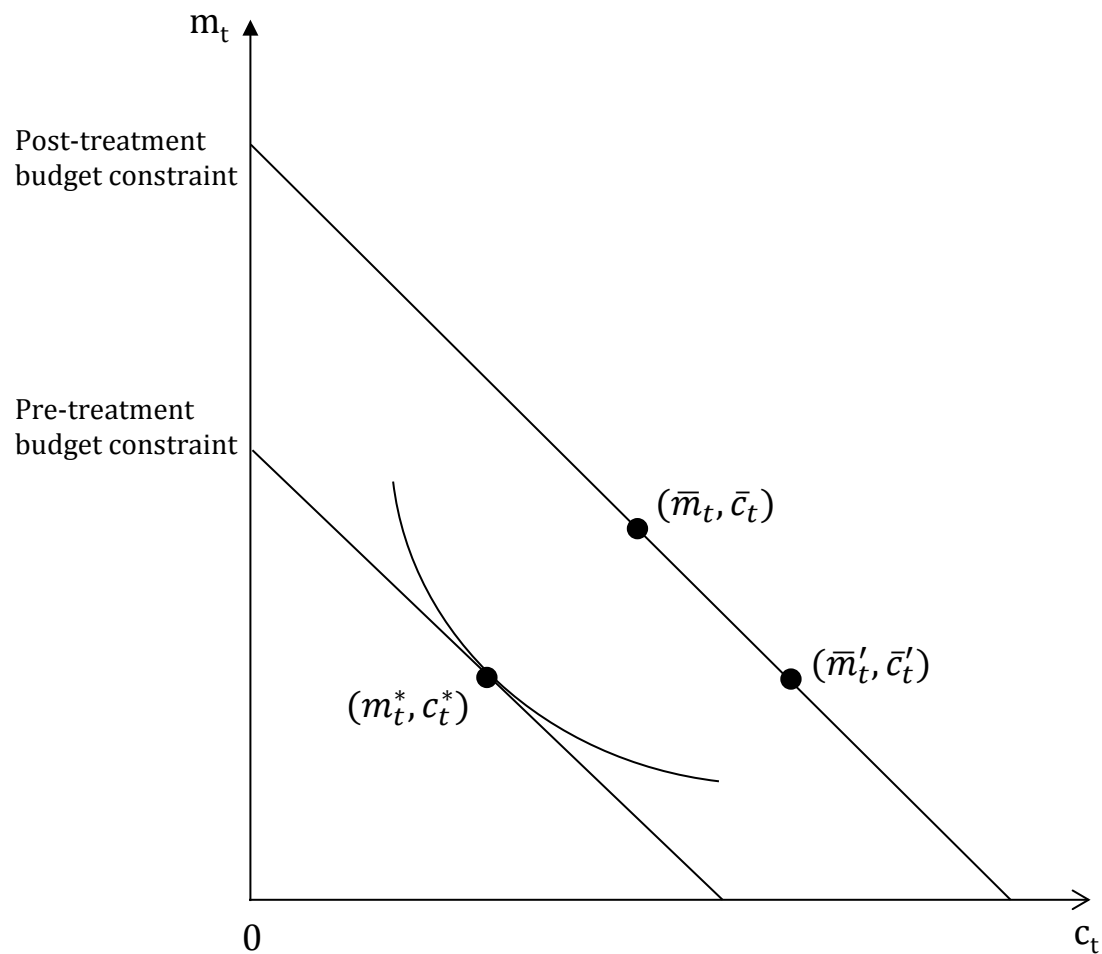


Figure 2: The within-season consumption problem. Assets available for consumption in season t must be allocated across staple food (y-axis) and non-food (x-axis). In autarky, the individual chooses (m_t^*, c_t^*) . Suppose, as a result of the treatment, more assets are allocated to season t . The budget line shifts out. Possible post-treatment bundles are (\bar{m}_t, \bar{c}_t) (homothetic utility) or (\bar{m}'_t, \bar{c}'_t) (staple satiation).

Figure 3. Timeline of surveys and treatment by year and month

		Survey	Credit	Storage
		(1)	(2)	(3)
YEAR 1	Sep '08	Round 1		
	Oct '08			
	<i>Nov '08</i>			
	<i>Dec '08</i>		Disbursement	
	<i>Jan '09</i>			
	Feb '09			
	Mar '09			
	Apr '09		Repayment	
	May '09			
	Jun '09			
	Jul '09	Round 2		
Aug '09			Distribute equipment	
YEAR 2	Sep '09			
	Oct '09			
	<i>Nov '09</i>	Round 3		
	<i>Dec '09</i>		Disbursement	
	<i>Jan '10</i>			
	Feb '10			
	Mar '10			
	Apr '10		Repayment	
	May '10			
	Jun '10			
	Jul '10	Round 4		
Aug '10			Distribute equipment	
YEAR 3	Sep '10			
	Oct '10			
	<i>Nov '10</i>	Round 5		
	<i>Dec '10</i>		Disbursement	
	<i>Jan '11</i>			
	Feb '11			
	Mar '11			
	Apr '11	Round 6		
	May '11			

Note: Months that are in italics (bold) correspond to the lean (harvest) season.

Table 1: Baseline Summary Statistics and Balance Check

	Control		Storage-Control			Credit-Control		
	Mean	SD	Coeff.	p-value	N	Coeff.	p-value	N
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<u>Panel A: Consumption and Income</u>								
Staple consumed, kCal	40.880	25.576	-0.064	0.245	2147	-0.063	0.261	1427
Non-food expenditure	34.242	27.808	0.068	0.299	2145	0.073	0.311	1431
Reported income	76.174	90.806	0.205	0.488	1970	0.270	0.377	1296
<u>Panel B: Seasonal Differences, Harvest - Lean </u>								
Staple consumed, kCal	24.520	33.102						
Monthly non-food expenditure items	10.406	13.709						
Reported income	80.726	108.684						
<u>Panel C: Food Shortages</u>								
1(Anticipate food shortage in January)	0.257	0.437	0.041	0.403	2150	0.095*	0.070	1433
1(Anticipate food shortage in April)	0.276	0.447	0.046	0.377	2150	0.089	0.101	1433
1(Anticipate food shortage in November)	0.102	0.303	0.013	0.619	2150	0.070**	0.047	1433
1(Lacked food last month)	0.590	0.492	-0.027	0.598	2150	0.053	0.339	1433
<u>Panel D: Health</u>								
1(Health expenditure shortages)	0.158	0.365	0.008	0.771	2150	0.005	0.856	1433
Number of sick days	0.180	0.557	0.059	0.115	2150	0.022	0.550	1433
Number of sick household members	0.024	0.050	0.004	0.331	2150	0.0004	0.925	1433
<u>Panel E: Agricultural Yields and Storage</u>								
Amount of maize produced, kg	145.137	179.054	7.662	0.717	2150	-5.080	0.826	1433
Amount of maize stored, kg	35.045	45.998	-4.542	0.384	2150	-9.709*	0.069	1433
Amount of rice produced, kg	132.165	282.393	-11.229	0.729	2150	-11.219	0.789	1433
Amount of rice stored, kg	27.408	61.887	-3.218	0.578	2150	3.987	0.666	1433
Ratio of maize stored	0.287	0.481	-0.017	0.596	1722	-0.057*	0.057	1145
Ratio of rice stored	0.236	0.416	-0.034	0.399	748	-0.031	0.419	519
<u>Panel F: Household Characteristics</u>								
1(Graduated primary school)	0.780	0.415	0.00001	1.000	2150	-0.007	0.826	1433
1(Graduated lower secondary school)	0.241	0.428	0.042	0.181	2150	0.0004	0.990	1433
Age	44.800	12.564	0.445	0.591	2106	0.028	0.977	1403
Number of chickens owned	3.116	3.584	-0.123	0.653	2150	-0.316	0.240	1433
Number of cows owned	0.470	0.988	-0.046	0.521	2150	0.077	0.379	1433
Number of pigs owned	1.269	1.218	-0.178*	0.059	2150	-0.005	0.969	1433
Number of motorcycles owned	0.067	0.251	0.051***	0.008	2150	0.019	0.259	1433
Household size	4.832	1.830	-0.143	0.314	2150	-0.030	0.854	1433
1(Has savings account in a bank)	0.067	0.251	-0.007	0.612	2150	0.003	0.810	1433

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

Notes—Columns 1 and 2 report means and standard deviations for control villages in the baseline. Columns 3 to 5 report results from an OLS regression comparing households in storage and control villages in the baseline, controlling for district fixed effects and clustering standard errors at the village level. Columns 3 and 4 report the coefficient and p-value corresponding to the storage dummy and column 5 reports the sample size for each regression. The full estimation sample for the storage versus control comparison includes 2150 households. Some dependent variables have missing values. Columns 6 to 8 report results comparing credit and control villages. The full estimation sample for the credit versus control comparison has 1433 households. In Panel A, we report means and standard deviations of consumption and income in levels (columns 1 and 2) but the regressions reported in columns 3 to 8 are in logs. All expenditure and income values are in thousands of Rupiahs (1 USD=9000 Rupiahs). All consumption and income variables in Panels A and B, as well as the last two health outcomes in Panel D, are in per capita per month units.

Table 2: Impact of Storage and Credit on Outcomes

Treatment: Season:	Storage				Credit			
	All	Lean	Harvest	N(All)	All	Lean	Harvest	N(All)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Consumption and Income								
Consumption and Income Index	0.246** (0.112)	0.188 (0.138)	0.277** (0.115)	5907	0.164 (0.107)	0.013 (0.116)	0.267** (0.126)	6565
Log(Staple consumed, kCal)	0.014 (0.066)	-0.034 (0.103)	0.039 (0.068)	6009	0.06 (0.086)	-0.067 (0.103)	0.145 (0.109)	6741
Log(Non-food expenditure)	0.324** (0.135)	0.311* (0.183)	0.332** (0.133)	6042	0.12 (0.124)	-0.015 (0.146)	0.209 (0.137)	6791
Log(Reported income)	0.515 (0.339)	0.431 (0.272)	0.56 (0.456)	5943	0.543** (0.249)	0.371 (0.242)	0.662* (0.347)	6615
Panel B: Seasonal Differences, Harvest - Lean 								
Seasonal Gap Index	-0.027 (0.077)			1834	-0.136 (0.085)			2444
Log(Staple consumed, kCal)	0.016 (0.074)			1909	0.003 (0.091)			2593
Log(Monthly non-food expenditure items)	0.006 (0.091)			1934	-0.160** (0.079)			2615
Log(Reported income)	-0.079 (0.146)			1858	-0.058 (0.127)			2472
Panel C: Food Shortages								
Food Shortage Index	-0.140 (0.096)	-0.306 (0.195)	-0.057 (0.114)	6450	-0.131 (0.127)	-0.014 (0.169)	-0.208 (0.136)	7165
1(Anticipate food shortage in January)	-0.033 (0.076)	-0.139 (0.140)	0.02 (0.091)	6450	-0.097 (0.082)	-0.043 (0.112)	-0.133* (0.080)	7165
1(Anticipate food shortage in April)	-0.013 (0.031)	-0.063 (0.039)	0.012 (0.032)	6450	-0.022 (0.030)	0.01 (0.045)	-0.043 (0.039)	7165
1(Anticipate food shortage in November)	-0.089* (0.048)	-0.123 (0.106)	-0.073 (0.062)	6450	-0.052 (0.066)	0.056 (0.108)	-0.124* (0.074)	7165
1(Lacked food last month)	-0.079 (0.061)	-0.177* (0.099)	-0.03 (0.063)	6450	-0.04 (0.067)	-0.08 (0.075)	-0.013 (0.083)	7165
Panel D: Health								
Health Index	-0.0002 (0.074)	0.134 (0.084)	-0.067 (0.091)	6450	-0.122 (0.103)	0.188 (0.148)	-0.330*** (0.116)	7165
1(Health expenditure shortages last month)	0.005 (0.026)	-0.053 (0.038)	0.034 (0.027)	6450	0.057* (0.032)	-0.015 (0.040)	0.105*** (0.037)	7165
Number of sick days	0.033 (0.589)	-0.033 (0.047)	0.066 (0.082)	6450	0.047 (0.092)	-0.160 (0.140)	0.185* (0.104)	7165
Number of sick household members	-0.004 (0.005)	-0.010 (0.008)	-0.0005 (0.005)	6450	0.006 (0.006)	-0.012 (0.008)	0.018*** (0.007)	7165

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

Notes—Column 1 reports the results from instrumental variable regressions where the main independent variable is a take-up dummy instrumented with the storage dummy, with district fixed effects and standard errors clustered at the village level. Column 1 pools all seasons, column 2 only includes lean season surveys and column 3 only includes harvest season surveys. Each pair of cells reports the coefficient estimate and standard error for the take-up dummy. The full estimation sample has 6450 observations, including households in storage and control villages from rounds 4 to 6 but the number of observations change for outcomes in logs, the sample sizes pooling all seasons are reported in column 4. Columns 5 to 8 report results for credit versus control villages. The full estimation sample has 7165 observations, including households in credit and control villages from rounds 2 to 6. All expenditure and income values are in thousands of Rupiahs (1 USD=9000 Rupiahs). All consumption and income variables in Panels A and B, as well as the last two health outcomes in Panel D, are in per capita per month units.

Table 3: Robustness Checks

Treatment:	Storage				Credit			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<u>Panel A: Consumption and Income</u>								
Consumption and Income Index	0.246**	0.213*	0.198*	0.106**	0.164	0.130	0.113	0.067
	(0.112)	(0.115)	(0.110)	(0.046)	(0.107)	(0.114)	(0.111)	(0.044)
Log(Staple consumed, kCal)	0.014	0.034	0.027	0.006	0.060	0.082	0.056	0.024
	(0.066)	(0.066)	(0.071)	(0.029)	(0.086)	(0.086)	(0.087)	(0.036)
Log(Non-food expenditure, in 1000 Rp)	0.324**	0.276**	0.267**	0.139**	0.120	0.070	0.061	0.049
	(0.135)	(0.116)	(0.112)	(0.054)	(0.124)	(0.110)	(0.115)	(0.050)
Log(Reported income)	0.515	0.487	0.462	0.221	0.543**	0.526**	0.487*	0.221**
	(0.339)	(0.353)	(0.336)	(0.144)	(0.249)	(0.263)	(0.266)	(0.103)
<u>Panel B: Seasonal Differences, Harvest - Lean </u>								
Seasonal Gap Index	-0.027			-0.012	-0.136			-0.057
	(0.077)			(0.034)	(0.085)			(0.035)
Log(Staple consumed, kCal)	0.016			0.007	0.003			0.001
	(0.074)			(0.033)	(0.091)			(0.038)
Log(Monthly non-food expenditure items)	0.006			0.003	-0.160**			-0.066**
	(0.091)			(0.040)	(0.079)			(0.032)
Log(Reported income)	-0.079			-0.035	-0.058			-0.024
	(0.146)			(0.064)	(0.127)			(0.054)
<u>Panel C: Food Shortages</u>								
Food Shortage Index	-0.140	-0.138	-0.130	-0.058	-0.131	-0.139	-0.138	-0.052
	(0.096)	(0.096)	(0.093)	(0.041)	(0.127)	(0.126)	(0.116)	(0.052)
1(Anticipate food shortage in January)	-0.033	-0.032	-0.023	-0.014	-0.097	-0.099	-0.101	-0.038
	(0.076)	(0.076)	(0.074)	(0.032)	(0.082)	(0.082)	(0.077)	(0.034)
1(Anticipate food shortage in April)	-0.013	-0.011	-0.012	-0.005	-0.022	-0.023	-0.025	-0.009
	(0.031)	(0.030)	(0.031)	(0.013)	(0.030)	(0.030)	(0.030)	(0.012)
1(Anticipate food shortage in November)	-0.089*	-0.089*	-0.087*	-0.037*	-0.052	-0.052	-0.052	-0.021
	(0.048)	(0.048)	(0.048)	(0.020)	(0.066)	(0.066)	(0.062)	(0.027)
1(Lacked food last month)	-0.079	-0.078	-0.075	-0.033	-0.040	-0.043	-0.040	-0.016
	(0.061)	(0.060)	(0.059)	(0.026)	(0.067)	(0.067)	(0.065)	(0.027)
<u>Panel D: Health</u>								
Health Index	-0.0002	0.011	0.026	-0.00008	-0.122	-0.119	-0.110	-0.048
	(0.074)	(0.071)	(0.070)	(0.031)	(0.103)	(0.100)	(0.098)	(0.041)
1(Health expenditure shortages last month)	0.005	0.005	0.010	0.002	0.057*	0.057*	0.064**	0.023*
	(0.026)	(0.026)	(0.025)	(0.011)	(0.032)	(0.031)	(0.032)	(0.012)
Number of sick days	0.033	0.022	0.001	0.014	0.047	0.044	0.036	0.019
	(0.059)	(0.056)	(0.056)	(0.025)	(0.092)	(0.090)	(0.085)	(0.037)
Number of sick household members	-0.004	-0.004	-0.005	-0.002	0.006	0.006	0.005	0.003
	(0.005)	(0.005)	(0.004)	(0.002)	(0.006)	(0.005)	(0.005)	(0.002)
Estimation	IV	IV	IV	OLS	IV	IV	IV	OLS
Dependant variable (round 1)	No	Yes	Yes	No	No	Yes	Yes	No
Demographics (round 1)	No	No	Yes	No	No	No	Yes	No

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

Notes—Column 1 is the same as column 1 in Table 2 (our main IV estimates for storage). Column 2 controls for baseline values of the dependent variable. Column 3 adds baseline values of demographics reported in Panel F in Table 1. Each pair of cells reports the coefficient estimate and standard error for the take-up dummy. Column 4 reports OLS coefficient estimates for the treatment dummy. Columns 5 to 8 report robustness checks for credit. The full estimation samples for storage are 6450 (columns 1, 2 and 4) and 6318 (column 3) because we dropped some observations with no age information. For credit, the full estimation samples are 7165 (columns 5, 6, and 8) and 7,015 (column 7), when we control for baseline demographics. All expenditure and income values are in thousands of Rupiahs (1 USD=9000 Rupiahs). All consumption and income variables in Panels A and B, as well as the last two health outcomes in Panel D, are in per capita per month units.

Table 4: Other Budget Set Items

Outcome:	Gifts	Remittances	Wage	Household size
	(1)	(2)	(3)	(4)
<u>Panel A: Storage</u>				
1(Take-up)	1.601 (4.740)	-0.308 (3.959)	6.989 (11.117)	-0.137 (0.351)
N	6450	6450	6450	6450
<u>Panel B: Credit</u>				
1(Take-up)	1.395 (4.208)	-2.742 (3.128)	-0.241 (8.853)	-0.058 (0.386)
N	7165	7165	7165	7165

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

Notes—This table repeats the IV estimation in column 1 of Table 2 (for storage, Panel A) and column 5 of Table 2 (for credit, Panel B). Each column is a regression where the dependent variable is reported in the column header. The sample sizes for each regression are reported in the bottom of the panel. The dependent variables for columns 1 to 3 are the per capita per month transfers, remittances and wages (in thousands of Rupiahs) reported by the household (including zero's). In column 4, household size is the number of household members.

Evaluating Seasonal Food Security Programs in East Indonesia (Appendix)

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February 26, 2014

1 Data

1.1 Describing the sample

In total, we sampled 2,877 households, followed over six survey rounds (odd rounds are lean season surveys and even rounds are harvest season surveys). Of these households, 720 were in credit villages, 1,440 were in storage villages (half were in pure and half in contract storage) and 717 were in control villages. There was no attrition. So, in total, we have 17,262 (calculated as 2,877 times 6) observations at the household-by-survey-round level.

We surveyed 30 households out of two hamlets per village in 96 villages. Hamlets within each village tended to be far apart so our survey team could only focus on surveying households in 2 hamlets per village. To increase the percent of surveyed households who would be offered treatment, we first instructed the survey team to select 30 households randomly within 2 hamlets in both the treatment and control villages. Then, we instructed the facilitators to offer all survey respondents in each village the option to participate. Since the selection of survey respondents was independent of the selection of program participants, the respondents in the treatment and control villages are still comparable, on average.

Our estimation sample includes 2,870 households (713 from control villages, 720 from credit villages and 1,437 from storage villages). We dropped 7 households because we were not able to use their ID in the household questionnaire to merge with any of the six rounds of individual questionnaires. Consequently, we do not have data on the demographics of these households and the number of household members (which we need to construct per capita variables).

Here are the number of observations for the main estimation samples:

- For the storage versus control villages comparison, the baseline regression (Table 1, column 5) includes 2150 observations (unless there are missing values, discussed below). For credit, we have 1433 observations (Table 1, column 8).
- The IV estimation for storage that pools all post-treatment surveys (rounds 4 to 6). It is reported in Table 2 (columns 1 and 4) and has 6450 observations (calculated as 1437 + 713 households times 3 survey rounds). The IV estimation for credit pools rounds 2 to 6. It is reported in Table 2 (columns 5 and 8) and has 7165 observations (calculated as 720+713 households times 5 survey rounds).

1.2 Defining key variables

We designed the survey in consultation with researchers from the local agricultural institute, who conducted the survey. Whenever possible, the survey questions were taken directly from Indonesia's annual household survey, Susenas. We pre-tested the survey questions and made slight modifications to adjust for local crops and staples. In Table A1, we describe how each variable in Table 1 was constructed.

1.3 Data issues

- Outliers: All measures related to income, consumption, production, storage and assets have been winsorized at the top 2% to minimize biases due to outliers. We also tried winsorizing at the top 5% and the results are similar.
- Calculating per capita per month values: To calculate per capita values we divided by number of household members in the contemporaneous survey round. For some household-by-survey round observations, we filled in the missing values for household size with the mean for that household (calculated using other survey rounds with non-missing values). To convert weeks to months, we multiplied the total by 4.
- Potential bias due to missing values: As discussed above, the IV estimation sample for the storage versus control comparison includes 6,450 observations and the estimation sample for the credit versus control comparison includes 7,165 observations. However, Panels A and B show that there are missing values because we take logs. Notably, the summary index (first row in each panel) is only defined if all outcomes used to calculate the index are non-missing. To check that the censoring due to logs is not driving the results, we also report results that drop all observations where any of the logged outcomes are missing (about 8% of the sample). We end up with 5907 observations for storage and 6565 observations for credit. As shown in Table A2, the results are broadly similar. There is still a zero effect on staple consumption, and sizeable increases in non-food expenditure for storage and increases in reported income for credit. The reduction in the seasonal difference in monthly non-food expenditure items remain for credit so do the health effects, with similar magnitudes.

2 Other results

2.1 Pure versus absolute seasonal differences

We chose to use absolute differences ($|Harvest - Lean|$) instead of pure differences ($(Harvest - Lean)$) because we are interested in testing whether the treatments reduced the magnitude of the seasonal gap between harvest and lean seasons for the average household in the treated village. There are two advantages to using absolute differences. First, we did not want households with positive pure differences to cancel out households with negative pure differences as we average across households' seasonal differences in a village. Taking absolute seasonal gaps would add both positive and negative seasonal differences.

Second, a significant number of households in our sample have negative pure differences,¹ and for these households, a further reduction in the pure difference (by transferring from the harvest to the lean season) may not be a welfare improvement. The interpretation depends on whether the reduction in pure differences comes from preferences or from adverse shocks.

While the absolute difference in consumption across seasons is not independently a measure of welfare, it can be interpreted in conjunction with overall levels of consumption. In particular, suppose utility functions are concave, identical and separable across seasons. Then, a reduction of the absolute seasonal difference can be interpreted as a rise in welfare if total annual consumption remains the same. In Figure 1, this means that along any inter-seasonal budget constraint with a slope of -1 (all bundles along this line have the same total consumption levels, i.e. $M_H + M_L$ is constant), consumption bundles closer to the 45-degree line are associated with higher indifference curves. Nevertheless, for completeness, we also report the results using pure differences in Table A3. None of the coefficients have p-values at or below 5%. The difference for staple consumption is positive, but only significant at the 10% level.

2.2 Heterogeneous treatment effects

We calculated the baseline retention rate using the total amount of rice and maize in stock in round 3 (lean) divided by the total amount of rice and maize in stock in round 2 (previous harvest). Then, we created an indicator for households' whose retention rate is below the median. Since retention rates are ratios, we had to drop some households that reported zero yield (the denominator) in round 2.

To estimate whether treatment effects differed by retention rates, we repeat Equation (6) but add two regressors: the indicator for households with below median retention rates and its interaction with the take-up dummy (where the interaction is instrumented by the interaction with the treatment dummy). Incidentally, we cannot construct baseline retention rates for credit households because we need a harvest and a lean season survey within the same agricultural cycle that is before treatment (rounds 2 and 3 for storage, but none exist for credit).

Table A4 in the appendix reports IV estimates of these heterogeneous treatment effects. The column labeled, N(All) reports sample sizes for the regression using all seasons. In the same column, the p-values in brackets correspond to the test of a zero treatment effect for low gamma households (we test whether the sum of the coefficients on the take-up dummy and the interaction

¹In our control group, close to half of the households have larger staple consumption or non-food expenditures in the lean season than the harvest season (so, the pure difference of harvest minus lean is negative).

term is zero, using the estimation sample that pools both seasons). The results show that most of the effects reported in Table 2 on consumption appear to be concentrated amongst households with low baseline retention rates (it is the coefficient on the interaction term that is positive and statistically significant). This is in line with our theory that the storage treatment expanded the budget set, with a more significant improvement for households with low baseline retention rates.

Table A1: Variable Construction

Variable	Data construction	Survey Question	Survey
Panel A: Consumption and Income			
Log(Staple consumed, kCal)	Calculated as $\text{Ln} [(Rice\ consumed\ in\ kg * 3.6*4 + Maize\ consumed\ in\ kg * 3.56*4) / (\text{Number of household members})]$. To convert kilograms to calories, we used rates available at http://www.fao.org/docrep/x5557e/x5557e04.htm#cereals . For rice, we used 100g to 360 calories (the rate for milled, white rice) and for maize, we used 100g to 356 calories (the rate for grain or whole meal).	Amount of rice and maize consumed in the past week.	Household
Log(Non-food expenditure)	Calculated as $\text{Ln} [(\text{Monthly expenditure items}) + (\text{Seasonal expenditures}/6) + (\text{Annual expenditures}/12)] / (\text{Number of household members})]$	We used the non-food expenditure module from Susenas. We asked households for monthly expenditure items (including rent, utilities, personal expenditures such as soap, make up and phonecards, health expenditures and health insurance costs), seasonal expenditures (including festival expenditures for own and others, including weddings, birthdays, religious ceremonies, traditional ceremonies and other festivities) and annual expenditure items (including education expenditures, clothing, durables, taxes).	Household
Log(Reported income)	Calculated as $\text{Ln} (\text{Quarterly reported income} / (3 * \text{Number of household members}))$	We asked for the reported income in the past 3 months, including income from the sale of agricultural output, wages, remittance and other receipts.	Household
Panel B: Seasonal Differences			
Log(Staple consumed, kCal)	Absolute difference of round 2 minus round 3 (for first agricultural cycle) and absolute difference of round 4 minus round 5 (for second agricultural cycle).		
Log(Monthly non-food expenditure items)	Only includes monthly expenditure items (including rent, utilities, personal expenditures such as soap, make up and phonecards, health expenditures and health insurance costs).		
Panel C: Food Shortages			
1(Anticipate food shortages in January)	1(Response = No)	Do you think you can afford to buy food for the following January?	Household
1(Anticipate food shortages in April)	1(Response = No)	Do you think you can afford to buy food for the following April?	Household
1(Anticipate food shortages in November)	1(Response = No)	Do you think you can afford to buy food for the following November?	Household
1(Lacked food last month)	1(Response = Yes)	Have you lacked food in the last month?	Household
Panel D: Health			
1(Health expenditure shortages)	1(Response = Yes)	Did you have problems paying health expenses the last month?	Household
Number of sick days	Calculated as the total number of sick days for the entire household, including zeros for households who were not sick, divided by (the total number of household members times 3) to obtain per capita per month units.	For any household members who were sick the last 3 months how many days of school/work were affected?	Household
Number of sick household members	Calculated as the total number of households who reported any sickness in the past 3 months divided by total number of household members times 3 to obtain per capita per month units.	Which household members were sick the last 3 months?	Household
Panel E: Agricultural Yields and Storage			
Amount of maize produced, kg	Total maize produced.	In the previous harvest season how much of maize did you produce (in kg)?	Household
Amount of maize stored, kg	Total maize in storage.	In the past 3 months, what is the amount of maize in storage now (in kg)?	Household
Amount of rice produced, kg	Total rice produced.	In the previous harvest season, how much of rice did you produce (in kg)?	Household
Amount of rice stored, kg	Total rice in storage.	In the past 3 months, what is the amount of rice in storage now (in kg)?	Household
Ratio of rice stored	Total rice in storage/total rice produced	Amount of rice stored, divided by amount of rice produced (in kg)	Household
Ratio of maize stored	Total maize in storage/total maize produced	Amount of maize stored, divided by amount of maize produced (in kg)	Household
Panel F: Household Characteristics			
1(Graduated primary school)	1(Household head completed primary school or more)	What is the highest education achieved? (Response: 02 Primary education)	Individual
1(Graduated lower secondary school)	1(Household head completed lower secondary school or more)	What is the highest education achieved? (Response: 03 Lower secondary education)	Individual
Age of household head	Year of survey - year of birth	What is the year of birth?	Individual
Number of chickens owned	Number of chickens owned	How of chickens do you own?	Household
Number of cows owned	Number of cows owned	How of cows do you own?	Household
Number of pig owned	Number of pig owned	How of pigs do you own?	Household
Number of motorcycles owned	Number of motorcycles owned	How of motorcycles do you own?	Household
Household size	Number of household members		Individual
1(Has savings in a bank)	1 if the household reports having savings in a bank		Household

Table A2: Missing outcomes

Treatment:	Storage				Credit			
Season:	All	Lean	Harvest	N(All)	All	Lean	Harvest	N(All)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<u>Panel A: Consumption and Income</u>								
Consumption and Income Index	0.246**	0.188	0.277**	5907	0.164	0.013	0.267**	6565
	(0.112)	(0.138)	(0.115)		(0.107)	(0.116)	(0.126)	
Log(Staple consumed, kCal)	0.017	-0.04	0.045	5907	0.044	-0.068	0.12	6565
	(0.066)	(0.101)	(0.069)		(0.082)	(0.102)	(0.103)	
Log(Non-food expenditure, in 1000 Rp)	0.337**	0.312*	0.352***	5907	0.12	-0.014	0.209	6565
	(0.132)	(0.177)	(0.131)		(0.119)	(0.141)	(0.133)	
Log(Reported income)	0.514	0.427	0.56	5907	0.536**	0.379	0.646*	6565
	(0.338)	(0.269)	(0.455)		(0.247)	(0.239)	(0.344)	
<u>Panel B: Seasonal Differences, Harvest - Lean </u>								
Seasonal Gap Index	-0.027			1834	-0.136			2444
	(0.077)				(0.085)			
Log(Staple consumed, kCal)	0.013			1834	-0.014			2444
	(0.075)				(0.090)			
Log(Monthly non-food expenditure items)	-0.003			1834	-0.156**			2444
	(0.091)				(0.078)			
Log(Reported income)	-0.085			1834	-0.072			2444
	(0.141)				(0.124)			
<u>Panel C: Food Shortages</u>								
Food Shortage Index	-0.122	-0.291	-0.04	5907	-0.139	-0.022	-0.217	6565
	(0.096)	(0.200)	(0.113)		(0.132)	(0.176)	(0.138)	
1(Anticipate food shortage in January)	-0.018	-0.13	0.037	5907	-0.089	-0.046	-0.118	6565
	(0.077)	(0.146)	(0.092)		(0.085)	(0.117)	(0.083)	
1(Anticipate food shortage in April)	-0.012	-0.065	0.015	5907	-0.03	0	-0.051	6565
	(0.032)	(0.040)	(0.032)		(0.029)	(0.044)	(0.036)	
1(Anticipate food shortage in November)	-0.080*	-0.108	-0.067	5907	-0.056	0.052	-0.128*	6565
	(0.048)	(0.106)	(0.062)		(0.069)	(0.111)	(0.076)	
1(Lacked food last month)	-0.078	-0.180*	-0.028	5907	-0.05	-0.076	-0.032	6565
	(0.063)	(0.105)	(0.063)		(0.070)	(0.078)	(0.084)	
<u>Panel D: Health</u>								
Health Index	-0.016	0.13	-0.089	5907	-0.127	0.176	-0.331***	6565
	(0.072)	(0.087)	(0.088)		(0.103)	(0.150)	(0.116)	
1(Health expenditure shortages last month)	0.005	-0.054	0.035	5907	0.055*	-0.01	0.100***	6565
	(0.026)	(0.040)	(0.027)		(0.032)	(0.041)	(0.038)	
Number of sick days	0.046	-0.032	0.087	5907	0.055	-0.154	0.196*	6565
	(0.056)	(0.049)	(0.077)		(0.092)	(0.143)	(0.104)	
Number of sick household members	-0.003	-0.009	0.001	5907	0.007	-0.011	0.018***	6565
	(0.005)	(0.008)	(0.005)		(0.006)	(0.008)	(0.007)	

* p<0.10, ** p<0.05, *** p<0.01

Notes—This table replicates Table 2, but drops all observations with missing values.

Table A3: Actual differences

Treatment:	Storage	Credit
	(1)	(2)
Seasonal Gap Index	0.010 (0.188)	0.047 (0.141)
log(Staple consumed, kCal)	0.252* (0.147)	0.256 (0.158)
log(Monthly non-food expenditure items)	0.047 (0.223)	-0.043 (0.190)
log(Reported income)	-0.414 (0.358)	-0.087 (0.225)

* p<0.10, ** p<0.05, *** p<0.01

Notes—This table repeats the regressions in Panel B of Table 2, except using actual differences instead of absolute differences. For the seasonal gap index, the estimation sample for storage includes 1834 observations and the estimation sample for credit includes 2444 observations.

Table A4: IV for Storage Treatment, by Baseline Retention Rate

Season:	N(All) [p-value]	All		Lean		Harvest	
		(1)	(2)	(3)	(4)	(5)	(6)
<u>Panel A: Consumption and Income</u>							
Consumption and Income Index	5494	0.088	(0.113)	0.070	(0.127)	0.098	(0.119)
Consumption and Income Index_LG	[0.00]	0.344***	(0.127)	0.276*	(0.148)	0.379***	(0.136)
Log(Staple consumed, kCal)	5583	-0.056	(0.069)	-0.099	(0.104)	-0.035	(0.078)
Log(Staple consumed, kCal)_LG	[0.20]	0.163*	(0.083)	0.178	(0.113)	0.156*	(0.094)
Log(Non-food expenditure, in 1000 Rp)	5603	0.151	(0.135)	0.139	(0.165)	0.158	(0.139)
Log(Non-food expenditure, in 1000 Rp)_LG	[0.00]	0.321**	(0.148)	0.349**	(0.163)	0.306*	(0.159)
Log(Reported income)	5515	0.259	(0.265)	0.327	(0.268)	0.229	(0.344)
Log(Reported income)_LG	[0.06]	0.613*	(0.313)	0.251	(0.308)	0.795**	(0.392)
<u>Panel B: Seasonal Differences, Harvest - Lean </u>							
Seasonal Gap Index	1721	0.037	(0.086)				
Seasonal Gap Index_LG	[0.25]	-0.148	(0.107)				
Log(Staple consumed, kCal)	1788	0.067	(0.070)				
Log(Staple consumed, kCal)_LG	[0.90]	-0.080	(0.090)				
Log(Monthly non-food expenditure items)	1801	0.001	(0.091)				
Log(Monthly non-food expenditure items)_LG	[0.97]	0.003	(0.112)				
Log(Reported income)	1735	0.003	(0.146)				
Log(Reported income)_LG	[0.22]	-0.246	(0.202)				
<u>Panel C: Food Shortages</u>							
Food Shortage Index	5916	-0.083	(0.090)	-0.197	(0.181)	-0.026	(0.107)
Food Shortage Index_LG	[0.11]	-0.122	(0.113)	-0.206	(0.166)	-0.080	(0.151)
1(Anticipate food shortage in January)	5916	-0.023	(0.066)	-0.105	(0.127)	0.019	(0.082)
1(Anticipate food shortage in January)_LG	[0.67]	-0.021	(0.085)	-0.048	(0.120)	-0.008	(0.107)
1(Anticipate food shortage in April)	5916	-0.018	(0.030)	-0.052	(0.040)	-0.002	(0.033)
1(Anticipate food shortage in April)_LG	[0.76]	0.006	(0.042)	-0.029	(0.062)	0.023	(0.041)
1(Anticipate food shortage in November)	5916	-0.021	(0.043)	-0.020	(0.100)	-0.021	(0.056)
1(Anticipate food shortage in November)_LG	[0.02]	-0.135**	(0.065)	-0.193**	(0.090)	-0.105	(0.095)
1(Lacked food last month)	5916	-0.084	(0.067)	-0.180*	(0.094)	-0.036	(0.074)
1(Lacked food last month)_LG	[0.18]	-0.004	(0.063)	-0.006	(0.105)	-0.003	(0.067)
<u>Panel D: Health</u>							
Health Index	5916	0.041	(0.078)	0.225**	(0.094)	-0.050	(0.097)
Health Index_LG	[0.58]	-0.095	(0.108)	-0.198**	(0.096)	-0.044	(0.144)
1(Health expenditure shortages last month)	5916	-0.007	(0.030)	-0.048	(0.047)	0.014	(0.032)
1(Health expenditure shortages last month)_LG	[0.37]	0.031	(0.030)	-0.009	(0.049)	0.051	(0.039)
Number of sick days	5916	0.019	(0.059)	-0.088*	(0.050)	0.073	(0.080)
Number of sick days_LG	[0.73]	0.012	(0.105)	0.098	(0.060)	-0.031	(0.148)
Number of sick household members	5916	-0.007	(0.006)	-0.019**	(0.007)	-0.001	(0.007)
Number of sick household members_LG	[0.70]	0.009	(0.007)	0.022***	(0.007)	0.002	(0.009)

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

Notes—This table reports heterogeneous treatment effect regressions by the baseline retention rate of each household. Each regression corresponds to an instrumental variable regression where the two main independent variables are (i) a take-up dummy instrumented with the treatment assignment (ii) the take-up dummy interacted with a dummy for below median retention rate. Each group of four cells above reports the coefficient estimate and standard error for these two independent variables in a regression. The dependent variable for each regression is noted in the table. All regressions include district (kabupaten) fixed effects because assignment of treatment was within each district. Standard errors reported in the parentheses. All standard errors are clustered at the village level. Columns 1-2 use all the post treatment data (rounds 4 to 6). Columns 3-4 only include lean season data (round 5). Columns 5-6 only include harvest season data (rounds 4 and 6). N(All) reports the sample size for the regression using all seasons (columns 1 and 2). P-values (in brackets) correspond to a test that the sum of the take-up dummy and the interaction is equal to zero, for the regression with all seasons.

Table A5: IV for Storage Treatment for Alfa Omega and TLM Districts

NGO:	Alfa Omega Districts			TLM Districts		
	All	Lean	Harvest	All	Lean	Harvest
	(1)	(2)	(3)	(4)	(5)	(6)
<u>Panel A: Consumption and Income</u>						
Consumption and Income Index	0.201** (0.103)	0.173 (0.170)	0.216*** (0.083)	0.307 (0.223)	0.209 (0.227)	0.359 (0.244)
Log(Staple consumed, kCal)	0.045 (0.069)	-0.026 (0.113)	0.079 (0.068)	-0.028 (0.127)	-0.044 (0.189)	-0.016 (0.135)
Log(Non-food expenditure, in 1000 Rp)	0.285** (0.142)	0.309 (0.236)	0.275** (0.129)	0.378 (0.255)	0.313 (0.289)	0.410 (0.262)
Log(Reported income)	0.214 (0.216)	0.294 (0.333)	0.175 (0.210)	0.923 (0.729)	0.615 (0.444)	1.085 (1.027)
<u>Panel B: Seasonal Differences, Harvest - Lean </u>						
Seasonal Gap Index	-0.035 (0.110)			-0.017 (0.104)		
Log(Staple consumed, kCal)	-0.049 (0.077)			0.105 (0.138)		
Log(Monthly non-food expenditure items)	0.086 (0.138)			-0.103 (0.110)		
Log(Reported income)	-0.105 (0.134)			-0.046 (0.287)		
<u>Panel C: Food Shortages</u>						
Food Shortage Index	-0.134 (0.102)	-0.360 (0.284)	-0.021 (0.110)	-0.147 (0.181)	-0.230 (0.246)	-0.105 (0.226)
1(Anticipate food shortage in January)	0.007 (0.088)	-0.214 (0.199)	0.117 (0.108)	-0.088 (0.135)	-0.036 (0.190)	-0.114 (0.155)
1(Anticipate food shortage in April)	-0.033 (0.042)	-0.070 (0.051)	-0.015 (0.041)	0.016 (0.045)	-0.052 (0.059)	0.050 (0.047)
1(Anticipate food shortage in November)	-0.057 (0.051)	-0.108 (0.160)	-0.031 (0.059)	-0.134 (0.089)	-0.143 (0.120)	-0.129 (0.123)
1(Lacked food last month)	-0.143* (0.077)	-0.216 (0.133)	-0.107 (0.070)	0.009 (0.096)	-0.124 (0.148)	0.076 (0.110)
<u>Panel D: Health</u>						
Health Index	-0.116 (0.107)	0.107 (0.121)	-0.228* (0.131)	0.159 (0.100)	0.172 (0.112)	0.153 (0.123)
1(Health expenditure shortages last month)	0.032 (0.035)	-0.045 (0.057)	0.070** (0.034)	-0.032 (0.039)	-0.064 (0.044)	-0.016 (0.044)
Number of sick days	0.098 (0.089)	-0.054 (0.060)	0.174 (0.125)	-0.057 (0.069)	-0.006 (0.073)	-0.082 (0.092)
Number of sick household members	0.004 (0.006)	-0.005 (0.010)	0.009 (0.007)	-0.014* (0.008)	-0.017 (0.013)	-0.013 (0.009)

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

Notes—This table repeats IV regressions for storage reported in columns 1 to 3 in Table 2, but does so separately for Alfa Omega villages (columns 1 to 3 in this table) and TLM villages (columns 4 to 6 in this table).

Table A6: IV for Credit Treatment for Alfa Omega and TLM Districts

NGO: Season:	Alfa Omega Districts			TLM Districts		
	All	Lean	Harvest	All	Lean	Harvest
	(1)	(2)	(3)	(4)	(5)	(6)
<u>Panel A: Consumption and Income</u>						
Consumption and Income Index	0.153*	0.016	0.246**	0.181	0.008	0.298
	(0.090)	(0.118)	(0.101)	(0.230)	(0.228)	(0.280)
Log(Staple consumed, kCal)	0.057	-0.044	0.125	0.064	-0.100	0.176
	(0.075)	(0.088)	(0.092)	(0.182)	(0.220)	(0.237)
Log(Non-food expenditure, in 1000 Rp)	0.129	-0.003	0.218	0.106	-0.032	0.195
	(0.128)	(0.157)	(0.147)	(0.241)	(0.277)	(0.262)
Log(Reported income)	0.390**	0.287	0.459***	0.772	0.497	0.966
	(0.152)	(0.239)	(0.150)	(0.581)	(0.485)	(0.840)
<u>Panel B: Seasonal Differences, Harvest - Lean </u>						
Seasonal Gap Index	-0.169**			-0.087		
	(0.085)			(0.169)		
Log(Staple consumed, kCal)	-0.024			0.043		
	(0.060)			(0.206)		
Log(Monthly non-food expenditure items)	-0.135			-0.198		
	(0.093)			(0.139)		
Log(Reported income)	-0.175			0.120		
	(0.131)			(0.249)		
<u>Panel C: Food Shortages</u>						
Food Shortage Index	-0.259*	-0.159	-0.326**	0.058	0.198	-0.036
	(0.135)	(0.196)	(0.142)	(0.246)	(0.301)	(0.267)
1(Anticipate food shortage in January)	-0.109	-0.111	-0.107	-0.080	0.057	-0.171
	(0.098)	(0.139)	(0.092)	(0.143)	(0.190)	(0.143)
1(Anticipate food shortage in April)	-0.065**	-0.020	-0.096**	0.042	0.052	0.035
	(0.033)	(0.048)	(0.037)	(0.055)	(0.085)	(0.075)
1(Anticipate food shortage in November)	-0.113	-0.040	-0.163**	0.038	0.196	-0.067
	(0.072)	(0.132)	(0.081)	(0.127)	(0.179)	(0.141)
1(Lacked food last month)	-0.132*	-0.101	-0.152	0.096	-0.048	0.191
	(0.078)	(0.087)	(0.095)	(0.124)	(0.133)	(0.155)
<u>Panel D: Health</u>						
Health Index	-0.112	0.243	-0.349**	-0.137	0.108	-0.301
	(0.125)	(0.187)	(0.144)	(0.176)	(0.242)	(0.191)
1(Health expenditure shortages last month)	0.044	-0.002	0.074*	0.077	-0.035	0.151**
	(0.034)	(0.039)	(0.042)	(0.060)	(0.080)	(0.068)
Number of sick days	0.069	-0.235	0.272**	0.015	-0.049	0.057
	(0.122)	(0.194)	(0.137)	(0.136)	(0.203)	(0.150)
Number of sick household members	0.005	-0.015	0.018**	0.009	-0.007	0.019*
	(0.007)	(0.010)	(0.008)	(0.010)	(0.013)	(0.012)

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

Notes—This table repeats IV regressions for credit reported in columns 5 to 7 in Table 2, but does so separately for Alfa Omega villages (columns 1 to 3 in this table) and TLM villages (columns 4 to 6 in this table).