

OXFAM AMERICA
Evaluation Report

MANAGING RISKS TO AGRICULTURAL LIVELIHOODS: IMPACT EVALUATION OF THE HARITA PROGRAM IN TIGRAY, ETHIOPIA, 2009–2012

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To promote both accountability and learning, Oxfam will share evaluation conclusions and recommendations with relevant stakeholders, both within the Oxfam system and externally in accessible language and ensuring that stakeholders have an opportunity to participate in discussion of those results in meaningful ways. In addition, to ensure transparency, Oxfam will publish the evaluation reports on our webpage.

As a rights-based organization, accountability, particularly to the communities we seek to serve, is of the highest importance to us. For Oxfam, accountability requires Oxfam to regularly and honestly assess the quality of its work, share and learn from its findings with primary stakeholders, and apply that learning in future work.

This is an evaluation of Oxfam America's Horn of Africa Risk Transfer for Adaptation (HARITA) project, part of the R4 Rural Resilience Initiative of Oxfam America and The World Food Programme. The program has been operating in Ethiopia since 2008 and this evaluation covers the period from 2009 to 2012.

The evaluation was commissioned by Maliha Khan, Director, Learning, Evaluation and Accountability Department, with funding from Oxfam America and The Rockefeller Foundation. The evaluation process was managed by Julia Fischer-Mackey, Research and Evaluation Advisor, from Oxfam America. The major evaluation activities took place between January 2010 and December 2013. The evaluation was carried out by Dr. Malgosia Madajewicz and reflects the findings as reported by her and validated by stakeholders.

For additional information regarding the evaluation Terms of Reference, please refer to the report appendices.

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Any remaining errors or omissions are the sole responsibility of the authors.

LIST OF ABBREVIATIONS

BoARD	Ethiopian Bureau of Agriculture and Rural Development
DAs	Development agents
FGD	Focus Group Discussion
HARITA	Horn of Africa Risk Transfer for Adaptation project
PSNP	Ethiopia's Productive Safety Net Program
REST	Relief Society of Tigray

LIST OF TIGRINYA WORDS

Equub	A rotating savings and credit association
Iddir	A funeral society in which members contribute in kind or in cash when an adverse event, such as death or serious illness, befalls one of the member families
Tabia	The second lowest unit of government administration in Tigray, Ethiopia; roughly equivalent to the notion of a village, although a tabia can be quite dispersed geographically
Timad	A measure of land area most commonly used in Tigray
Woreda	The third lowest unit of government administration in Tigray, Ethiopia; a district

EXECUTIVE SUMMARY

Rural livelihoods in developing countries are increasingly vulnerable to risks posed by weather and climate. Droughts can reduce a farmer's productivity for many years because farmers often sell assets that they need to farm, such as draught animals, in order to survive the poor harvest. Also, farmers may reduce investments in good seasons because they fear that they will lose the investment if a drought occurs. Farmers need effective strategies for managing the risks posed by climate in order to attain food security and improve their livelihoods (Barnett et al 2008).

In response to these challenges, Oxfam America, the Relief Society of Tigray (REST), Swiss Re, and their partners developed an integrated risk management approach to enable poor farmers to strengthen their food security and improve livelihoods. The Horn of Africa Risk Transfer for Adaptation (HARITA) project in the drought-prone northern state of Tigray in Ethiopia combines improved resource management and weather index insurance. Farmers work on community-level risk reduction projects designed to reduce agricultural risk, such as improving the soil and reducing water run-off. They then have the option to purchase weather index insurance to transfer a portion of the remaining risks. Traditional crop insurance has not been successful in smallholder agriculture. Unlike traditional insurance, weather index insurance compensates for weather events that cause loss, for example insufficient rainfall, not for actual crop losses that are difficult to document.

HARITA offers a unique opportunity to learn about the potential that weather index insurance has to improve rural resilience because it has successfully addressed some of the early concerns such as low take-up rates of insurance in early pilots and the feasibility of making index insurance available to poor farmers (Gine and Yang 2007, Cole et al 2008, Morduch 2006). HARITA uniquely serves food-insecure farmers through an innovative partnership with Ethiopia's Productive Safety Net Program (PSNP) that allows farmers to pay for insurance with labor devoted to the risk reduction projects. HARITA is operating at capacity. Many more farmers want to buy insurance through the labor-for-insurance option than the program budget allows. The insurance component reaches a relatively large average 29% of the population, with the proportion reaching 38% in some villages.

This report documents the lessons that HARITA offers for building resilience to drought among smallholder farmers. We adopt a mixed methods approach that combines quantitative evidence based on a panel of household data collected in three rounds of surveys in treatment and control villages between 2009 and 2012 with qualitative evidence from interviews and focus group discussions (FGDs). The quantitative analysis uses a 3-period difference-in-difference approach in order to estimate impacts that can be attributed to HARITA. We observe one good season, in 2010, and one drought, in 2012, in the course of the evaluation, allowing us to examine the impacts of HARITA on resilience to drought and on agricultural investments in a good season.

SUMMARY OF FINDINGS

The main conclusion of the study is that HARITA is achieving the critical objective of helping farmers to maintain their livelihoods in the face of drought, thereby addressing an urgent threat to livelihoods in the drought-prone region of Tigray. On average, across all villages included in the evaluation, farmers insured through HARITA have increased their savings and the number of oxen, the most valuable animal and the main animal used to plough the fields, relative to uninsured farmers. The impacts differ considerably across the 3 evaluated districts, and our data does not suggest that each of the average effects has occurred in each district. In one district, insured farmers increased their levels of grain reserves more than did uninsured farmers. In another district, insured farmers increased the number of oxen owned relative to the uninsured. The number of oxen declined slightly among the uninsured. In a third district, insured farmers increased the number of loans and amounts borrowed relative to the uninsured.

HARITA is also having some impacts on investments in production in good seasons. We do not yet see evidence of corresponding increases in yields. Lack of increases in yields is not surprising in the second evaluated season due to the drought. On average, across all evaluated villages, insured farmers have increased the amount of compost that they use per unit of land relative to uninsured farmers. In addition, in one of the three districts insured farmers increased their investments in fertilizer and traditional seeds relative to uninsured farmers. Farmers in the other two districts increased their investments in fertilizer and improved seeds relative to uninsured farmers but only in the 2010 season, not over the entire evaluation period. Female-headed households, who are among the more vulnerable farmers, seem to be achieving some of the most significant increases in agricultural inputs among the participants. If such productive investments continue to grow, they will contribute to building the farmers' resilience to droughts.

Based on interviews and FGDs with farmers and village leaders, we learned that farmers consider knowledge about new agricultural production inputs and techniques to be the most valuable contribution made by HARITA. We do not characterize the improvement in knowledge as an impact of the program since the knowledge comes primarily from the Ethiopian agricultural extension service, which works closely with HARITA but also works with farmers in non-HARITA villages. However, it is useful for program design to understand the importance of working closely with a capable extension service, as HARITA is doing.

Farmers and village leaders overwhelmingly affirm the value of HARITA in helping to reduce the hardships imposed by droughts, and they express tremendous appreciation for the program. Almost all also agree that HARITA is not yet improving livelihoods in a transformative way. Improving living standards is an ambitious goal that requires time, and it is too early to assess whether the program in its current form can achieve this goal.

MAIN RECOMMENDATIONS

Discussions with farmers, village leaders, and program staff suggest a number of recommendations:

1. Most farmers and village leaders believe that HARITA needs to expand its scope in order to address the obstacles that impede significant improvements in living standards in rural Tigray. They recommend that HARITA invest in irrigation, since current rainfall may be insufficient to support large increases in agricultural productivity, and that HARITA engage in diversifying rural livelihoods.
2. The HARITA program may consider whether irrigation and/or diversification of livelihoods are essential to maintaining livelihoods, not necessarily improving them, in the driest parts of the region, as droughts worsen. Determining sustainability of rainfed agricultural activity requires more time to observe whether the recent apparent increase in frequency of drought in some parts of the region is a short-term anomaly or a long-term trend.
3. The insurance part of the program is currently attracting few better-off farmers who can pay in cash in areas in which the labor-for-insurance option is offered. Inclusion of better-off farmers may be important for the sustainability of the program and it may broaden and deepen the impacts of the program on the livelihoods of the more vulnerable.
4. An uncertain funding flow has delayed the sales of insurance every year with multiple negative consequences for the functioning and potential impacts of the program. HARITA now appears to have addressed the uncertainty of funding. The program may realize a significant improvement if it begins to schedule registration for insurance and the implementation of risk reduction activities well before farmers need to begin to prepare their own lands for planting.
5. The program would benefit from an expanded, and possibly redesigned, communication and education strategy that informs farmers about the program and explains the mechanics of index insurance. A separate communication and education strategy needs to be developed to attract better-off farmers.
6. The program would benefit from broader participation by farmers who want to be involved in decisions about risk reduction activities. There should be a clear process for farmers to offer comments and to receive a response.
7. The HARITA program needs a well-developed, systematic monitoring system that collects data on an annual basis.
8. The program may consider working with farmers to develop ways to manage small payouts. Walking long distances to pick up small payout amounts is unnecessarily onerous for the farmers.

INTRODUCTION

OVERVIEW OF CONTEXT AND PROJECT

Rural livelihoods, in developing countries are increasingly vulnerable to risks posed by weather and climate. The livelihoods of smallholder farmers who rely on rainfed crops fluctuate with droughts, floods, and erratic rainfall. Livelihoods suffer not only in seasons in which yields are poor. Bad seasons have a long-term influence on farmers' productivity because, in order to survive the poor harvest, farmers may sell assets that they need to farm. Also, farmers may reduce investments in their production in all seasons because they fear that they will lose the investment if the season is poor, thereby reducing livelihoods in all seasons. Farmers need effective strategies for managing the risks posed by climate in order to attain food security and improve their livelihoods (Barnett et al 2008).

In response to these challenges, Oxfam America, the Relief Society of Tigray (REST), Swiss Re, and their partners developed an integrated risk management approach to enable poor farmers to strengthen their food security and improve livelihoods. The Horn of Africa Risk Transfer for Adaptation (HARITA) project in the drought-prone northern state of Tigray in Ethiopia combines improved resource management and weather index insurance. Farmers work on community-level risk reduction projects designed to reduce agricultural risk, such as improving the soil and reducing water run-off. They then have the option to purchase weather index insurance to transfer risks that cannot be sufficiently reduced. Traditional crop insurance has not been successful in smallholder agriculture. Weather index insurance compensates for weather events that cause loss, for example insufficient rainfall, not for actual crop losses that are difficult to document.

Weather index insurance has been generating the kind of excitement that development interventions have not enjoyed since the early days of microcredit. However, index insurance is still in an experimental phase. HARITA offers a unique opportunity to learn about the potential that index insurance has to improve rural resilience, because it has successfully addressed some of the early concerns such as low take-up rates of insurance in some early pilots and the feasibility of making index insurance available to poor farmers (Gine and Yang 2007, Cole et al 2008, Morduch 2006).

HARITA's insurance component is notable for reaching a relatively large average 29% of the population, with the proportion reaching 38% in some villages. The program uniquely serves food-insecure farmers through an innovative partnership with Ethiopia's Productive Safety Net Program (PSNP) that allows farmers to pay for insurance with labor devoted to the risk reduction projects.

OVERVIEW OF THE EVALUATION

The objective of this report is to document the lessons that HARITA offers for building resilience to drought among smallholder farmers. The analysis constitutes one of the first evaluations of impacts that weather index insurance has on production decisions and farming livelihoods, albeit not by itself but in combination with risk reduction activities.¹ We adopt a mixed methods approach that combines quantitative evidence based on a panel of household data collected in three rounds of surveys in treatment and control villages between 2009 and 2012 with qualitative evidence from interviews and focus group discussions. The quantitative analysis uses a 3-period difference-in-difference approach in order to estimate impacts that can be attributed to HARITA.

The theory behind HARITA's design is that the program should have two main types of effects, which differ depending on whether the season is good or bad. (1) It should improve farmers' resilience to a drought. Resilience is a multi-dimensional concept. We look primarily for maintenance of assets, maintenance of access to food, and access to credit after bad seasons. Loans can help a household to maintain assets and access to food. (2) In good seasons, the promise of an insurance payout if the season turns out badly should improve farmers' ability to make agricultural investments and thereby improve yields and livelihoods. This causal channel also builds resilience but through a different mechanism. We observe one good season, in 2010, and one drought, in 2012, in the course of the evaluation, allowing us to examine both channels through which HARITA may affect livelihoods.

SUMMARY OF FINDINGS

The main conclusion of the study is that HARITA is achieving the critical objective of helping farmers to maintain their livelihoods in the face of drought, thereby addressing an urgent threat to livelihoods in the drought-prone region of Tigray. On average, across all villages included in the evaluation, farmers insured through HARITA have increased their savings and the number of oxen, the most valuable animal and the main animal used to plough the fields, relative to uninsured farmers.

HARITA's impacts on resilience differ across the 3 evaluated districts. Insured farmers increased their savings more than the uninsured in two districts, but the differences are not statistically significant in any single district, only when all 3 districts are combined for a larger sample size. The increase in oxen is statistically significant in one district, in which the number of oxen declined slightly among the uninsured. In a second district, insured farmers increased their levels of grain reserves more than did uninsured farmers. In the third district, insured farmers increased the number of loans and amounts borrowed relative to the uninsured.

HARITA is also having some impacts on investments in production in good seasons, though we do not yet see evidence of corresponding increases in yields. On average, across all evaluated villages, insured farmers have increased the amount of compost that they use per unit of land

¹ Other studies that examine the impacts of weather index insurance on production decisions are Cole et al 2011, Gine 2011, and Karlan et al 2012.

relative to uninsured farmers. In addition, in one district insured farmers increased their investments in fertilizer, and traditional seeds relative to uninsured farmers. Farmers in the other two districts increased their investments in fertilizer, and improved seeds relative to uninsured farmers, but only in the 2010 season, not over the entire evaluation period. Female-headed households, who are among the more vulnerable farmers, seem to be increasing agricultural investments more than are male participants. If such investments continue to grow, they will contribute to the farmers' resilience to droughts.

Farmers and village leaders overwhelmingly affirm the value of HARITA in helping to reduce the hardships imposed by droughts in interviews and FGDs. The demand for insurance is testimony to the farmers' appreciation. HARITA is operating at capacity. Many more farmers want to buy insurance through the labor-for-insurance option than the program budget allows.

Farmers say that the main benefit of the HARITA program is the knowledge that the program provides about new agricultural production inputs and techniques. We do not characterize the improvement in knowledge as an impact of the program since the knowledge comes primarily from the Ethiopian agricultural extension service, which works closely with HARITA but also works with farmers in non-HARITA villages. However, it is useful for program design to understand the role that agricultural knowledge plays in HARITA and the importance of working closely with a capable extension service, as HARITA is doing.

Almost all farmers and village leaders also agree that HARITA is not yet improving livelihoods in a transformative way. Improving living standards is an ambitious goal that requires time, and it is too early to assess whether the program in its current form can achieve this goal.

HARITA faced an uncertain flow of funding during the evaluation years, which delayed the sale of insurance every year until the beginning of the planting season. The delays are likely to have had multiple adverse effects on the functioning of the program and therefore its impacts. Second, HARITA has managed an impressive scale-up with a very small implementation team. The program seems to have addressed the funding constraints, and the next several years may provide better evidence about the potential of the current HARITA model.

At the same time, most farmers and village leaders believe that HARITA needs to expand its scope in order to address the obstacles that impede significant improvements in living standards in rural Tigray. They recommend that HARITA invest in irrigation, since current rainfall may be insufficient to support large increases in agricultural productivity. Many farmers, especially in drier districts, also mention the need for diversification of livelihoods. Another direction that may improve both the sustainability and the impacts of HARITA is a more systematic and intentional effort to include better-off farmers in the program.

THE HARITA PROJECT

HARITA brings together a network of partners including Ethiopian farmers, the Relief Society of Tigray (REST), Nyala Insurance Share Company, Africa Insurance Company, Dedebit Credit and Savings Institution (DECSI), Mekelle University, the Government of Ethiopia, the International Research Institute for Climate and Society (IRI), Swiss Re and Oxfam America. The project is funded by the Rockefeller Foundation and Swiss Re.

The integrated risk management framework begins with community-level risk reduction activities that are designed to reduce risks by improving the management of resources. The community participates in designing and implementing measures such as preventing soil erosion, preventing rainfall run-off, preparing compost, and constructing small-scale irrigation. The risk reduction activities are implemented with labor that pays for insurance. HARITA coordinates these activities with existing PSNP activities in order to increase impacts beyond what would be possible with the labor that pays for insurance alone.

The second part of the framework is the transfer of risks that cannot be reduced. Farmers can purchase weather index insurance, which makes payments contingent on recorded rainfall rather than yields. Basing payments on rainfall eliminates the costly moral hazard problems involved in verifying yields on smallholder farms and therefore makes the premiums more affordable. In the event of a seasonal drought, insurance payouts are triggered automatically when rainfall drops below a pre-determined threshold at a pre-determined time during the growing season. HARITA relies on satellite data for rainfall measures.²

Existing approaches to providing drought insurance to the poorest have not been effective due to high administrative costs and the inability of cash-poor smallholders to afford premiums. In the HARITA team's conversations with farmers, the farmers themselves suggested a solution – they could pay for insurance with their labor. Oxfam America worked with the Relief Society of Tigray and the Government of Ethiopia to build an “insurance-for-work” program on top of the government's “food- and cash-for-work” Productive Safety Net Program (PSNP), a well-established program that serves eight million chronically food-insecure households in Ethiopia. The resulting innovation allows cash-poor farmers who are PSNP participants the option to work for their insurance premiums on the risk reduction activities. During the 2010 growing season, 80% of farmers who bought insurance were PSNP participants who paid with labor, while in 2012 93% paid with labor in those villages in which farmers had the option to pay with labor.³

As part of their effort to reach the most vulnerable farmers, both the PSNP and HARITA particularly target female-headed households. In 2012, 24.7% of farmers who purchased

² More technical information about the insurance index, how it is constructed, and how it works is available in Chen et al 2010.

³ In 2012, HARITA offered insurance for cash only in 33 villages. The available budget is insufficient to provide the labor-for-insurance option in all villages.

insurance in tabias in which the labor for insurance option is available were female.⁴ In tabias in which insurance is available only for cash, the percentage of female purchasers is 10.5%.

Importantly, farmers who participate in the PSNP and choose to pay for insurance with labor do not forego their option to participate in the PSNP for cash and/or food. The insurance-for-labor program is additional to the cash-and-food-for-work program, not a substitute for it.

Better-off farmers can pay their insurance premiums in cash. In 2012, households who purchased insurance with labor had to contribute 10% of the payment in cash in order to begin the process of encouraging farmers to pay for insurance in cash, which is necessary to strengthen the sustainability of the program.

Risk reduction activities begin after farmers have purchased insurance since the amount of insurance purchased determines the amount of labor that farmers have to provide. The timing of the sale of insurance is critical to ensuring that the labor obligation on risk reduction activities does not compete for time with the work on farmers' own fields.

The institutional structure that implements HARITA is very decentralized. REST implements HARITA in partnership with DECSI, woreda and tabia administrations, and the Bureau of Agriculture and Rural Development (BoARD).⁵ The small implementation team at REST consists of 2 regional coordinators at the head office who oversee 5 microinsurance assistants, each of whom is assigned to one woreda. Each tabia has a design committee that includes the tabia administrator, tabia executives, chairperson of the women's association, crop agricultural agent, natural resources management development agent, chairperson of the Farmer's Cooperative, religious leaders and elders. Risk reduction activities are planned by members of the design committee working together with REST and external experts. Farmers' Cooperatives collect insurance premia and give out payouts, with the money then passing through DECSI to the insurance agencies. Also REST natural resource conservation experts and agronomists work on the project.

REST staff provide education about insurance to farmers about 3 times per year. Once a year, REST staff provide training to farmers on improved seeds and cultivation techniques and design committee members provide such training 2 times per year. REST educates the design committee members about insurance and risk reduction activities 2 times per year. REST also provides training to development agents (DAs) about insurance and preparation of household vegetable gardens about 3 times a year in all tabias in which REST operates, not just those tabias in which HARITA is present. DAs are agricultural extension agents who work for the Ethiopian agricultural extension service (BoARD) and they work closely with HARITA in each tabia.

In its four years of delivery in Ethiopia, the HARITA project has scaled from two hundred households who purchased insurance in one tabia in 2009, to over 18,000 purchasing

⁴ We refer to female-headed households as those in which there is no male head of household residing at home. Most often the female head of household does not have a husband but in some cases the husband is away most of the time. Not all women who purchase insurance are heads of households. Some reside in male-headed households in which the husband is also buying insurance.

⁵ DECSI is a non-profit non-government organization that offers microcredit. Woreda is a district. Tabia is the second lowest unit of administration in Tigray, roughly equivalent to the notion of a village, although a tabia can be quite dispersed geographically.

households in 76 tabias in 2012 – directly affecting approximately 95,000 people. Households in 43 tabias have the option to purchase insurance with labor, while in the remaining 33 villages they can only purchase in cash.

HARITA'S THEORY OF CHANGE

The Theory of Change provides a conceptual guide for the evaluation by describing how the HARITA program is supposed to work. In the Theory of Change, we explain the causal linkages that may lead from HARITA's initiatives to changes in farmers' behavior and to impacts on livelihoods. The evaluation will then examine which causal linkages seem to be active based on evidence of changes in behavior and impacts on livelihoods.

HARITA's risk reduction activities are likely to affect livelihoods of those households whose fields are within the range of the constructed infrastructure and those who use the compost made as part of the risk reduction activities. The risk reduction activities may influence yields. Water diversion and water retention structures protect fields from excess water and retain water for dry spells. Trees prevent soil runoff. Female-headed households may include work on their own vegetable gardens as part of risk reduction activities. Participating households may also learn techniques while working on the risk reduction activities that they can then use on their own fields.

Different households may benefit differently from the risk reduction activities depending on where their fields are located, to what extent the activities address problems that affect their fields, and the soil quality on their fields. The net benefits of the activities will also depend on how household members are affected by the requirement that they contribute labor. Women and children may be particularly heavily impacted by the labor requirement if the women provide the labor and are still expected to fulfill the remainder of their household responsibilities and/or the children have to help with more of the household chores or fieldwork. In these cases, the labor requirement may have unexpected negative consequences for women's health and possibly children's health and schooling. On the other hand, if women are providing the labor, they may benefit from gaining skills and experience.

We expect to see two kinds of effects of index insurance on farmers' behavior, which should ultimately lead to impacts on livelihoods (for a discussion of the conceptual framework on which this section is based see Carter and Barrett 2006 and Barnett et al 2008). The effects, the assumptions under which they operate, and the possible unintended consequences of the program are likely to function differently for households that are more and less vulnerable to risks, and especially for female-headed households and for women and girls within households than for male-headed households and men.

The first potential effect is on farmers' resilience after a drought. The direct risks that drought poses for farming households are that they may have to reduce food consumption as food becomes scarce and more expensive, safe drinking water may become scarce and expensive, and health may decline as a result. These effects may have long-run consequences for the household if declines in health last into future growing seasons and reduce productivity. Drought may also have indirect effects. Farmers often sell productive assets, such as draught animals, in order to feed their families after a drought (Rosenzweig and Wolpin 1993, Tafere et al 2010). Such sales reduce yields and the family's income for many seasons, potentially resulting in a poverty trap. Farmers may also be unable to repay loans and may then be denied credit in the

future. Since farmers in Tigray purchase many farming inputs on credit, loss of access to credit can reduce productivity in future seasons.

The insurance payout may improve livelihoods by allowing farmers to preserve food consumption and/or their asset holdings after a drought and to repay their loans. Farmers who receive an insurance payout may not need to sell assets in order to feed their families and to repay loans. Therefore, farmers may maintain higher yields in subsequent seasons, preserving food security and livelihoods. These effects may also influence migration patterns since men from farming household may be less likely to migrate if livelihoods at home improve. We will examine this channel through quantitative evidence of maintained assets, access to food, and access to credit.

The second potential effect is on productive investments and consumption in growing seasons with good rainfall. The threat of drought may cause farmers to invest less in all seasons and to avoid borrowing to finance investments because farmers worry that investments will be wiped out by drought. The promise of an insurance payout that will help to repay loans and buy food in case of a drought may enable farmers to increase investments, translating into higher yields, assets, and incomes in good seasons, and therefore improved food security and livelihoods in all seasons. As above, these effects may also affect migration. We will identify this channel through quantitative evidence regarding investments and yields and qualitative evidence of other changes in production decisions.

The effectiveness of these two channels in generating changes in the behavior of the insured farmers and impacts on livelihoods depends on a number of conditions. These conditions are likely to vary from household to household and many can also vary between different members of the same household. The first channel, improvement in resilience to drought, requires that:

- Sufficient food be available in the area during and after a drought. If supplies are limited, influential families and those with better ability to pay are likely to secure access first. If division of resources within the household is uneven, some may benefit less from the fact that the household has insurance, typically women and girls.
- Basis risk be sufficiently low that most households receive an insurance payout when their crops have failed.⁶
- The insurer be in a sufficiently good financial position and sufficiently responsible to pay according to the contract.
- The size of the effect is likely to depend on a household's own resources and access to resources from elsewhere such as friends, family, and community support groups. Households that have sufficient own resources may not benefit very much in the season following a drought. The benefit to them may show up in increased productivity in future seasons as they invest the insurance payment in production.

The second channel, improvement in productivity, requires that:

- Households have access to the inputs that they need to increase investments, such as fertilizer, improved seeds, land, labor, and others, and these inputs be available in time

⁶ Basis risk is the risk that rainfall on a farmer's field can be quite different from the rainfall at the point where rainfall is measured for the purpose of triggering an insurance payment. In the case of HARITA, satellite readings determine the rainfall levels that trigger insurance payouts.

for planting. For example, female-headed households may not have sufficient family labor available to increase cultivation and it may be difficult for them to hire labor.

- A particularly important condition for improving productivity may be access to credit. Insurance payouts in themselves may not be sufficient to make cash available for investment. Their main role may be to prevent losses of assets and reductions in consumption. Cash-constrained households may not be able to invest more unless credit is available. Lenders may approve loans for farmers who are insured more readily since they are more confident that the farmer will repay. Farmers may be more willing to apply for loans if they have insurance, because insurance enables them to repay the loan in case of a drought. In focus group discussions (FGDs) in Ethiopia, farmers commonly note that access to credit is not a problem but that the risk of not being able to repay is a powerful deterrent to borrowing, and that insurance gives them the confidence to apply for loans. This effect may differ for different households. For example, female-headed and poorer households may face discrimination in lending even if they are insured.
- Farmers need to have sufficient own resources. Very poor farmers may not be able to increase investments even with insurance.
- Farmers need to trust that the insurance payment will be forthcoming according to the contract conditions.
- Farmers need to recognize the productive opportunities, understand how insurance helps them to realize those opportunities, and be willing to undertake them.

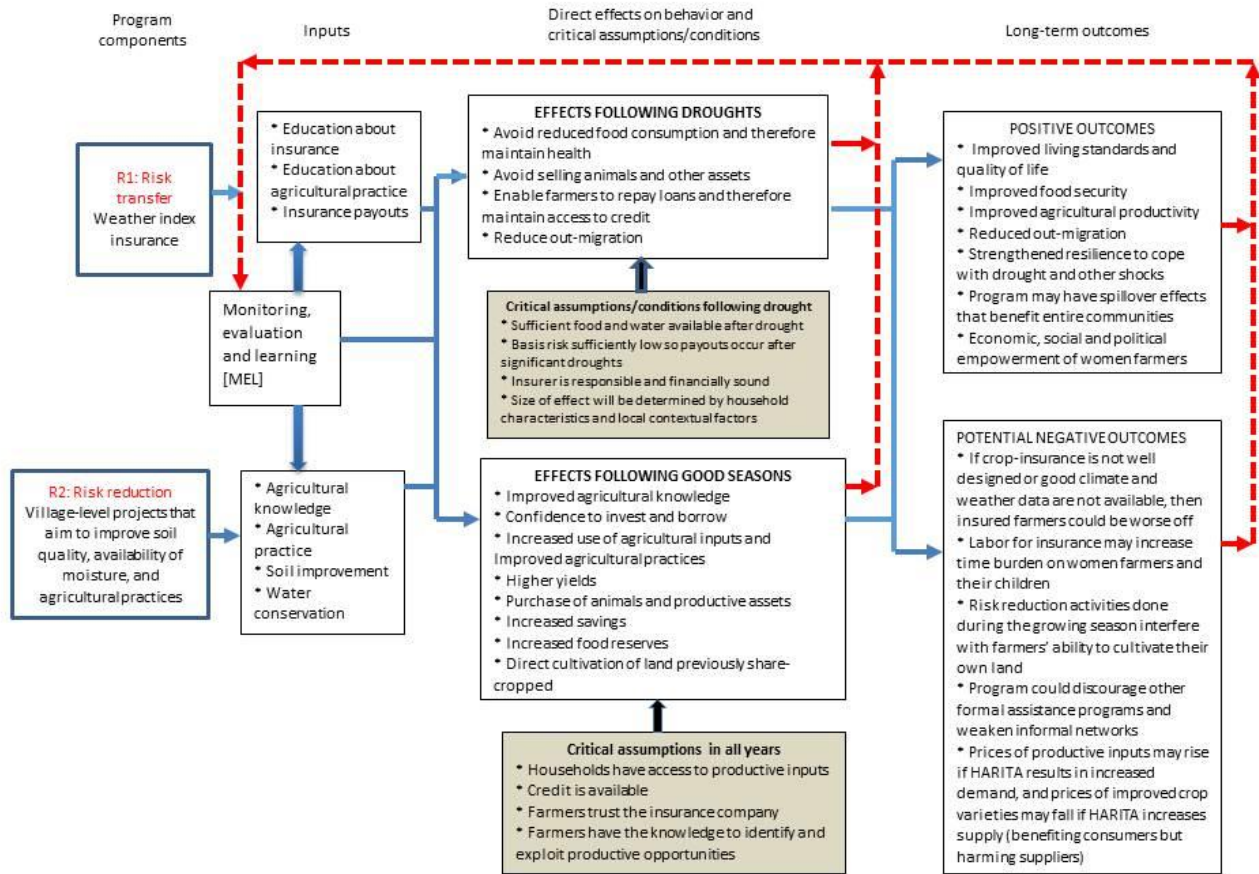
In addition to intended outcomes and impacts, HARITA may have other positive and negative consequences.

- If basis risk is larger than expected and/or the index is poorly designed and/or based on poor quality data, then the insurance may not reduce the risk that farmers face.
- The program may affect how other organizations function such as government institutions, NGOs, and community organizations. It may erode existing insurance networks if people who are insured perceive less need to rely on others in their communities in times of need and therefore offer less help to community members. However, it may also improve these networks if insured farmers are better able to insure each other against idiosyncratic risks that are not covered by the index insurance.
- The government may provide fewer services and/or respond less energetically to disasters in communities served with insurance.
- If insurance results in greater demand for certain productive inputs, prices of these inputs may rise, with adverse effects on investment. If insured farmers plant more high-value crops, prices of these crops may decline.
- The insurance for labor may affect labor supply and therefore wages.

HARITA may also affect the livelihoods and food security of other residents in the village, who are not direct beneficiaries of the program:

- Insured people could help the uninsured weather bad seasons.
- The uninsured may benefit from risk reduction activities and from new information disseminated by HARITA since the insured may pass on information to the uninsured.
- The uninsured will be affected by any changes in informal insurance networks, government services, prices, and wages discussed above.

Figure 1: The HARITA Theory of Change



EVALUATION FRAMEWORK

EVALUATION PURPOSE AND QUESTIONS

The objectives of the evaluation are to:

1. Test and improve the HARITA pilot.
2. Inform the scale-up of HARITA within Tigray as well as the scale-up of an expanded approach to other regions of Ethiopia and to other countries. In 2010, Oxfam America and the United Nations World Food Programme (WFP) agreed to take the HARITA model to multi-national scale by launching the R4 Rural Resilience Initiative. R4 refers to the four risk management strategies that the initiative integrates: improved resource management (risk reduction), insurance (risk transfer), microcredit (prudent risk taking), and savings (risk reserves).
3. Provide evidence relevant to the debate about the effectiveness of weather index insurance as an approach to risk management among smallholder farmers.

The evaluation effort focused on the following questions:

1. How does HARITA impact the agricultural decisions that farmers make, the outcomes of those decisions, resilience, and livelihoods?
2. How do the impacts differ across different types of farmers and different conditions?
3. Why do we observe certain impacts and not others, and why do impacts differ across types of farmers and conditions?

The evaluation did not fully address questions about implementation processes, or sustainability of the program due to resource constraints.

EVALUATION CONTEXT

We carried out the evaluation in 5 tabias in which HARITA was operating in 2010: Adi Ha and Awet Bikalsi in Kola Tembien woreda, Hade Alga and Genete in Raya Azebo woreda, and Hadush Adi in Saesi Tsaedaemba woreda, as well as 1 control tabia in each of the 3 woredas that contain the program tabias. The program was operating in Adi Ha since 2009, and it began in the other 4 tabias in 2010. Adi Ha and Awet Bikalsi are very close to each other, as are Hade Alga and Genete. The two tabias in each pair face very similar climate and socio-economic conditions to each other, with a few differences that will be discussed below.

The 3 woredas that contain the 5 program tabias and 3 control tabias face somewhat different climate conditions and they had different climate outcomes over the course of the evaluation. Drought conditions are becoming more frequent in all 3 woredas. Some of the biggest changes seem to be happening in Raya Azebo, where the growing season is becoming shorter, and possibly the late season may be becoming more prone to drought although it is too soon to establish such a pattern based on existing data. While Kola Tembien has the shortest growing season of the 3 woredas, it has experienced fewer significant droughts since the HARITA project began than have the other woredas..

The baseline season, 2009, was affected by drought in all 3 woredas. The first follow-up season of the evaluation, 2010, was good in all 3 woredas. Rainfall was plentiful. In 2011, the season was not a drought but also not very good in Kola Tembien and in Hade Alga. The end of the season was rather dry in Genete, while Hadush Adi suffered a fairly significant drought early in the season. Genete received a small insurance payout in 2011, 6% of the maximum possible, while Hadush Adi received a 31% payout. During the second follow-up season, 2012, the 3 areas experienced a drought. The rains started out well in all 3 areas but failed to varying extents across the 3 woredas late in the season. The 2012 drought was by far worst in Raya Azebo. Raya is the only woreda in which we actually see a decline in yields between 2009 and 2012 in our data. The drought was severe enough that farmers in Hade Alga received a payout that was 100% of the maximum possible, while Genete received 67%. The drought was also quite severe in Saesi Tsaedaemba, and farmers received a payout that was 63% of the maximum. The 2012 drought was not very severe in Kola Tembien. Farmers in Adi Ha and Awet Bikalsi received a 4% payout.

The soil conditions are quite different in the 3 woredas. Raya Azebo has very fertile soil that is highly productive if sufficient water is available. The soil in Saesi Tsaedaemba is rocky, not very fertile, and suffers from considerable erosion. The soil in Kola Tembien is good but not as fertile as in Raya.

Different crops are appropriate to the soils in the 3 woredas. The primary crops in Kola Tembien are teff and maize (the two insured crops), though people also grow sorghum, niger and they use irrigation to grow fruit, vegetables, and coffee. Primary crops in Raya Azebo are teff and sorghum, and these are the insured crops. In Saesi Tsaedaemba, the main crops are wheat and barley, which are the insured crops, although people also grow teff and chickpea. In all tabias, those who have access to irrigation grow fruits and vegetables but irrigation is most common in Kola Tembien thanks to an extensive Oxfam project that implemented an irrigation system in Adi Ha tabia. There are a number of irrigation wells dug by the government near Hade Alga but these are inactive at the moment.

The three woredas also have somewhat different socioeconomic conditions. Raya Azebo is the most accessible and developed of the three. Hade Alga and Genete are both near to the bustling trading town of Mohoni and easily accessible by road. Hade Alga has a new school, health center, and safe drinking water. Hadush Adi is easily accessible by road though the 2 kilometer long track that connects it to the main road is rough. The nearest school, health center, and market are all quite far away. The tabias in Kola Tembien are the least accessible of the three locations. There is a very rough 34 kilometer long track to Adi Ha that leads from a dirt

road. There is no road at all to Awet Bikalsi and it is almost impossible to get there except by foot in rainy season. Schools, health facilities, and markets are far away.

Farmers in all tabias suffer from a shortage of land, with families subdividing their small plots among the children with each generation. The problem is particularly severe in Saesi Tsaedaemba, where plots are especially small.

EVALUATION METHODOLOGY

This report evaluates the impacts that the HARITA program as a whole had in the 2010 and 2012 growing seasons. In 2010, the index insurance covered teff, wheat, and barley. In 2012, the coverage expanded to include maize and sorghum. Different crops are most commonly grown in different tabias. We only analyze inputs into and yields of those crops that are grown by a sufficient number of farmers in our survey sample in each tabia. In Saesi Tsaedaemba, we only analyze the production of wheat and barley because too few farmers in our sample grow other crops. In Kola Tembien, we only analyze teff and maize for the same reason. In Raya Azebo, we only analyze teff and sorghum.

The evaluation uses mixed methods, combining data from household surveys and information from focus group discussions and interviews to understand the impacts that the HARITA program had on inputs into production and on yields in the 2010 and 2012 growing seasons.

Quantitative Analysis

In the quantitative analysis of survey data we use an approach called “difference-in-difference” to identify impacts that are directly attributable to HARITA. “Difference-in-difference is widely used in the program evaluation literature to estimate impacts of interventions that are due to the intervention alone, eliminating the influence of other factors.” We explain the approach below.

One way to examine the effects of HARITA is to compare inputs applied and yields obtained by participants and non-participants in the program. However, any difference between the two groups cannot be necessarily understood as the effect of HARITA. Participants are very likely to be different from non-participants. For example, we already know that a participant is more likely to be a PSNP member than is a farmer randomly selected from the village population. If we could observe all differences between participants and non-participants then we could simply compare inputs and yields of participants to a non-participant group chosen to match the participants.

However, participants in HARITA may differ in ways that are not observable to the evaluator, a problem known as selection bias. Participants may be more skilled (or less skilled) farmers than non-participants, for example because the more skilled farmers expect to be better able to take advantage of insurance. This is just an example, and there may be other differences. One indication that participants and non-participants may have different farming skills or different approaches to farming is that inputs and yields were different for purchasers and non-purchasers before insurance was offered. For example, in Kola Tembien HARITA participants

used much more fertilizer than did non-participants before they ever joined HARITA. Therefore, inputs and/or yields of participants and non-participants may differ only or mostly because of the difference in farming skills between the two groups, and an evaluator cannot identify farmers with the same farming skills.

A different comparison that we could make is between inputs made and yields obtained by participants before they had index insurance and afterwards. Since we are comparing the outcomes for the same people at two different points in time, any observed difference could not be caused by a difference in farming skills or other characteristics unless these characteristics changed over the period for which we have data. However, any observed difference still cannot be interpreted as the result of HARITA. Suppose that fertilizer use increases after HARITA is introduced, but it increases for everyone, those who participate in HARITA and those who do not. Then the effect is not likely to be due to HARITA but rather to factors that influenced everyone's fertilizer use such as weather conditions being better during the season after HARITA is introduced and/or as a result of activity by other programs that affected everyone's production decisions, such as BoARD programs.

In order to illustrate the difference-in-difference, we focus first on identifying the effects of HARITA in the 2010 season. We have just discussed two problems that the difference-in-difference has to address. It needs to identify the change in production inputs and measures of resilience that is due to the HARITA program rather than to (1) pre-existing differences between participants and non-participants, and rather than to (2) other factors or programs that affected the production inputs and measures of resilience of all farmers in the area over the same time. In order to address the first problem, we calculate the difference between the outcome of interest, for example amount of an input invested in production in the 2010 growing season and the amount invested in the 2009 growing season. This gives us the change from before HARITA to after HARITA for each person in our sample that is free of the effects of their pre-existing characteristics. Only households in Adi Ha had access to HARITA for the 2009 growing season, therefore for most households investments made in 2009 were made in the absence of HARITA. The problem with this difference is that it is still affected by other factors and programs that influenced production inputs of all farmers in the area between 2009 and 2010.

In order to address the second problem, we subtract the difference between outcomes in the 2010 and 2009 growing seasons for participants from the difference for non-participants. Non-participants represent the outcomes that would have occurred had HARITA not been offered, or the counterfactual. The difference in their production inputs between 2009 and 2010 is affected only by other factors and programs, not by HARITA. When we subtract the change in non-participant inputs from the change in participant inputs, we remove the effect of other conditions and/or programs and we are left with the effect of HARITA alone, called a difference-in-difference.

The difference-in difference estimator is the causal effect of index insurance on the outcome of interest under the assumption that unobservable characteristics, such as farming skills, do not change differently for farmers who purchase insurance and farmers who do not purchase insurance between successive survey seasons. Unfortunately, since we cannot observe characteristics such as farming skills, we cannot test this assumption. However, over the short

time period between the successive survey rounds in this evaluation, the most likely reason why the skills of participating farmers may increase faster than those of non-participants is the education provided by the program itself. This would be part of the legitimate impact of the program.

In the quantitative analysis we estimate the effects of insurance on purchasers who bought insurance in 2010 only and then stopped buying insurance and on purchasers who bought insurance in 2010 and 2012. We treat these two groups of purchasers separately because they behave quite differently.

We have data on 2 different follow-up seasons, which strengthens the evaluation by allowing us to observe the program impacts in two different climate scenarios. The 2010 season had good rainfall, while in 2012 there was a drought. We estimate two separate difference-in-difference estimates: one for the entire project period covered by the evaluation, from 2009 until 2012, and the second for the first year of the evaluation, from 2009 until 2010. The two estimates allow us to compare how the impacts of the program differed after a good season and after a drought.

In section 8 we present the difference-in-difference regression results. In the regressions, we control for the effect that observable farmer characteristics have on the impacts of insurance, such as amount of livestock owned, amount of land owned, savings, other assets, education, age, and gender. We also estimate standard errors clustered at the level of a kushet, the smallest administrative unit in Tigray, in order to account for similarities in characteristics of households residing within a kushet relative to households from other kushets. Our standard errors would be too small without such a correction. We drop all households who bought insurance for the first time in 2012 from the sample in order to estimate the effect of buying insurance in 2010 only and the effect of buying in 2010 and 2012. The number of first-time buyers in 2012 in our sample is very small and we cannot identify the effect of buying insurance in 2012.

The mathematical statement of the econometric model is in Appendix B.

Qualitative Analysis

The qualitative data collection and analysis contributes several elements to the analysis:

1. It allows us to identify benefits and/or disadvantages of HARITA for the farmers about which we did not collect data in the surveys.
2. It helps to understand why particular benefits and/or disadvantages of HARITA are occurring or not occurring and why they differ across different groups of farmers and conditions. It enables us to take any differences in the implementation process into account in explaining the benefits and/or disadvantages of HARITA.
3. The qualitative data provides an alternative source of information, enabling us to check the results from the quantitative analysis against the qualitative findings and vice versa.

4. The interviews and FGDs provide the perspective of the beneficiaries, including their experience with the program, their perceptions of the performance of the program, and their recommendations for improving the program.

The interviews and FGDs were conducted by individuals hired by a qualitative research expert who offered the interviewers a 3-day training. The expert also oversaw the qualitative data collection.

We transcribed all interviews and some of the FGDs, and we translated all interviews and FGDs into English. For most of the FGDs, the interviewers wrote reports in English detailing what was discussed during the FGD by various topics since transcribing the FGDs was too time and resource intensive. Reporting on FGDs rather than transcribing them is common practice in qualitative research.

We coded all transcripts and reports using Nvivo. We then analyzed the data by organizing the material from the interviews and FGDs according to the type of informant and specific topic of evaluation. For example we compared the benefits of HARITA reported by different types of informants to examine whether different types of participants experience different benefits and why.

DATA USED

Survey Data

The quantitative analysis is based on data from three surveys, a baseline survey and two follow-up surveys, one after the growing season in 2010 and one after the growing season in 2012. We surveyed the same households every time.

We conducted the baseline survey of 400 households in August and September of 2010 in 5 tabias in which HARITA was implemented and in 3 control tabias in which no program activities took place. We randomly chose one control tabia in each of the 3 woredas in which the program tabias are located: Menji in Kola Tembien, Were Abaye in Raya Azebo, and Agazi in Saesi Tsaedaemba. We conducted the survey after the farmers decided whether or not to buy insurance at the beginning of the growing season. We had to conduct the survey after farmers decided whether or not to buy insurance in order to have a sufficient number of households who purchased insurance in the sample. On average, 20% of households purchased insurance in 2010. If we conducted the survey before purchase decisions were made, we would have had to survey more households than was possible given our budget in order to have a sufficient representation of households who would eventually buy insurance.

We selected the households for the survey using proportional and stratified sampling. We sampled 15% of households that purchased insurance and 3.5% of households that did not purchase insurance in each program tabia, and we surveyed 2.9% of all households in each control tabia. We selected the households randomly from the lists of households that purchased insurance and that did not purchase insurance in each program tabia, and randomly from the

entire list of households in each control tabia. We sampled 301 households in program tabias and 99 households in control tabias. In the final data set used for the analysis, we have a total of 379 households, of which 202 are purchasers, 82 are non-purchasers in treatment tabias, and 95 are non-purchasers in control tabias. We lost 21 households to migration during the follow-up. When we report means of variables for an entire tabia, we use probability weights to scale the influence of each household to the actual proportion of the group that the household belongs to in the tabia population.

The available budget constrained the sample size. An important consequence of the small sample size is that we can only identify large effects and may be missing a range of smaller effects on production decisions, yields, and measures of resilience that may be statistically significant in a larger data set. Sample size also limits our ability to disaggregate the data analysis. We analyze differences across woredas. We also analyze differences between male-headed and female-headed households for those variables for which we have observations in our entire sample, which include resilience variables and investments in all crops but excludes investments in specific crops each of which is only grown by a subset of farmers in the sample. We cannot analyze differences between groups of farmers at the woreda level.

The baseline survey gathered detailed information from farmers about crops cultivated, inputs into production, loans taken, and yields in the 2009 growing season through retrospective questions. We collected data about assets by asking each respondent about the amount of each type of asset that they may own from a list of assets owned in the study area. We also collected information about socio-economic characteristics of households, their participation in various community organizations, whether or not they attended index insurance training, how well informed they are about index insurance, and why they did or did not buy insurance.

In the baseline survey, we were asking questions about one year after farmers made decisions about inputs and about nine months after they harvested crops. We were able to check the accuracy of recall with respect to prices of inputs, and we found that farmers have very good recall up to one year before. Relying on recall may introduce noise into the data, resulting in larger variances than we would have if we were asking questions contemporaneously with the decisions and therefore making it more difficult to identify statistically significant effects. However, relying on recall should not introduce a bias since farmers who purchase insurance should not have systematically different recall than do farmers who do not purchase insurance.

In March 2011 and in November 2012 and April 2013, we conducted two follow-up surveys with the same households that were interviewed for the baseline. The 2011 follow-up documented outcomes for the 2010 growing season and the 2012/2013 surveys documented outcomes for the 2012 growing season. We asked about the same decisions and outcomes in the follow-up survey as we had asked in the baseline survey. In 2012, we asked questions about inputs and yields and various household characteristics in November. We returned in early April 2013 to ask about outcomes that may differ at different times of the year, such as grain reserves, assets, etc. These questions needed to be asked at the same time of the year as they were asked in 2011.

We identified farmers who bought insurance using records from the HARITA project, not survey responses.

Qualitative Data

We conducted two rounds of interviews and focus group discussions (FGDs). The first round took place before the baseline survey. We conducted FGDs with groups of randomly selected men and, separately, randomly selected women in each of the evaluated tabias in order to learn from representative groups of farmers about the context, the main challenges to livelihoods, and the major coping strategies. We used the information to design the evaluation and the quantitative survey.

We primarily report information from the second round of interviews and FGDs, which took place after the 2012 growing season, in April 2013, and in which we collected information in 3 tabias: Awet Bikalsi, Hade Alga, and Hadush Adi. We interviewed staff at REST headquarters and the REST woreda coordinator for each of the 3 woredas included in the evaluation. We also interviewed staff at the DECSI head office. In each tabia, we interviewed one DA and three village leaders including the head of the women's association, the head of the farmers' cooperative, and one of the head of the equub or iddir or credit and savings association depending on availability. We also held FGDs with design team members.

We held separate FGDs with 6 groups of farmers: male farmers who paid for insurance with labor, male farmers who paid for insurance in cash, male farmers who participate in the PSNP and who did not buy insurance, male farmers who do not participate in the PSNP and who did not buy insurance, women who bought insurance, women who did not buy insurance. Male farmers who do not participate in the PSNP are a better comparison group to male farmers who bought insurance in cash than are PSNP participants who did not buy insurance.

We did not differentiate between women who paid in cash and women who paid in labor in 2 out of the 3 woredas because almost no women in those woredas paid in cash. We did hold a separate FGD with women who paid in cash in Saesi Tsaedaemba because a considerable number of women paid in cash in this one woreda. Almost all of them were PSNP participants who were able to pay in cash because they participated in a special initiative through which HARITA helped women to plant cactus as a risk reduction activity and then offered to purchase the cactus fruit for cash. Almost all the women who did not buy insurance participated in the PSNP.

We also conducted interviews with male insurance purchasers. The FGDs and these interviews provided information about farmers' direct experience with the program. We spoke to male farmers who increased their use of productive inputs after buying insurance and those who did not in order to try to understand the reasons why some intensified production while others did not. We used information from the quantitative surveys to identify farmers who changed production decisions after buying insurance and those who did not and then we interviewed a farmer who paid in cash and a farmer who paid with labor in each of these categories in each of the 3 tabias. We did not interview female farmers because of insufficient resources.

EVALUATION FINDINGS

Based on the program theory, we expect the HARITA program to have different impacts on farmers' production decisions and livelihoods in growing seasons with normal rains than in growing seasons with poor rains. The period of evaluation covers one follow-up season during which rains were plentiful, 2010, and one growing season during which the rains were poor, 2012. Therefore we are able to examine both causal mechanisms noted in the program theory: the impacts on resilience during droughts and the impacts on production during good growing conditions.

The climatic variation does pose a challenge. The good rainfall season occurred when the program was in its first year of operation in 4 out of the 5 program tabias included in the evaluation. Weather index insurance is an entirely new financial instrument and farmers need time to learn whether they want to buy insurance and how they can best use any opportunities that index insurance may create for them. It may be difficult to observe effects on production decisions and especially on yields in the first season in which insurance is offered.

The dry season occurred during the third year in which the program was operating in 4 out of the 5 evaluated program tabias. This season offers an opportunity to observe impacts on resilience during droughts. We should also observe impacts that the program has had on inputs into production in 2012 since the rains started out well early in the season and the farmers had no reason to expect a drought. We would not expect to observe any impacts of increased inputs on yields in 2012 because the drought affected crops late in the season.

The evaluation considers HARITA participants to be farmers who buy insurance. What we call the impacts of HARITA in this study are the impacts on participants, which are composed of the impacts of risk reduction activities and index insurance combined. However, farmers who do not buy insurance may also benefit from risk reduction activities. Risk reduction activities are implemented by farmers who paid for insurance in labor but they are not carried out on their own land. Only female-headed households conduct risk reduction activities on their private land. Other activities are undertaken on common land, typically adding to activities already underway as part of the PSNP. We do not have sufficient numbers of non-participating households in program tabias to estimate the benefits of HARITA for non-participants by comparing them to farmers in non-program tabias. Since some farmers in our control group may be benefiting from the risk reduction activities, the impacts that we find may underestimate the true impacts of HARITA.

Throughout, we report only effects that are statistically significant without repeatedly referring to their statistical significance. We also only report statistically significant effects in the tables. We included many variables in the analysis and we included the same variables in the analysis in all districts for the crops for which we have a sufficient number of farmers in the sample in each district. Most variables did not have statistically significant effects and reporting them would consume considerable space. We note explicitly where we discuss effects that are not statistically significant in the text. Appendix C lists all the production variables and measures of resilience for which we have examined the impacts of HARITA.

DIFFERENCES BETWEEN HOUSEHOLDS WHO PARTICIPATE IN HARITA AND THOSE WHO DO NOT

The evaluation compares the decisions made and outcomes attained by households who participate in HARITA and those who do not. The households who participate and those who do not made different production decisions and attained different outcomes even before they joined HARITA. These pre-existing differences are the reason why we need the difference-in-difference approach to identify that part of the difference between the households that is actually the result of participating in HARITA. We first report differences in the behavior and outcomes attained by participating and non-participating households. Then we report differences in household characteristics.

Another important difference in our sample is between farmers who bought insurance in 2010 and 2012 and farmers who bought insurance only in 2010. These two groups behave quite differently in the data. Thirty six percent of farmers in our sample stopped buying insurance after 2010. The annual drop-out rates from the HARITA program and why farmers drop out requires further research.⁷ The current registration system makes it extremely difficult to track each farmer from year to year to understand whether s/he continues to buy or not and if s/he drops out, whether s/he returns to the program in the future.

Tables in Appendix A.1 report results relevant to the analysis in this section. Each of the tables contains the year 2009 means of each variable listed in the first column for each group of farmers defined at the top of the 3rd, 4th, and 5th columns. The last 3 columns contain p values for hypothesis tests that examine respectively: in column 6 whether the mean for those who bought insurance only in 2010 is statistically significantly different from the mean for non-purchasers (who include non-purchasers in treatment tabias and households in control tabias), in column 7 whether the mean for those who bought insurance in 2010 and 2012 is statistically significantly different from the mean for non-purchasers, in column 8 whether the mean for those who bought insurance in 2010 only is statistically significantly different from the mean for those who bought insurance in 2010 and 2012.

In Kola Tembien, the teff-producing households who joined HARITA seem to farm more intensively and obtain better outcomes. The households who eventually joined HARITA applied 4 times more fertilizer in the production of teff and almost 5 times more fertilizer per timad before they joined HARITA than did non-participants.⁸ Households who eventually bought insurance in 2010 and 2012 also had higher yields of teff per timad and used more improved seeds in the production of teff before joining HARITA than did non-participating households. Households who eventually bought insurance in 2010 and 2012 used about half the compost in the production of teff as did non-participating households before joining HARITA. See Table A.1 in Appendix A.

⁷ It is possible that farmers who dropped out did not show up for registration quickly enough in 2012 and therefore missed the chance to register since the number of insurance policies sold in each tabia is limited by the budget. However, HARITA staff give purchasers from previous years priority in registering. Also, some farmers report that they did not know that they have to sign up each year in order to remain registered. They thought that they only need to register once.

⁸ Timad is a measure of land area most commonly used in Tigray. It is equivalent to one-quarter of a hectare.

In the production of maize in Kola Tembien, households who eventually bought insurance applied about 4 times the amount of improved seeds and twice the compost of non-participant households. Also households who eventually bought insurance in 2010 and 2012 applied more fertilizer per timad than did non-participating households. See Table A.4.⁹

The picture seems to be similar in Raya Azebo, in that the farmers with higher investments and better outcomes at least with respect to sorghum buy insurance. Households who eventually bought insurance in 2010 and 2012, had higher yields of sorghum and applied over 6 times more compost in the production of sorghum than did non-participating farmers. See Table A.5. Very few farmers in Raya Azebo used any fertilizer before HARITA began to operate there.

In Saesi Tsaedaemba, the picture is similar if we confine the comparison to non-purchasing households in Hadush Adi. All participating households had higher wheat yields and households who bought insurance in 2010 and 2012 used about 4 times more improved seeds in the production of wheat before they joined HARITA. In the production of wheat, households who eventually purchased insurance in 2010 and 2012 applied about half the fertilizer before joining HARITA of the amount applied by non-participating households. Households who bought insurance only in 2010 behaved similarly to non-participants. See Table A.2.¹⁰

There are also several differences between the characteristics of participating and non-participating farmers. Across all tabias, households who eventually buy insurance in 2010 and 2012 own 0.3 fewer oxen than do non-participating households but they do not differ in terms of other assets. Households who eventually bought insurance only in 2010 do not differ from control households in terms of assets. Among all households who eventually buy insurance, a higher proportion are literate than among non-participants and in a higher proportion the spouse is also literate. Also a higher proportion of participating households are female-headed households than among non-participants,¹¹ but only in the group that buys insurance in 2010 and 2012. In other words, the female-headed households seem to be less likely to stop buying insurance than are male-headed households. See Table A.8.

IMPACTS OF HARITA ON RESILIENCE DURING DROUGHT

In this section we examine the first mechanism in the program theory, the impacts of HARITA on farmers' ability to weather drought. We analyze HARITA's impacts on resilience and impacts on agricultural production decisions separately in order to examine evidence for the two different

⁹ Some of the difference in the application of fertilizer in the production of maize portrayed in Table A.4 reflects a difference between the program tabias and the control tabia of Menji. However, when we confine the comparison to participating households and non-participants in the program tabias, the participants still apply more fertilizer per timad in the production of maize than do non-participants and the difference is statistically significant, but it is not as large in as Table A.4.

¹⁰ Table A.2 reports differences between participants and non-participants including the control tabia of Agazi in the latter. The reported differences in wheat yields and application of improved seeds to wheat production reflect differences between participants and non-participants in Hadush Adi only. Farmers in Agazi are somewhat better off than in Hadush Adi and used more inputs.

¹¹ Female-headed households are over-represented in the HARITA program because HARITA has especially targeted female-headed households who are considered to be particularly vulnerable. Also, the PSNP especially targets female-headed households, and most of the participants in HARITA also participate in the PSNP.

mechanisms through which HARITA may influence livelihoods. The two mechanisms both contribute to resilience since improvements in productivity help farmers to survive drought in future seasons. In this section, we focus on such measures of resilience as maintenance of assets, access to food, and access to credit. Access to credit mediates both resilience to drought and agricultural productivity. Loans provide resources to survive dry seasons and a means to purchase inputs into production. Almost all farmers report buying fertilizer and seeds on credit.

The quantitative analysis provides strong evidence that HARITA is helping farmers to build resilience to drought. On average, across all districts, insured farmers increased the amount of savings by 123% more than did the uninsured. The insured farmers tripled their savings from an average amount of 465 birr in 2009. The insured farmers also increased the number of oxen that they own by 0.18 of an ox more than did uninsured farmers, for a total increase of 0.25 of an ox from an average of 1.53 oxen owned in 2009 by those who eventually bought insurance. The results are in Table 10. Please see note number 1 in the Tables section for a detailed explanation of how to read the tables.

We do not have evidence that the average impacts occurred in each district. Rather the impacts differ considerably across the 3 districts. The change in savings occurred mainly among farmers who bought insurance only in 2010 in Kola Tembien and all insured farmers in Raya Azebo. The effect is statistically significant only in Kola Tembien. The effect is not statistically significant in an analysis of Raya Azebo alone but the increase in savings among insured farmers in Raya Azebo is quite a bit larger than is the increase among uninsured farmers, thereby contributing to the statistical significance of the effect on average across all woredas. The change in savings among farmers who continued to buy insurance in 2012 in Kola Tembien and all insured farmers in Saesi Tsaedaemba is very similar to the change among the uninsured.

The increase in numbers of oxen among the insured farmers relative to the uninsured occurred mainly among farmers who bought insurance in both 2010 and 2012 in Raya Azebo (see Table 5). The uninsured farmers in Raya suffered a decline in the numbers of oxen. There is also a smaller and not statistically significant effect in Saesi Tsaedaemba, where the number of oxen owned by the uninsured declined somewhat while the numbers owned by the insured increased somewhat. Oxen are particularly important assets since farmers use them to plough the fields. Helping farmers to maintain their livestock is one of the primary objectives of HARITA. The evidence is encouraging that HARITA is beginning to achieve this objective.

In Kola Tembien, ownership of oxen remained more or less constant for all farmers over the period 2009 – 2012, with only a very small decline for the uninsured. In the 2010 season the insured in Kola Tembien maintained their number of oxen while the uninsured suffered a sizeable decline after the drought in 2009. The very small decline for the uninsured over the period 2009 – 2012 suggests that by 2012 the uninsured were able to recover much of the loss that they suffered after 2009.

In Kola Tembien, farmers who bought insurance in both 2010 and 2012 increased their reserves of grain between 2009 and 2012 254% more than did uninsured farmers. However, these insured farmers seem to have had a smaller increase in livestock value than did uninsured farmers. The apparent trade-off between an improvement in grain reserves and an improvement

in livestock value raises the question whether the insured farmers experienced a net benefit. See Table 5 for results.

Farmers who bought insurance in 2010 but not in 2012 experienced a wider range of improvements in Kola Tembien. They diversified their income sources, increased their grain reserves, and increased their savings more than did uninsured farmers. One possible reason is that farmers who only bought insurance in 2010 seem to be better off in Kola Tembien than are the farmers who continued to buy in 2012 and their baseline means of livelihood may have enabled them to benefit more from HARITA.

In Hadush Adi, farmers who bought insurance in both 2010 and 2012 increased the number of loans that they took and the quantity borrowed more than did uninsured farmers. As in the case of Kola Tembien, farmers who bought insurance in 2010 but not in 2012 experienced a wider set of improvements. They maintained the number of oxen they own relative to uninsured farmers whose number of oxen declined slightly, increased the number of loans that they took, and the quantity borrowed relative to uninsured farmers. However, they seem to have experienced a smaller increase in the total value of all their assets (including livestock) than did uninsured farmers. (See Table 5 for results)

We also examined the effects of HARITA on all livestock owned and the value of livestock owned, but we found no statistically significant impacts on these variables. In Saesi Tsaedaemba, numbers of livestock overall declined for all farmers suggesting that farmers made an effort to hold on to their oxen while selling other animals. The decline was smallest for the insured but the difference is not statistically significant. In Kola Tembien, the value of livestock owned increased much more for uninsured farmers than for those farmers who bought insurance in both 2010 and 2012, even though the latter had a larger increase in numbers of livestock, but neither difference is statistically significant. The value of livestock is a number reported by the farmers and may be more difficult for the farmers to assess than are the numbers of livestock.

Qualitative evidence from interviews and FGDs in general supports the finding that HARITA is helping to maintain livelihoods after drought. Many farmers note that insurance is a form of saving which helps them to survive droughts. Farmers report that insurance is like saving money in a bank, and that insurance teaches them to save money. One farmer said that “We agreed to get compensation in time of bad harvest and to do otherwise to the insurance in time of good harvest. They tell us this in training,” and another “it saves your money in time of good harvest and compensate you when situations in terms of rain are not good. On the other hand, you benefit from increased yields as a result of the inputs and knowledge when the harvest is good.” Insurance training teaches the farmers the idea of insurance as saving as well as compensating the program in good times.

HARITA’s effects on resilience can also be gleaned from farmers’ discussions of how they use insurance payouts. Farmers in Hade Alga, which received the most substantial payout in 2012, cite the payout as the main benefit of the program. The main role of the payout is in preventing losses. Farmers state that the payout helped them to keep their animals, which they would have had to sell otherwise in order to repay loans and buy food, and helped them to not have to borrow money at high interest rates from moneylenders. Farmers in Hade Alga and Hadush Adi

also report using the payout to repay loans, buy food, buy animals, buy clothes, and school supplies.

Qualitative evidence supports the finding that HARITA is improving the use of credit in Saesi Tsaedaemba since farmers' most common comment about the benefits of insurance is that it gives them the confidence to take loans because a payout enables them to repay loans. All farmers agree that loans are easy to obtain for anyone, and the difficulty with obtaining credit is that farmers are afraid that they may not be able to repay the loan in case of a drought, and they are not willing to take loans if they are not confident that they can repay.

All farmers say that the insurance with its promise of a payout does not improve access to loans since institutional lenders, such as DECSI, do not pay attention to whether a farmer is insured or not. However, some farmers did say that institutional lenders come to the village on the day of the insurance payout to collect debts, therefore being insured may informally influence creditors' perceptions even if their formal policy is that being insured does not affect access to loans. A few farmers mention that insurance does help them to obtain credit from their neighbors or wealthy individuals since these individuals are more confident that they will be repaid if the borrower is insured.

Some farmers mention that the payout helps to prevent migration. We cannot examine this hypothesis quantitatively since we did not collect data on migration. Migration used to be an important mechanism for coping with drought in all 3 woredas. Farmers report that they used to leave their homes because there was not enough food. Almost all farmers say that migration in search of food after a drought almost does not exist anymore. The main source of help that allows farmers to remain in their homes is the PSNP. However, farmers say that the payout helps as well, especially so in Hade Alga.

Young people are still migrating away in search of a better life. One important reason for migration by young people is the shortage of land for farming. Migration is especially extensive in Raya Azebo, where farmers say that they are losing most of their young people, but it is also common in Saesi Tsaedaemba and less so in Kola Tembien. The young people often migrate to Saudi Arabia where they face extreme dangers, as well as to other regions of Ethiopia. The migration by young people is affecting the viability of small businesses that women used to rely on in Raya Azebo, such as selling drinks.

Discussion of HARITA's Impacts on Resilience in Drought

Every evaluated tabia received a payout in 2012 and two of the tabias also received payouts in 2011. In 2012, Hade Alga in Raya Azebo was the only one among evaluated tabias that received 100% payout. Genete in Raya Azebo received a payout that was 67% of the maximum possible. Hadush Adi in Saesi Tsaedaemba a 64% payout. Both tabias in Kola Tembien received 4% of the maximum.

The large payout in Hade Alga may help to explain why we observe statistically significant impacts of HARITA on farmers' ability to maintain their numbers of oxen in Raya Azebo but not elsewhere. The 100% payout enabled most farmers to pay off their loans and attend to other needs without having to sell animals. The payouts may have been insufficient for this purpose

elsewhere, especially in Kola Tembien. Another reason may be that farmers in Raya Azebo are generally better off than are farmers in the other two woredas and the farmers who buy insurance in Raya Azebo do not differ from non-participants on various measures of resources. They may be able to do more with the payout because of their own resources.

The impacts of HARITA on grain reserves in Kola Tembien may reflect the favorable weather conditions in that woreda relative to the other two woredas. Kola Tembien is the only one of the 3 woredas that did not experience a significant drought since 2010.

The impacts of HARITA on borrowing in Saesi Tsaedaemba may also reflect weather patterns. Hadush Adi had the worst drought out of the evaluated tabias in 2011 and a significant drought in 2012. Farmers may have been short of resources by 2012, and the insured farmers may have been more willing to rely on loans than the uninsured farmers.

Despite the benefits of the payouts, farmers for the most part do report that the payout will not change their life very much. They need good harvests in order to improve their livelihoods.

IMPACTS OF HARITA ON FARMERS' KNOWLEDGE

In interviews and FGDs, farmers in Kola Tembien and Saesi Tsaedaemba overwhelmingly say that knowledge creation is the main benefit of HARITA in response to the question "What are the main benefits of the insurance program?" The knowledge that the program creates according to farmers has two main dimensions. One dimension is best summarized in the following quote from one farmer: "Now the farmers are aware how they can change their life even if there is no insurance e.g. they have learnt the culture of saving, benefits of credit, and mechanisms for increasing yield." Similarly, a leader of a women's association states that: "...insurance encourages you to think differently, that is, instead of just depending on the safety net indefinitely; it assists you to see things differently through the efforts it puts on you in terms of awareness, training and knowledge building."

The second dimension of the new knowledge, and the one that farmers focus on most often, is knowledge about new agricultural inputs and cultivation practices, such as improved seeds, crop rotation, sowing in rows instead of broadcasting, ploughing fertilizer into the soil instead of leaving it on top of the soil, and conserving soil moisture. One farmer said of HARITA "It has given us knowledge about science-based farming, insurance assists us just in the provision of knowledge." Farmers say that the new knowledge is enabling them to change their production practices and increase yields.

However, all farmers report that they learn about new agricultural inputs and practices from the development agents (DAs) and from each other. DAs, who are the agricultural extension agents stationed in rural areas, work with all farmers, HARITA participants and non-participants, in all tabias as part of BoARD's effort to improve rural productivity, which was significantly intensified in 2010. DAs organize farmers into groups in which farmers learn from the DAs and from each other's experience with testing new seeds and practices. DAs select model farmers after each growing season whose example can help to educate other farmers. Three to five DAs live in

most tabias whereas HARITA insurance officers visit each tabia about once a month, therefore DAs have much more intensive contact with the population than do the HARITA program staff. A group of farmers said that “Distancing from a development agent is like distancing oneself from your food.”

The DAs and HARITA staff work closely together, and farmers generally perceive them as being part of one, general government program. Insurance training reinforces the DAs message that farmers should be increasing their productivity by adopting new varieties of seeds and new cultivation methods.

Farmers are divided in their opinions whether insured farmers receive more education than do uninsured farmers. About half of the respondents say that insured and uninsured farmers receive the same training with respect to agricultural production and make the same decisions. They maintain that they discuss with and learn equally from insured and uninsured farmers. This is especially true of women who tend to say that they make their decisions with their neighbors, and make the same decisions as the neighbors, whether those neighbors are insured or not. Another half of farmers say that insured farmers receive better training than uninsured farmers and the uninsured learn from them.

Farmers gave one example of education that is different for insured farmers than for the uninsured. REST insurance officers teach farmers how to use compost as part of the HARITA program because digging compost pits is one of the risk reduction activities. While DAs also teach farmers about compost, farmers say that insurance officers provide more detailed instruction on the construction of compost pits, management of compost, and the substitution of compost for fertilizer. Insured farmers also report learning valuable information through risk reduction activities other than compost preparation.

This evaluation cannot establish whether farmers who participate in HARITA have better agricultural knowledge than non-participants. We were not able to conduct interviews or FGDs in the control tabias therefore we do not know what farmers say about improvements in their knowledge in non-HARITA tabias. We do not have direct evidence about knowledge from the survey. However, farmers’ emphasis on knowledge as the main benefit validates the importance of HARITA working closely with the agricultural extension service.

Based on qualitative evidence from FGDs and interviews, HARITA may especially improve the knowledge of female farmers who are heads of household. The main reason is that the program provides knowledge and inputs for female-headed households that it does not provide to men, such as knowledge and materials for cultivating vegetable gardens and growing fruit-bearing cactus. Many men and women report that women are the main beneficiaries of the HARITA program.

IMPACTS OF HARITA ON AGRICULTURAL PRODUCTION DECISIONS

In this section, we discuss the evidence for the second mechanism through which HARITA can influence livelihoods, the effect of HARITA on investments in agricultural production and the effects of those investments on yields. We would expect to see effects on investments in production in any season unless farmers have a reason to expect a drought at the beginning of the season. We would expect to see impacts on yields only in good growing seasons.

We first report the changes that occurred over the entire evaluation period, from 2009 to 2012. We examine many inputs into the production of each crop and we examine yields.¹² As discussed above, we report only cases in which the difference in the decisions made by the insured and the uninsured is statistically significant. When the insured and the uninsured make the same decisions then the reason for those decisions is not likely to be the HARITA program.

On average, across all woredas, insured farmers have increased their application of compost per timad of land in all grains cultivated in the 3 woredas by 315% more than have uninsured farmers. The insured farmers increased the amount of compost by about 91kg per timad over the mean compost use of 59kg in 2009 by those who eventually purchased insurance. As in the case of resilience to drought, impacts of HARITA on inputs into production vary considerably across the 3 districts. The effect on the use of compost is mainly due to changes that have taken place in Kola Tembien. Farmers who bought insurance in 2010 and 2012 in Raya Azebo also increased their use of compost per timad much more than uninsured farmers in the production of sorghum but the effect is not statistically significant by itself.

The only statistically significant differences between the investments made by the insured and the uninsured over the entire period of evaluation, 2009 to 2012, in our data occur in Kola Tembien. Farmers who bought insurance in 2010 and 2012 increased the quantity of compost they applied by 503% more than did uninsured farmers. The impact is equivalent to an average increase in use of compost of 80kg by insured farmers relative to the baseline. Farmers who bought insurance only in 2010 increased the quantity of compost applied by 842% more than did the uninsured farmers. See results in Table 4.

In Kola Tembien, farmers who bought insurance only in 2010 increased their use of fertilizer in the production of maize more than did uninsured farmers, and all insured farmers increased their expenditure on fertilizer in the production of maize more than did uninsured farmers (see Table 3 for results).¹³ For example, farmers who bought insurance in both 2010 and 2012 increased their expenditure on fertilizer by 65% more than did uninsured farmers, which represents an increase of 279 birr over the period of evaluation.

All insured farmers increased their use of fertilizer in the production of teff less than did uninsured farmers (see Table 1 for results). Everyone increased their use of fertilizer, but the uninsured increased it more than the insured. Those who bought insurance were already using

¹² One constraint is that we do not have quantitative data on cultivation methods that farmers use.

¹³ It is not surprising to see increases in expenditure on fertilizer without a corresponding increase in the amount of fertilizer used since the price of fertilizer increases every year.

a lot more fertilizer in the production of teff than the uninsured before they bought insurance, therefore they may not have had much ability and/or need to increase their purchases of fertilizer further. Those who bought insurance in both years increased their use of compost more than did uninsured farmers, so they may also have been substituting compost for fertilizer in the production of teff. The results may be consistent with the farmers' reports in interviews and FGDs that maize is a much more important crop for them than teff is, leading farmers to concentrate increases of expensive fertilizer on maize.

The only difference between the insured and the uninsured with respect to use of improved seeds over the entire evaluation period is a negative one. In Kola Tembien, farmers who bought insurance in both 2010 and 2012 decreased their use of improved seeds and their expenditure on improved seeds in the production of teff more than did uninsured farmers (see Table 1). The amount of improved seeds in cultivation and expenditure on improved seeds actually declined for both groups between 2009 and 2012. One possible reason, as with the fertilizer result above, is if the insured farmers were switching investment resources from teff to maize more than uninsured farmers were.

Also in Kola Tembien, all insured farmers increased the amount of traditional seeds in total and per timad invested in maize production and reported expenditure on traditional seeds more than did uninsured farmers.¹⁴ Farmers reported that maize was particularly affected by the drought in Kola Tembien in 2012, while teff weathered the drought reasonably well. The increase in the amount of seed used in the production of maize may reflect an effort to rescue the maize yield from the drought.

In Saesi Tsaedaemba, all insured farmers increased the amount of land planted with barley more than did uninsured farmers. Farmers in Raya Azebo who bought insurance in 2010 and 2012 decreased the hours of family labor and of their own oxen overall and per timad in agricultural production while uninsured farmers increased both. Insured farmers increased their use of hired labor more than did uninsured farmers.

Below, we analyze separately the impacts of insurance in the 2010 season. There are more differences in production inputs between the insured and the uninsured in the 2010 season than over the entire evaluation period, and the 2010 season may represent the potential for future improvement. The fact that the changes that took place in 2010 do not show up over the entire evaluation period is puzzling. We discuss potential explanations in the discussion section.

There are two instances in which insured farmers increased their use of improved seeds more than did uninsured farmers in the 2010 growing season. In Raya Azebo, farmers who bought insurance in 2010 and 2012 increased the use of improved seeds and their expenditure on improved seeds overall and per timad in the production of teff (see Table 6). In Saesi Tsaedaemba, farmers who bought insurance only in 2010 and then stopped participating increased their use of improved seeds in the production of wheat and barley (see the bottom section of Table 7).

¹⁴ A point worth noting is that improved cultivation practices, such as sowing in lines, require fewer seeds than traditional practices such as broadcasting in the absence of any changes in the amount of land planted.

There are two instances in which insured farmers increased their use of fertilizer more than uninsured farmers in the 2010 season. In Raya Azebo, farmers who bought insurance in 2010 and 2012 increased the amount of fertilizer and the expenditure on fertilizer in the production of sorghum more than did uninsured farmers (see Table 9). In Saesi Tsaedaemba, farmers who bought insurance in 2010 and 2012 increased the amount of fertilizer per timad and their expenditure on fertilizer per timad in the production of barley more than did uninsured farmers (see middle section of Table 7).

Farmers who bought insurance in 2010 and 2012 in Saesi Tsaedaemba increased their use of compost per timad in the production of wheat and barley more than did uninsured farmers (see bottom section of Table 7).

In Kola Tembien, farmers who bought insurance in 2010 and 2012 decreased the amount of fertilizer in the production of teff and their expenditure on fertilizer while the uninsured farmers increased the amount of fertilizer and their expenditure on fertilizer and the statistically significant difference persisted until 2012 (see top section of Table 6).

In Kola Tembien, farmers who bought insurance in 2010 and 2012 increased their use of traditional seeds overall and per timad in the production of teff and per timad in the production of maize more than did uninsured farmers (see Tables 6 and 8). Also, farmers who bought insurance in 2010 only increased their use of traditional seeds overall and per timad in the production of maize more than did uninsured farmers (see Table 8).

In interviews and FGDs most farmers, whether insured or not, say that they have switched to improved varieties of crops and have adopted new production techniques. In Kola Tembien and Saesi Tsaedaemba, both insured and uninsured farmers say that these changes have been very productive in improving yields. In Raya Azebo, farmers say that the rains have been too poor for farmers to benefit from production improvements.

In discussions, farmers do not recognize insurance as a reason for making different production decisions when asked explicitly. Almost all farmers state that insurance does not influence their production decisions. However, a few farmers say that insurance gives them the confidence to try new methods and many farmers say that insurance gives them the confidence to take loans. Loans are critical to increasing agricultural inputs since most farmers obtain these inputs on credit from the farmers' cooperatives. The statement that insurance gives confidence to increase investment and take loans receives a lot of emphasis in the insurance training program.

Impacts on Yields

Over the entire evaluation period, from 2009 to 2012, in Saesi Tsaedaemba, farmers who only bought insurance in 2010 increased the quantity and value of their yields of barley more than did uninsured farmers. Farmers who bought insurance in 2010 and 2012 saw smaller increases in the quantity and value of yields per timad of barley than did uninsured farmers. We do not detect any impacts on yields during the 2010 season.

Production Decisions of Female-Headed Households

We examine differences between HARITA's impacts on female-headed households who purchased insurance and other purchasers of insurance, who may be men or women in male-headed households. We use REST's designation of female-headed households. These are households in which the main decision maker is a woman who either does not have a husband or whose husband lives somewhere else. The results suggest that female-headed households, who are a particularly vulnerable group and of particular importance to HARITA, are more likely to make some changes in production than are other purchasers. We focus on variables for which we have observations for the entire sample, such as measures of resilience and decisions with respect to planting, sharecropping, and/or renting land.¹⁵ The sample size is too small to analyze differences between female-headed households and other purchasers with respect to inputs into production of specific crops.

In FGDs in Kola Tembien and Saesi Tsaedaemba, women from female-headed households mentioned that a particular benefit of the HARITA program is that they have stopped sharecropping out their land and have started cultivating it themselves. Sharecropping out land seems to be more common among female-headed households than among male-headed households as female-headed households are more likely to lack the oxen and the labor that they need to cultivate their own land. Sharecropping out land is a significant obstacle to improving livelihoods as the person who farms the land retains either one-half or two-thirds of the yields, depending on the district.

We examine the quantitative evidence on sharecropping out land using the survey data and the difference-in-difference approach. The quantitative analysis at least partly confirms what we learned in the FGDs. In Kola Tembien, insured female-headed households decreased the amount of land that they share out more than did other insured farmers and more than did the uninsured. In Saesi Tsaedaemba, all insurance purchasers reduced the amount of land that they share out more than did non-purchasers. The decline experienced by female-headed households was not different from the decline experienced by other insured households in a statistically significant way in our data. Female-headed households also appear to have increased their spending on hired labor and hired oxen more than did other insured farmers and more than did the uninsured across all woredas, which may explain partly how they were able to start cultivating more of their own land.

The quantitative analysis of results across all woredas indicates that insured female-headed households increased the amount of land planted more than did other insured farmers and more than did the uninsured. They also increased the amount of improved seeds per timad, the proportion of improved seeds in all the seeds that they plant, and the total amount of compost more than did all other groups.

Insured female-headed households increased the number of loans that they take and the amounts that they borrowed more than did other insured farmers and more than did the uninsured. The increased borrowing may have enabled them to increase their inputs.

¹⁵ Sharecropping is an arrangement in which the person who owns the land is different from the person who cultivates the land. The farmer who cultivates the land retains a percentage of the yield. The owner and the cultivating farmer may or may not share the cost of inputs. We use the term sharecropping out to denote what the owner of the land does (asking another farmer to cultivate her/his land), and sharecropping in to denote what the farmer who cultivates the land does (cultivating someone else's land). Renting land is an arrangement in which a farmer pays some cash amount to the owner of the land in order to farm the land and retains all proceeds from the farming.

Insured female-headed households increased the amount of savings less than did other insured farmers. They may have been prioritizing agricultural inputs over savings.

Qualitative evidence from interviews and FGDs suggests that female-headed households who do not participate in HARITA may be considerably more vulnerable than other groups that we studied in the evaluation. Non-participant female-headed households report more often that they are sharing out their land, that they discuss cropping decisions only with their neighbors, and that they have not started using improved seeds or improved cultivation techniques. They also often do not take loans from the farmers' cooperative for seeds and fertilizer, like most other farmers do, but rather take more expensive loans from individuals whom they know.

Discussion of HARITA's Impacts on Production Decisions

Achieving impacts on agricultural production is even more challenging than is achieving impacts on resilience during drought. Farmers require time to learn how they can best use their access to insurance and more time may need to pass before we can observe the full potential impacts of the program as it is currently designed. The changes that have begun occurring are an impressive indication that HARITA has the potential to influence production.

One question that arises based on the results is why we mainly observe impacts of HARITA on production decisions in Raya Azebo and Saesi Tsaedaemba in the 2010 growing season but not in the 2012 growing season, while we observe impacts on production decisions in Kola Tembien in the 2012 season but not in the 2010 season. One reason may be that the 2011 season was not good especially in Saesi Tsaedaemba. While farmers in Hadush Adi received a 31% payout in 2011, the dry growing season may have still impeded their ability to invest in 2012. The 2011 season had fine rainfall in Kola Tembien therefore farmers there may have been in a better position to invest in 2012. The 2009 growing season was affected by a big drought in Kola Tembien, which may help to explain the lack of impacts on investment in the woreda in 2010. The drought was not as bad in 2009 in Saesi Tsaedaemba, possibly facilitating HARITA's impacts on investments in 2010 in that woreda.

The seasonal rainfall pattern offers a better explanation of changes in investment in Kola Tembien and Saesi Tsaedaemba than in Raya Azebo. First, the rainfall data suggest that the 2011 growing season was not very bad in Raya Azebo, although farmers in Genete did receive a small payout, and farmers in Hade Alga maintain that the season was much worse than the rainfall data indicate. Nevertheless, we do not observe increases in investments in 2012. Second, the 2009 growing season was very dry in Raya Azebo and we do find impacts of HARITA on investments in 2010.

Another component of an explanation may be that the potential for increases in investment in fertilizer may be limited, especially in Raya Azebo but also in Saesi Tsaedaemba. Few farmers in Raya Azebo were using any fertilizer in 2009. HARITA began to operate in Raya in 2010 and, reportedly, BoARD intensified efforts to improve the use of fertilizer in 2010 throughout Tigray. We see considerable increases in use of fertilizer among all farmers in Raya from 2009 to 2010, with some significant impacts on HARITA participants. This season constituted the first experience with fertilizer for many of the farmers. The increases for the 2-year period from 2010 to 2012 are much smaller for all farmers in Raya than are the increases for the one year from

2009 to 2010. In 2012, farmers in Raya report that fertilizer burns crops when there is insufficient rain, causing bigger losses than would occur otherwise. They also say that under good rainfall conditions, fertilizer does not always produce big improvements in their fertile soils, and for some crops it results in tall stalks that are susceptible to wind damage. Experience with fertilizer in Raya may be suggesting limited benefits.

In Saesi Tsaedaemba, significant impacts of HARITA occurred in 2010. All farmers increased the use of fertilizer by about the same amount over the one year from 2009 to 2010 as over the two years from 2010 to 2012, suggesting smaller annual increases in the second period. In 2012, farmers report that they are storing fertilizer because the amounts that the DAs advise them to buy are more than they can use. They also have the concern that fertilizer burns crops when there is insufficient rain, causing bigger losses than would occur otherwise.

The potential for impacts of HARITA on fertilizer may also be limited in Kola Tembien. Farmers who eventually bought insurance were using a lot more fertilizer in the production of teff and somewhat more fertilizer in the production of maize before they bought insurance than were farmers who did not buy insurance. The insured farmers may not be able to increase their use of fertilizer at a faster rate than the uninsured.

Farmers say that purchases of fertilizer are a significant cause of indebtedness since prices of fertilizer increase steeply every year. Especially if farmers are buying more fertilizer than they can use, the purchases may be impeding other investments.

Farmers especially appreciate the HARITA program for teaching them about compost, since compost is an alternative to expensive fertilizer and it lacks some of the harmful effects of fertilizer. According to farmers, compost does not burn crops when there is lack of rain and in fact it helps to conserve moisture.

The main reason why we do not observe impacts of the HARITA program on yields in the 2012 season is most likely to be the drought. However, small improvements may have occurred in Kola Tembien that we cannot detect in our data because of the small sample. In the 2010 season, the reason may be that the changes in investment during this season, in which insurance was offered for the first time in 4 out of the 5 program tabias, were too small to affect yields in a way that we can detect in the data given the baseline variance in yields across farmers and the small sample.

An obstacle that likely impeded increases in investment during the evaluation, possibly to different degrees in different woredas, are the annual delays in the sale of insurance due to uncertainty in the flow of funding for HARITA. Insurance has been sold as farmers are beginning to plant crops. Once planting begins, it is late for farmers to consider what changes they may make to their production decisions as a result of having insurance and to secure the resources to make those new decisions. Farmers have not been able to incorporate new investments into their cash flow plans. Furthermore, farmers are pressed for time since work on risk reduction activities begins after insurance has been sold while they should be working on their own fields, preparing the soil and planting.

A chart summarizing HARITA's impacts appears below.

Summary of HARITA's Impacts on Resilience, Agricultural Investments, and Yields in all Three Woredas.

All impacts report changes in the inputs and/or yields experienced by the insured relative to the uninsured.

Red font indicates that the insured farmers experienced smaller increases than the uninsured or declines relative to the uninsured.

Time period	Kola Tembien	Raya Azebo	Saesi Tsaedaemba	Effect is statistically significant across all woredas for all farmers who ever bought insurance
Resilience of farmers who bought insurance in 2010 and 2012				savings; number of oxen
2009 - 2012	grain reserves	number of oxen owned	number of loans; quantity borrowed	
Resilience of farmers who bought insurance only in 2010				
2009 - 2012	grain reserves; savings; number of sources of income	none	number of loans; quantity borrowed; number of oxen	
Agricultural investments made by farmers who bought insurance in 2010 and 2012				
2009 - 2012	compost; expenditure on fertilizer for maize; traditional seeds for maize (total and per timad); decreased amount of and expenditure on improved seeds for teff	Hired labor; decreased own labor and labor of own oxen	land planted with barley	

2009 - 2010	traditional seeds for teff (total and per timad); traditional seeds per timad for maize; decreased amount of fertilizer and expenditure on fertilizer for teff	improved seeds and expenditure on improved seeds (total and per timad) for teff; fertilizer and expenditure on fertilizer for sorghum	fertilizer per timad and expenditure on fertilizer per timad for barley; compost per timad for wheat and barley	compost per timad
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Agricultural investments made by farmers who bought insurance in 2010 only			
2009 - 2012	compost; fertilizer for maize; expenditure on fertilizer for maize; traditional seeds for maize (total and per timad);	none	land planted with barley
2009 - 2010	traditional seeds for maize (total and per timad)	none	improved seeds for wheat and barley
Yields of farmers who bought insurance in 2010 and 2012			
2009 - 2012	none	None	smaller increase in yields per timad of barley than uninsured
2009 - 2010	none	none	none
Yields of farmers who bought insurance only in 2010			
2009 - 2012	none	none	quantity and value of yields of barley;
2009 - 2010	none	none	none

ASSESSMENT OF THE HARITA PROGRAM OPERATIONS

The assessment of the operations of HARITA is based mainly on discussions with key informants in the program tabias, farmers, and REST staff. The comments below reflect primarily how the program beneficiaries experience the program. The evaluation team did not inspect risk reduction activities, nor did it conduct an extensive review of program records.

The main conclusion that emerges from discussions with key informants and farmers is the overwhelming support for the program among the beneficiaries. Farmers appreciate the help that the program offers, they consider the program to be very useful to them, and they would like most of all to see the program expand. In fact, the main comment about the program is that the number of insurance-for-labor policies that can be sold is insufficient and should be increased. The number of policies is limited in tabias in which the insurance-for-labor option is available since the money required for the premium in the insurance-for-labor transaction does

not come from the farmer but rather from donors. Many more people would like to buy insurance for labor than can buy given the available funding.

When interviewers asked farmers and key informants directly about any weaknesses or areas of the program that could be improved, respondents generally repeated their deep appreciation for the program first. Then they mentioned several common themes. Below we report these common themes. We only report issues that were mentioned by a majority of respondents.

Dissemination of Information about the Program

Almost all key informants and farmers request that the program expand the effort to disseminate information about the program itself and improve education about how weather index insurance works.

There are several examples of confusion. In Kola Tembien, farmers report that they believed they had registered for insurance for maize, and that the coverage was later changed to teff. They were under the impression that they did not get a payout because the teff yield was reasonably good in 2012, while maize failed. They were extremely disappointed because they said that maize is a much more important crop for them than teff.

Perhaps the most important point about the above confusion is that farmers are not clear about what triggers the insurance payout in the woreda in which HARITA has been working the longest. The payout is not based on yields for any crop but rather on the amount of rainfall recorded through satellite readings. In fact, farmers note that they feel that there is a lack of transparency about what triggers the payout. Farmers, and especially women farmers, also report being confused about which crops are being insured. The source of this confusion seems to be simply insufficient communication rather than any problem in the way that insurance is administered.

Another example of confusion about what triggers a payout occurred in Hade Alga in 2011. Farmers maintained that they suffered a significant loss of crops as a result of an early end to the rains, and that the drought conditions merited a payout. However, a payout was not warranted by the insurance index.

The follow-up survey that we carried out in 2012 provides the following information about levels of understanding about insurance among those farmers who purchased insurance. Fifty-nine percent of respondents who purchased insurance answered that insurance pays out when rainfall is below a certain level according to rain gauge or satellite. Thirty-three percent answered that insurance pays out when yields are poor. Seventy-seven percent of insured respondents responded “yes” to the question whether the purchaser will receive a payout every time that yields are poor. Fifty-six percent of insured respondents said that most of the time index insurance will only cover a part of the losses incurred (rather than all the losses). Eleven percent of insured respondents said that you could receive a refund of the premium.

Quite a few respondents in the interviews and FGDs report that they believe that they have to be invited to register. According to them, tabia administration selects farmers who are invited to register for insurance. In one FGD, people said “tabia leaders have alienated us and registered whom they want.”

The official procedure for registering farmers for insurance is that the days on which registration will be occurring in the tabia are announced widely in the tabia. On those days, farmers register on a first-come-first-served basis. When farmers purchase insurance, they receive a coupon that documents the crop that they registered and the amount. The belief that the tabia administration invites people to register suggests that either people are not widely informed that insurance is sold on a first-come-first-served basis or that the procedure is not always working as it is supposed to be. Since many more people want to buy insurance for labor than there are contracts available for sale, it is worth following up the farmers' reports to investigate whether some farmers receive information about the registration process earlier than others do.

Another point of confusion is that some farmers do not understand that they have to register for insurance every year in order to remain registered. Some farmers who did not pay for insurance in 2012 but had paid for insurance in a previous year thought that they were entitled to a payout in 2012.

Most farmers who did not buy insurance say that they had heard about people registering for insurance but they know very little about insurance, do not understand what triggers a payout, and would need more information to get involved. Women who did not buy insurance said that they know about HARITA "by hearsay." These reports suggest that information about HARITA training sessions and about registration for insurance is not reaching everyone.

The following statistics from the follow-up survey that was administered in 2012 provide more information about levels of awareness among the uninsured. In this survey, 98% of respondents who purchased insurance report that they heard about insurance being offered in the tabia, while 67% of non-purchasers in the HARITA tabias report that they heard about insurance being offered. Ninety-six percent of purchasers report that they knew about insurance training/education sessions while 48% of non-purchasers in the HARITA tabias report knowing about the sessions. Ninety-two percent of purchasers report attending a training/education session, while 39% of non-purchasers report attending. All these differences are statistically significant.

As mentioned before, in tabias in which HARITA offers labor-for-insurance, the percentage of farmers who pay for insurance only in cash has gone down over time from 20% to 7%. The fact that the program is not attracting better-off farmers in larger numbers in the tabias in which labor for insurance is available may adversely affect its sustainability since the need for donor funding may be reduced if an increasing number of participants could pay in cash. Greater participation by better-off farmers also has the potential to improve impacts.

HARITA has offered insurance on a cash-only basis in 33 tabias. The evaluation team was not able to collect information in those tabias. Presumably better off farmers are buying the insurance for cash, and the experience of those villages may demonstrate that it is indeed possible to attract the better off to the program. However, targeting the more vulnerable and the better off in different tabias may be missing the opportunity to engage more better-off farmers in all tabias.

According to key informants and farmers, lack of information is a primary reason why better-off farmers are not buying insurance in larger numbers in tabias in which the labor-for-insurance

option is available. Key informants and farmers report that better-off farmers need more awareness of how insurance functions and its benefits, transparency in administration, and clearer communication about payout amounts. One FGD commented that the reason why better-off farmers do not buy insurance is “I think this is lack of knowledge. They don’t create awareness about the benefit of insurance, I have never heard a promotion or teaching about insurance in social gatherings.” One better off farmer said of insured farmers “they have paid insurance for the last three years but didn’t get any benefit from it. So why do we commit the same mistake. ” In another tabia, farmers also said that better off farmers “don’t trust the program, don’t trust that the program will pay.” The few better off farmers that the evaluation team was able to speak to report lack of communication with the HARITA team and lack of awareness about what insurance is, how it is administered, and how it may benefit them.

The common request by farmers to expand communication about the program and education activities may be due to insufficient staff numbers and time being devoted to these activities and/or the quality of the education program. The implementation team is indeed extremely small for the scale of the HARITA program. Communication and education would doubtlessly benefit if more financial and human resources could be devoted to them. We have no evidence about the quality of the education program.

Management of Risk Reduction Activities

Most key informants and farmers report that risk reduction activities constitute the second most substantive benefit of the HARITA program after knowledge building. Most believe that the potential for future improvement of livelihoods through HARITA lies in the risk reduction activities. This opinion is especially strong and prevalent in Kola Tembien and Saesi Tsaedaemba. Among the risk reduction activities, farmers consider efforts to conserve soil and especially to conserve moisture in the soil particularly important and useful.

Key informants and farmers do report a need for some improvements in the management of the risk reduction activities. One common point is that farmers find the administration to not be receptive to feedback from farmers. Farmers have suggestions or questions about the risk reduction activities and they either do not know to whom they can take their comments, or, more often, they do not receive a response. There is consensus in all 3 woredas that the risk reduction activities could benefit from improved communication with farmers beyond those who are on the design teams.

Farmers in Hade Alga express disappointment with the risk reduction activities. Risk reduction in Hade Alga is focused on drainage work in the hills, quite far from the farmlands. As in all cases, HARITA risk reduction here is integrated with existing PSNP activities in order to achieve maximum impact. The drainage work has been going on for decades and farmers report little benefit. One farmer said, “A lot of labor is being wasted on these areas which could be used on our lands to double crop production.” A key informant said “We are spending our labor on slopes which have not had results for the last 20 years. It is better to focus on the farmlands.”

The dissatisfaction with risk reduction activities may again be an issue of communication. There may be very good reasons for the design of the risk reduction activities in Raya. However, these

reasons have not been communicated clearly to farmers and farmers have not received any response to their comments.

A number of farmers in all 3 woredas indicated that the follow-up of the risk reduction activities is rather loose, occasionally leading to damage and lack of sustainability.

Another common concern is the timing of the risk reduction activities. In at least 2 of the woredas, farmers report that the labor on risk reduction activities competes for time with their work on their own farms. They request that the work be scheduled earlier in the season. This is one of the many adverse impacts of the uncertainty in the HARITA flow of funds. Risk reduction activities cannot begin until farmers have been registered for insurance and registration has been happening at the beginning of the growing season, delayed by uncertainty about the availability of funds. As a result, farmers are working on risk reduction activities during the planting season, when they should be tending their own fields. A number of farmers reported that the additional labor demands of the risk reduction activities at a time when they are busy in their own fields caused them to pull their children out of school in order to help with chores.

Management of Insurance

The management of insurance receives considerable praise from many respondents. People mentioned that insurance staff who were issuing the payout in 2012 on occasion stayed late into the night to ensure that everyone receives the money and they even provided escorts to enable people to carry their money safely after dark. People greatly appreciate these efforts.

Respondents did have several requests for improvement. In at least 2 out of the 3 woredas, key informants and farmers reported that people who registered for insurance did not receive a payout when others who paid the same premium did. One person said that he was told that he was not getting a payout because there was a “computer problem,” others were told that there was a problem with the lists of registered people.

REST staff informed us that there were occasional difficulties with identifying people on the list of insured farmers. The names on the list are written in English, not in Tigrinya, and there are different English spellings used for the same Tigrinya name. Also, multiple people have the same names. More information may need to be recorded about each purchaser to ensure proper identification.

Monitoring and Evaluating the Program

Based on observations made by the evaluation team, the HARITA program would benefit from additional resources for monitoring the performance of the program. Currently the program gathers data about risk reduction activities accomplished, people registered for insurance, and payouts made. The data on registration and payouts is very thorough but it has a few shortcomings.

The current system makes it difficult to track a key indicator of program performance, the retention of purchasers in the program from year to year. Name spellings vary from year to year for the same person and purchasers are not tracked from year to year to determine if they continue to buy insurance or not. Estimates from the evaluation survey and estimates obtained

from REST staff about the retention of purchasers in the program are different from each other. Data on drop-out rates is extremely important for monitoring the program. Also, selection of farmers based on registration data has resulted in a few mistakes, in which farmers who were recorded as paying in cash actually paid in labor.

The program does not currently collect indicators of progress toward program goals. Monitoring data that tracks maintenance and performance of risk reduction activities over time also would be helpful.

Current monitoring does not include indicators that could inform program staff about management problems. The program implementation is very decentralized and problems can occur at various levels that cannot be detected in official rosters that record insurance purchases and payouts. Data on indicators of management performance should be based on information collected from farmers about problems that they have encountered. Independent data collectors should collect these data. Beneficiaries of programs in general are reluctant to reveal problems to program staff, especially if they value the program highly. Programs generally need independent channels for collecting data about management problems and they need procedures for following up on any reports while maintaining the confidentiality of the sources of information.

CONCLUSION

The results of the quantitative analysis and the consensus among key informants and farmers both indicate that the HARITA program is achieving the critical objective of helping farmers to maintain their livelihoods in the face of drought. This is the primary goal of the program, and it addresses an urgent threat to livelihoods in the drought-prone region of Tigray. Farmers show overwhelming appreciation for the program. They request that the program expand and include more people.

HARITA is helping to maintain livelihoods by assisting farmers in maintaining their asset levels, access to food, and access to credit. These impacts do not all occur in every woreda. Farmers in each woreda have experienced different benefits, possibly because of the variation in insurance payouts across the woredas, the variation in rainfall patterns, and the variation in farmers' own resources.

The program is also beginning to show impacts on investments made by farmers in their agricultural production, which again differ across the woredas. Female-headed households, who are among the most vulnerable, have been making the biggest changes in production as a result of their participation in HARITA. If such productive investments continue to grow, they will contribute to building the farmers' resilience to droughts. We do not find evidence of any impacts that the changes in investment decisions may have had on yields. The likely reason for lack of such impacts in 2012 is the drought that occurred late in the growing season.

The consensus among farmers and key respondents is that HARITA is not yet having a transformative effect on livelihoods, in the sense of helping people to grow out of poverty. One farmer said "Insurance is building capacity to improve livelihoods in the future. It hasn't improved them yet." Another said "I wouldn't expect the livelihood of the community to change much if the rainfall is not improved."

The objective of helping smallholder farmers to transform their livelihoods and begin to reduce poverty levels is extremely challenging. It is most likely too soon to determine whether the program in its current form can make progress toward this goal because such progress most likely requires more time. However, the program can address certain obstacles that may be impeding such progress and it may consider new initiatives that may facilitate progress towards this ambitious goal.

The potential of the current design of the HARITA program to have more transformative impacts on livelihoods is difficult to assess in the presence of two operational constraints that the program faces. The first one is budgetary uncertainty, which has delayed the sale of insurance and therefore the implementation of the risk reduction activities every year. The consequences of these delays are likely to be quite significant as the farmers obtain training late, have little time to plan their production decisions with insurance in mind and secure adequate resources to fund those decisions, have to work on risk reduction activities when they should be working in their own fields, and have to pay for insurance at a time when they have had to spend their

money on production inputs. The program is currently well-placed to address this obstacle and therefore its full potential may be realized in the next several years.

The second constraint is that the program seems to need a more developed communication and education strategy and a systematic, well-developed monitoring system to realize its full potential. The program grew quite rapidly, over 3 years, from one tabia to 76 tabias, while the implementation team has remained very small. The program may well need more human resources in its implementation to support the current scale.

Making progress toward a transformation of livelihoods and reductions in poverty may require an expansion of the program's scope. The great majority of farmers and key respondents express the opinion that the program cannot have significant impacts on livelihoods without investing in irrigation and possibly in diversification of livelihoods. The problem of drought is worsening across the region and sustainability of agricultural livelihoods may well depend on irrigation that goes beyond the very valuable moisture conservation efforts undertaken as part of the current risk reduction activities.

If expanding involvement in irrigation is of interest to the program, then the sustainability of irrigation in different parts of the region needs to be established. There is underground water in Raya Azebo, but what will be the consequences of exploiting it? Apparently, underground water is plentiful in Kola Tembien and since the woreda has the least severe problem with drought out of the 3 evaluated woredas, it may have the best potential for fairly inexpensive, small scale, and sustainable irrigation. The need for irrigation and the intensity of the farmers' requests for it are greatest in Saesi Tsaedaemba and Raya Azebo.

The REST staff have emphasized that irrigation is a large undertaking quite beyond the capacity provided by the labor that pays for insurance. Undertaking irrigation would most likely require a restructuring of the program and its resources. However, farmers seem to have ideas about how to implement irrigation with limited resources, especially in Saesi Tsaedaemba, and closer consultation with farmers may reveal possible ways forward.

Without access to irrigation, agricultural livelihoods for small-scale farmers may be constrained in the drier parts of the region. However, other sources of livelihoods could be developed in many of these regions. For example, considerable scope seems to exist for various types of small businesses in Raya Azebo.

A current feature of the project that may affect both its sustainability and its impact on livelihoods is that it is not yet implementing a planned, systematic effort to attract better off farmers. The program is currently offering insurance for cash only in 33 tabias. Confining the recruitment of better off farmers to separate tabias may be unnecessarily limiting their participation. In the tabias in which the labor-for-insurance option is present, a small and declining percentage of farmers pay in cash. Better off farmers with whom the evaluation team has spoken report having little to no contact with the program. Better off farmers may have different needs than the more vulnerable farmers who are the current focus of the program. Attracting them is likely to require a separate, well-planned effort developed in consultation with better off farmers.

HARITA would become more sustainable with a larger percentage of purchasers who pay in cash since the cash payments would pay both for the cash component of the program and possibly would help support the management infrastructure for the program as a whole. There are two roads to increasing the number of farmers who pay in cash. One is to attract better off farmers. The second is to improve the livelihoods of more vulnerable farmers sufficiently so that they can begin to pay in cash. The latter is a challenging and long-term undertaking.

Attracting better off farmers into the program has the potential to improve impacts on livelihoods, although it is also not without risk. The more vulnerable farmers may not have enough capital to benefit from access to insurance sufficiently to transform livelihoods. The long experience of microcredit is instructive. Microcredit has helped borrowers to maintain livelihoods but evidence does not support the view that microcredit helps the poor to grow out of poverty. If access to insurance helps to expand the agricultural and/or business operations of better off farmers then the expansion of these operations may provide valuable, steady jobs to more vulnerable farmers and to the landless. HARITA could consider implementing a small pilot program to learn what would be the impacts of expanding the program to better off farmers on the livelihoods of entire communities.

RECOMMENDATIONS

1. HARITA program management may want to consider if the program needs to expand its scope in order to have more transformative effects on livelihoods over time, in particular to help reduce poverty, and whether such an expansion is desirable and/or feasible. There may be a limit to what the current strategy can accomplish in the face of increasing frequency and severity of drought and shortage of land. Possible directions for expanding impacts include irrigation, support for business activities that can diversify sources of income, and inclusion of better off farmers in the program. An investment in irrigation would require research into the sustainability of the water sources for that irrigation.
2. The HARITA program may consider whether irrigation and/or diversification of livelihoods are essential to maintaining livelihoods, not just to improving them, in the driest parts of the region. Determining sustainability of rainfed agricultural activity requires more time to observe whether the recent, apparent increase in frequency of drought in some parts of the region is a short-term anomaly or a long-term trend.
3. The weather index insurance is currently attracting few better off farmers who can pay in cash in areas in which the labor-for-insurance option is offered. Inclusion of better off farmers may be important for the sustainability of the program and it may broaden and deepen the impacts of the program on the livelihoods of the more vulnerable. On the other hand, there could also be negative effects such as diversion of benefits to the better off. The needs of the better off farmers are likely to differ from the needs of the more vulnerable. An effort to broaden the program to different wealth levels requires a plan developed in consultation with better off farmers and a pilot to test the strategy.
4. A more stable funding stream for the program presents the opportunity to conduct registration for insurance and the implementation of risk reduction activities well in advance of the beginning of planting season, preferably months in advance. The annual delays in sales of insurance have a number of negative consequences.
5. The program would benefit from an expanded and possibly redesigned communication and education strategy that informs farmers about the program and explains how index insurance works. The expansion is likely to require more staff and a larger budget than have been allotted to communication and education so far. A separate communication and education strategy would need to be developed to attract better off farmers.
6. The HARITA program needs a systematic monitoring system that collects data on an annual basis. The system should have at least 4 components:
 - a. *Keeping insurance registration records that: (i) collect sufficient identifying information to eliminate the possibility of mistaken identity, (ii) have one unique record for each farmer that allows the program to track from year to year whether each farmer continues to buy insurance or drops out, and if s/he drops out,*

whether s/he returns to the program in subsequent years. Ideally the system should also collect information about reasons why farmers drop out.

- b. Keeping records of completion and maintenance of risk reduction activities.*
 - c. Monitoring progress toward program objectives.*
 - d. Monitoring performance of all partners and problems that farmers encounter. This information should be collected by someone who is independent of the program and who can preserve the confidentiality of sources of information.¹⁶*
7. The program would benefit from establishing clear communication channels through which farmers can ask questions and/or offer feedback and/or ideas, especially about risk reduction activities. There should be a clear process for farmers to offer comments and to receive a response.
 8. The program may consider working with farmers to develop ways to manage small payouts. Farmers prefer not to travel long distances to collect insignificant payout amounts. Ideas that have been suggested include applying the amount of the payout to the farmer's next insurance premium payment or organizing a savings group that could receive and manage the money.
 9. The program may wish to conduct another evaluation after 3 to 5 years. The next evaluation should be able to provide more definitive evidence on the full potential of the current design of the program. The next evaluation should assess performance in tabias in which insurance is offered for cash only as well as tabias in which the labor-for-insurance option is available. Also, the evaluation needs to cover at least one good season and one dry season. Another evaluation would benefit immensely from a span of baseline data that covers several years. Data from the current evaluation can be used for this purpose, and a good monitoring system could provide several additional years of data though it would cover a small subset of the variables included in this evaluation.

¹⁶ An example would be a survey administered in every year in which there is a payout, which asks a random sample of insurance purchasers 2 questions: how much did they pay in cash or contribute in labor, how much did they receive in payout.

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TABLES

Notes:

- 1) In each table, we report the difference-in-difference regression in which the dependent variable is at the top of each column starting with the second or third column depending on the table. The first column describes the crop and/or the region for which the regression was done. The second column identifies which group of insurance purchasers is being analyzed in each row. In some cases, as in Table 1, the title of the table completely describes the crop and region so the first column identifies the group of insurance purchasers. For example, in Table 1, the second cell (column titled Traditional Seed Use) in the third row (row titled 2010-only) contains the impact of buying insurance in 2010 only on the amount of traditional seeds used in the production of teff in Kola Tembien over the entire evaluation period 2009 - 2012. The next cell to the right contains the impact of buying insurance in 2010 only on the amount of total seeds (traditional and improved) used in the production of teff in Kola Tembien over the entire evaluation period 2009 - 2012. The cell in the second column and fourth row and the cell in the third column and fourth row are blank because the impacts of buying insurance in 2010 and 2012 on the amount of traditional seed used and on the amount of total seed used were not statistically significant. The cell in the fourth column and fourth row contains the impact of buying insurance in 2010 and 2012 on the amount of improved seeds used per timad in the production of teff in Kola Tembien, and so on.

In Table 2a, the left-most column contains information about the crop being analyzed and the second column contains information about the group of insurance buyers. For example, the number in the cell in the fourth column and third row is the impact of buying insurance in 2010 only on the amount of all land planted (rainfed and irrigated) with wheat in Saesi Tsaedaemba. The number in the third column and eighth row is the impact of buying insurance in 2010 and 2012 on rainfed land planted with barley in Saesi Tsaedaemba. As above, if a cell is blank then the effect on the input in that column for the group of buyers in that row was not statistically significant.

Rows labeled with N contain the sample size for each regression.

The impact number is the coefficient in the regression. The number of stars next to it denotes the level of statistical significance (see the notes below each table). The number below the coefficient in parentheses is the standard error. In some cells we also provide the size of the effect. The size is the third number in the cell and it is always the percentage by which the change in the input made by insured farmers exceeds the change in the input made by uninsured farmers. We do not report effect sizes when the insured farmers increased their inputs less than the uninsured. If the effect size is in red font, the uninsured decreased the amount of that input, while the insured increased the amount.

Each of the regressions includes control variables specified below the table and regressions that cover more than one woreda include woreda fixed effects. We do not report regression coefficients for control variables in the tables in order to conserve space.

2) We examine inputs into and yields for those crops in each woreda for which we have a sufficient number of farmers in our sample who grow the given crop:

- Teff grown in Kola Tembien and Raya Azebo only.
- Wheat and barley grown in Saesi Tsaedaemba only (observations in Raya Azebo are insufficient for individual crop analysis).
- Maize grown in Kola Tembien only.
- Sorghum grown in Raya Azebo only.
- In analyses of all grains:
 - For Kola Tembien all grains are teff, maize, and millet.
 - For Saesi Tsaedaemba all grains are wheat and barley.
 - For Raya Azebo all grains are teff, wheat, barley, and sorghum.

Table 1: 2012-2009 impacts of HARITA on investments in teff in Kola Tembien

Insurance buyers	Traditional Seed Use (kg)	Total Seed Use [#] (KG)	High-Yield Seed Use per Area Planted (kg/timad)	Fertilizer Use (kg)	Fertilizer Use Per Area Planted (kg/timad)	Compost Use (kg)
<i>N</i>	78	78	81	75	75	72
<i>2010-only</i>	-50.53* (26.09)	-48.08* (25.52)		-18.43* (8.689) [-83.36%]		
<i>2010 + 2012</i>			-3.139** (1.346) [-497.3%]		-10.36*** (3.115) [-75.04%]	138.90* (76.81) [220.9%]
<i>Control variables^{##}</i>	Yes	Yes	Yes	Yes	Yes	Yes

* denotes significance at the 10% level

** denotes significance at the 5% level

*** denotes significance at the 1% level

[#] Total Seed Use includes both Traditional and High-Yielding Seeds.

Control variables include: whether the household head can read and write, whether the spouse of the household head can read and write, household size, whether the household head is female, value of all household assets including livestock.

Red font indicates that the uninsured decreased the amount of that input, while the insured increased the amount.

Table 2a: 2012-2009 impacts of HARITA on investments in wheat and barley in Saesi Tsaedaemba

Model	Insurance buyers	Area of Rainfed Land Planted (timad)	Total Area of Land Planted (Rainfed + Irrigated) (timad)	Yield from Rainfed Land (Quintal)	Total Yield (from Rainfed + Irrigated Land) (Quintal)	Per Area Yield from Rainfed Land (Q/timad)	Per Area Yield from Rainfed + Irrigated Land (Q/timad)	Total Seed Use per Area Planted# (kg/timad)
Wheat Saesi T. only	<i>N</i>		32					31
	<i>2010-only</i>		-1.127** (0.439)					
	<i>2010 + 2012</i>							7.031*** (1.662)
	<i>Control variables##</i>		Yes					Yes
Barley Saesi T. only	<i>N</i>	78	80	47	47	47	47	
	<i>2010-only</i>	0.530* (0.224)	0.501* (0.225)	1.277* (0.628) [466.6%]	1.277* (0.627) [466.6%]			
	<i>2010 + 2012</i>	0.337** (0.119)	0.304* (0.129)			-1.026** (0.391) [-110.8%]	-1.026** (0.391) [-110.8%]	
	<i>Control variables##</i>	Yes	Yes	Yes	Yes	Yes	Yes	

* denotes significance at the 10% level

** denotes significance at the 5% level

*** denotes significance at the 1% level

Total Seed Use includes both Traditional and High-Yielding Seeds.

Control variables include: whether the household head can read and write, whether the spouse of the household head can read and write, household size, whether the household head is female, value of all household assets including livestock.

Table 2b: 2012-2009 impacts of HARITA on investments in wheat and barley in Saesi Tsaedaemba (cont.)

Model	Insurance buyers	Value of Yield from Rainfed Land (birr)	Total Value of Yield (from Rainfed + Irrigated Land) (birr)	Per Area Value of Yield from Rainfed Land (birr/timad)	Per Area Value of Yield from Rainfed + Irrigated Land (birr/timad)
Wheat Saesi T. only	<i>N</i>	30	32		
	<i>2010-only</i>	-680.00* (334.50) [-93.56%]	-865.90** (305.50) [-114.9%]		
	<i>2010 + 2012</i>				
	<i>Control variables##</i>	Yes	Yes		
Barley Saesi T. Only	<i>N</i>	47	47	47	47
	<i>2010-only</i>	767.50* (380.30) [263.8%]	768.00* (379.30) [264.0%]		
	<i>2010 + 2012</i>			-616.50** (238.10) [-126.0%]	-616.50** (238.10) [-126.0%]
	<i>Control variables##</i>	Yes	Yes	Yes	Yes

* denotes significance at the 10% level

** denotes significance at the 5% level

*** denotes significance at the 1% level

Control variables include: whether the household head can read and write, whether the spouse of the household head can read and write, household size, whether the household head is female, value of all household assets including livestock.

Table 3: 2012-2009 impacts of HARITA on investments in maize in Kola Tembien

Insurance buyers	Traditional Seed Use (kg)	Traditional Seed Use per Area Planted (kg/timad)	Fertilizer Use (kg)	Expend-iture on Fertilizer (birr)	Compost Use (kg)
<i>N</i>	69	69	64	64	63
<i>2010-only</i>	6.945* (3.741)		15.35** (5.759) [220.7%]	240.60*** (43.03) [142.6%]	383.90* (180.4) [253.3%]
<i>2010 + 2012</i>	8.649** (3.006)	7.580** (3.258)		109.70** (46.03) [65.03%]	
<i>Control variables##</i>	Yes	Yes	Yes	Yes	Yes

* denotes significance at the 10% level

** denotes significance at the 5% level

*** denotes significance at the 1% level

Control variables include: whether the household head can read and write, whether the spouse of the household head can read and write, household size, whether the household head is female, value of all household assets including livestock.

Table 4: 2012-2009 impacts of HARITA on investments in all grains in Kola Tembien (including teff, maize, sorghum, wheat, barley, millet)

Insurance buyers	Total Seed Use[#] (kg)	Fertilizer Use (kg)	Compost Use per Area Planted (kg/timad)
<i>N</i>	103	102	101
<i>2010-only</i>	-39.31** (17.58)	-13.93* (7.622) [-40.99%]	132.80** (44.89) [842.2%]
<i>2010 + 2012</i>	-14.88* (7.597)	-23.60** (9.943) [-69.44%]	79.39** (30.54) [503.5%]
<i>Control variables^{##}</i>	Yes	Yes	Yes

* denotes significance at the 10% level

** denotes significance at the 5% level

*** denotes significance at the 1% level

[#] Total Seed Use includes both Traditional and High-Yielding Seeds.

^{##} Control variables include: whether the household head can read and write, whether the spouse of the household head can read and write, household size, whether the household head is female, value of all household assets including livestock.

Table 5: 2012-2009 impacts of HARITA on income, assets, and credit

Model	Insurance buyers	# of Children in School	# of Income Generating Activities	Quantity of Grain on Reserve (kg)	Quantity of Savings (ETB)	# of Oxen Owned by Household	Value of Livestock Owned by Household (ETB)	Value of Productive Assets + Livestock Owned by Household (ETB)	# of Loans Taken by Household	Quantity Borrowed by Household (ETB)
Kola Tembien	N		124	126	116		125			
	2010-only		0.473*** (1.138) [461.2%]	187.10** (66.50) [328.2%]	698.20* (340.40) [174.9%]					
	2010 + 2012			145.00** (60.62) [254.4%]			-4500.40* (2211.40)			
	Control variables#		Yes	Yes	Yes		Yes			
Saesi T.	N	83				100		83	100	65
	2010-only					0.271* (0.137) [185.8%]		-8964.90* (4569.30)	0.803*** (0.214) [3855.0%]	1280.70** * (302.40) [199.7%]
	2010 + 2012	0.481* (0.237)							0.475* (0.234) [2280.4%]	1060.20* (518.20) [165.4%]
	Control variables#	Yes				Yes		Yes	Yes	Yes

Raya Azebo	<i>N</i>					119				
	<i>2010-only</i>									
	<i>2010 + 2012</i>					0.448** (0.190) [1478.4%]				
	<i>Control variables[#] #</i>					Yes				

* denotes significance at the 10% level

** denotes significance at the 5% level

*** denotes significance at the 1% level

Control variables for all regressions except number of oxen, value of livestock, and value of assets include: whether the household head can read and write, whether the spouse of the household head can read and write, household size, whether the household head is female, value of all household assets including livestock. The savings, number of oxen, value of livestock, and value of assets regressions exclude household assets from the controls.

Red font indicates that the uninsured decreased the amount of that input, while the insured increased the amount.

Table 6: 2010-2009 impacts of HARITA on investments in teff in Kola Tembien and Raya Azebo

Model	Insurance buyers	Traditional Seed Use (kg)	Traditional Seed Use per Area Planted (kg/timad)	High-Yield Seed Use (kg)	High-Yield Seed Use per Area Planted (kg/timad)	Expenditure on High Yield Seeds (birr)	Expenditure on High Yield Seeds per Area Planted (birr/timad)	Fertilizer Use (kg)	Expenditure on Fertilizer (birr)
Kola Tembien	N	83	83					77	77
	2010-only								
	2010 + 2012	10.40* (4.907) [116.8%]	9.902*** (3.115) [160.3%]					-14.41** (6.115) [-137.9%]	-93.56** (41.29) [-115.7%]
	Control variables#	Yes	Yes					Yes	Yes
Raya Azebo	N			78	78	78	78		
	2010-only								
	2010 + 2012			8.675** (2.920) [248.8%]	2.613** (1.132) [352.5%]	78.21*** (24.15) [352.7%]	25.49** (9.662) [710.9%]		
	Control variables#			Yes	Yes	Yes	Yes		

* denotes significance at the 10% level

** denotes significance at the 5% level

*** denotes significance at the 1% level

Control variables include: whether the household head can read and write, whether the spouse of the household head can read and write, household size, whether the household head is female, value of all household assets including livestock.

Red font indicates that the uninsured decreased the amount of that input, while the insured increased the amount.

Table 7: 2010-2009 impacts of HARITA on investments in wheat and barley in Saesi Tsaedaemba

Model	Insurance buyers	High-Yield Seed Use per Area Planted (kg/timad)	Fertilizer Use per Area Planted (kg/timad)	Expenditure on Fertilizer per Area Planted (birr/timad)	Compost Use per Area Planted (kg/timad)
Wheat	<i>N</i>				28
	<i>2010-only</i>				
	<i>2010 + 2012</i>				395.50* (196.0) [195.8%]
	<i>Control variables^{##}</i>				Yes
Barley	<i>N</i>		50	50	38
	<i>2010-only</i>				
	<i>2010 + 2012</i>		10.05* (4.550) [225.8%]	72.39* (32.23) [207.7%]	223.40* (117.10) [116.1%]
	<i>Control variables^{##}</i>		Yes	Yes	Yes
Wheat + Barley	<i>N</i>	74			52
	<i>2010-only</i>	5.923** (2.027) [94.77%]			
	<i>2010 + 2012</i>				139.10* (60.08) [114.7%]
	<i>Control variables^{##}</i>	Yes			Yes

* denotes significance at the 10% level

** denotes significance at the 5% level

*** denotes significance at the 1% level

Control variables include: whether the household head can read and write, whether the spouse of the household head can read and write, household size, whether the household head is female, value of all household assets including livestock.

Red font indicates that the uninsured decreased the amount of that input, while the insured increased the amount.

Table 8: 2010-2009 impacts of HARITA on investments in maize in Kola Tembien

Insurance buyers	Traditional Seed Use (kg)	Traditional Seed Use per Area Planted (kg/timad)
<i>N</i>	67	67
<i>2010-only</i>	11.03*** (3.394) [125.7%]	8.173*** (2.344) [148.6%]
<i>2010 + 2012</i>		6.410* (3.159) [116.5%]
<i>Control variables##</i>	Yes	Yes

* denotes significance at the 10% level

** denotes significance at the 5% level

*** denotes significance at the 1% level

Control variables include: whether the household head can read and write, whether the spouse of the household head can read and write, household size, whether the household head is female, value of all household assets including livestock.

Red font indicates that the uninsured decreased the amount of that input, while the insured increased the amount.

Table 9: 2010-2009 impacts of HARITA on investments in sorghum in Raya Azebo

Insurance buyers	Fertilizer Use (kg)	Expenditure on Fertilizer (birr)
<i>N</i>	60	60
<i>2010-only</i>		
<i>2010 + 2012</i>	10.46** (3.60) [93.72%]	93.93** (32.33) [93.72%]
<i>Control variables^{##}</i>	Yes	Yes

* denotes significance at the 10% level

** denotes significance at the 5% level

*** denotes significance at the 1% level

^{##} Control variables include: whether the household head can read and write, whether the spouse of the household head can read and write, household size, whether the household head is female, value of all household assets including livestock.

Table 10: 2012 – 2009 impacts of HARITA on resilience and production decisions for all woredas

	Savings (birr)	Number of oxen owned	Compost Use per Area Planted (kg/timad)
<i>N</i>	272	345	230
<i>Ever bought insurance</i>	513.3* (270.9) [123%]	0.184* (0.0904)	68.76** (25.44) [315%]
<i>Control variables^{##}</i>	Yes	Yes	Yes
<i>Woreda fixed effects</i>	Yes	Yes	Yes

* denotes significance at the 10% level

** denotes significance at the 5% level

*** denotes significance at the 1% level

^{##} Control variables for all regressions except number of oxen include: whether the household head can read and write, whether the spouse of the household head can read and write, household size, whether the household head is female, value of all household assets including livestock. The number of oxen regression excludes household assets from the controls.

APPENDIX A

Table A.1: Differences in baseline means for teff production

Variable	N	All Woredas			p-value:	p-value:	p-value:
		Mean for Non-Purchasers	Mean for 2010-only Purchasers	Mean for 2010&2012 Purchasers	Control v. 2010-only	Control v. Bothyrs	2010-only v. Bothyrs
Teff							
Rainfed Land Planted	227	2.239	2.902	2.128	0.151	0.732	0.025**
Total Land Planted	227	2.325	2.902	2.162	0.216	0.597	0.028**
Rainfed Yield	189	1.632	1.634	2.108	0.997	0.123	0.295
Total Yield	194	1.600	1.634	2.158	0.938	0.087*	0.264
Traditional Seed Use	192	14.833	31.571	10.227	0.155	0.031**	0.070*
High-Yield Seed Use	195	3.270	4.709	5.059	0.485	0.198	0.869
Total Seed Used	188	18.644	36.393	15.774	0.129	0.112	0.077*
Fertilizer Use	189	7.223	25.833	29.445	0.022**	0.001***	0.634
Compost Use	183	94.599	323.113	44.444	0.415	0.070*	0.324

* denotes significance at the 10% level

** denotes significance at the 5% level

*** denotes significance at the 1% level

Red font denotes that the significance test becomes not significant when we exclude those who bought insurance in 2009 (in Adi Ha only) from the analysis.

Table A.2: Differences in baseline means for wheat production

Variable	N	All Woredas			p-value:	p-value:	p-value:
		Mean for Non-Purchasers	Mean for 2010-only Purchasers	Mean for 2010&2012 Purchasers	Control v. 2010-only	Control v. Bothyrs	2010-only v. Bothyrs
Wheat							
Rainfed Land Planted	202	0.446	0.286	0.394	0.217	0.751	0.575
Total Land Planted	202	0.453	0.298	0.436	0.249	0.923	0.504
Rainfed Yield	77	1.089	1.038	0.775	0.919	0.410	0.431
Total Yield	80	1.064	0.964	0.872	0.834	0.603	0.762
Traditional Seed Use	81	7.919	9.333	5.217	0.629	0.446	0.327
High-Yield Seed Use	80	15.826	7.225	12.804	0.173	0.687	0.419
Total Seed Used	78	24.310	17.225	18.841	0.194	0.379	0.750
Fertilizer Use	80	3.655	5.143	1.500	0.450	0.070*	0.016**
Compost Use	68	170.588	162.308	57.143	0.950	0.145	0.354

* denotes significance at the 10% level

** denotes significance at the 5% level

*** denotes significance at the 1% level

Table A.3: Differences in baseline means for barley production

Variable	N	All Woredas			p-value:	p-value:	p-value:
		Mean for Non-Purchasers	Mean for 2010-only Purchasers	Mean for 2010&2012 Purchasers	Control v. 2010-only	Control v. Bothyrs	2010-only v. Bothyrs
Barley							
Rainfed Land Planted	200	0.900	1.167	1.112	0.119	0.286	0.828
Total Land Planted	202	0.901	1.167	1.097	0.137	0.305	0.774
Rainfed Yield	135	1.386	1.197	1.349	0.520	0.901	0.556
Total Yield	136	1.363	1.197	1.355	0.582	0.980	0.538
Traditional Seed Use	134	35.070	36.424	36.500	0.792	0.877	0.995
High-Yield Seed Use	138	0.833	1.324	0.568	0.740	0.710	0.621
Total Seed Used	134	35.947	37.788	37.068	0.725	0.902	0.948
Fertilizer Use	128	7.723	10.326	4.981	0.514	0.266	0.190
Compost Use	124	120.511	141.719	76.837	0.671	0.358	0.235

* denotes significance at the 10% level

** denotes significance at the 5% level

*** denotes significance at the 1% level

Table A.4: Differences in baseline means for maize production

Variable	N	All Woredas			p-value: Control v. 2010-only	p-value: Control v. Bothyrs	p-value: 2010-only v. Bothyrs
		Mean for Non- Purchasers	Mean for 2010-only Purchasers	Mean for 2010&2012 Purchasers			
Maize							
Rainfed Land Planted	121	0.831	0.702	0.851	0.648	0.938	0.467
Total Land Planted	121	0.949	1.045	1.079	0.797	0.629	0.882
Rainfed Yield	77	1.194	1.186	1.691	0.988	0.293	0.359
Total Yield	86	1.435	1.440	2.158	0.993	0.261	0.230
Traditional Seed Use	87	11.148	7.600	6.750	0.344	0.252	0.714
High-Yield Seed Use	86	0.750	4.475	4.579	0.125	0.017**	0.967
Total Seed Used	84	11.926	12.711	11.684	0.878	0.955	0.792
Fertilizer Use	81	12.340	17.711	27.919	0.173	0.011**	0.065*
Compost Use	80	102.315	222.790	193.853	0.030**	0.068*	0.524

* denotes significance at the 10% level

** denotes significance at the 5% level

*** denotes significance at the 1% level

Red font denotes that the significance test becomes not significant when we exclude those who bought insurance in 2009 (in Adi Ha only) from the analysis.

Table A.5: Differences in baseline means for sorghum production

Variable	N	All Woredas			p-value:	p-value:	p-value:
		Mean for Non-Purchasers	Mean for 2010-only Purchasers	Mean for 2010&2012 Purchasers	Control v. 2010-only	Control v. Bothyrs	2010-only v. Bothyrs
Sorghum							
Rainfed Land Planted	105	2.191	3.300	2.517	0.079*	0.589	0.272
Total Land Planted	106	2.255	4.050	2.435	0.007***	0.756	0.0003***
Rainfed Yield	67	1.563	2.577	2.786	0.437	0.013**	0.877
Total Yield	70	1.514	2.577	2.786	0.418	0.009***	0.877
Traditional Seed Use	68	10.788	11.385	12.227	0.827	0.431	0.793
High-Yield Seed Use	70	1.171	3.615	1.227	0.281	0.964	0.055*
Total Seed Used	68	12.030	15.000	13.455	0.458	0.406	0.666
Fertilizer Use	69	0.000	3.846	0.000	0.252	.	0.252
Compost Use	67	32.636	753.846	204.762	0.225	0.041**	0.315

* denotes significance at the 10% level

** denotes significance at the 5% level

*** denotes significance at the 1% level

Table A.6: Differences in baseline means for production of all grains

Variable	N	All Woredas			p-value:	p-value:	p-value:
		Mean for Non-Purchasers	Mean for 2010-only Purchasers	Mean for 2010&2012 Purchasers	Control v. 2010-only	Control v. Bothyrs	2010-only v. Bothyrs
All Grains							
Rainfed Land Planted	323	4.124	4.728	3.819	0.506	0.622	0.141
Total Land Planted	323	4.297	5.124	4.045	0.386	0.680	0.078*
Rainfed Yield	306	3.155	2.929	3.400	0.750	0.667	0.230
Total Yield	312	3.226	3.045	3.758	0.800	0.374	0.098*
Traditional Seed Use	310	38.773	47.270	30.333	0.226	0.224	0.066*
High-Yield Seed Use	313	9.030	7.730	8.892	0.705	0.959	0.723
Total Seed Used	306	49.054	55.116	39.582	0.440	0.175	0.094*
Fertilizer Use	305	11.949	30.080	33.278	0.010**	0.013**	0.693
Compost Use	295	224.082	525.841	189.576	0.341	0.479	0.262

* denotes significance at the 10% level

** denotes significance at the 5% level

*** denotes significance at the 1% level

Red font denotes that the significance test becomes not significant when we exclude those who bought insurance in 2009 (in Adi Ha only) from the analysis.

Table A.7: Differences in baseline means for human and animal labor inputs

Variable	N	All Woredas			p-value:	p-value:	p-value:
		Mean for Non-Purchasers	Mean for 2010-only Purchasers	Mean for 2010&2012 Purchasers	Control v. 2010-only	Control v. Bothyrs	2010-only v. Bothyrs
Family Labour	323	29.766	43.177	38.332	0.027**	0.131	0.517
Family Labour Per Timad	296	10.042	11.162	10.422	0.558	0.808	0.629
Hired Labour	319	4.319	7.169	5.612	0.517	0.547	0.591
Hired Labour Per Timad	291	1.057	1.113	1.176	0.917	0.718	0.900
Own Oxen	326	15.293	18.346	16.944	0.436	0.618	0.717
Own Oxen Per Timad	298	3.839	3.603	3.578	0.672	0.577	0.971
Hired Oxen	327	4.571	7.734	7.302	0.044**	0.031**	0.782
Hired Oxen Per Timad	299	2.195	2.346	2.235	0.812	0.940	0.842

* denotes significance at the 10% level

** denotes significance at the 5% level

*** denotes significance at the 1% level

Red font denotes that the significance test becomes not significant when we exclude those who bought insurance in 2009 (in Adi Ha only) from the analysis.

Table A.8: Differences in baseline means for household characteristics, income, asset, and credit

Variable	N	All Woredas			p-value: Control v. 2010-only	p-value: Control v. Bothyrs	p-value: 2010-only v. Bothyrs
		Mean for Non- Purchasers	Mean for 2010-only Purchasers	Mean for 2010&2012 Purchasers			
Female Headed HHs	360	0.270	0.300	0.480	0.688	0.002***	0.010**
# of HH Members	345	5.497	5.471	5.447	0.942	0.883	0.930
HH Head Literacy	335	0.221	0.441	0.441	0.015**	0.001***	0.995
HH Spouse Literacy	338	0.040	0.203	0.126	0.002***	0.021**	0.201
# of HH Members in School	346	1.444	1.486	1.659	0.860	0.285	0.470
Grain on Reserve	346	129.34	129.29	149.76	0.999	0.708	0.662
Amount of Savings	322	400.08	337.68	563.33	0.796	0.622	0.105
Area of Land Owned	346	3.590	3.452	4.561	0.761	0.255	0.126
Net Land Rented [#]	339	-0.025	0.076	-0.100	0.170	0.474	0.171
Net Land Shared ^{##}	346	0.972	2.154	0.685	0.072*	0.375	0.019**
# of Oxen Owned	346	1.10	1.19	0.772	0.647	0.011**	0.006***
Value of Livestock Owned	346	6879.87	7260.14	4802.55	0.847	0.131	0.067*
Value of Productive &	346	2937.77	2086.06	4948.42	0.125	0.178	0.036**

HH Assets							
Number of Loans Taken	346	0.595	0.629	0.659	0.805	0.581	0.805
Quantity Borrowed	346	821.018	1379.493	971.998	0.353	0.569	0.504

* denotes significance at the 10% level

** denotes significance at the 5% level

*** denotes significance at the 1% level

denotes amount of land rented in minus amount of land rented out.

denotes amount of land sharecropped in minus amount of land sharecropped out.

Red font denotes that the significance test becomes not significant when we exclude those who bought insurance in 2009 (in Adi Ha only) from the analysis.

APPENDIX B

The base model considered can be expressed as follows:

$$y_{it} = b_0 + b_1wii10_{it} + b_2wii12_{it} + b_32012_t + b_4X_{it} + b_5Z_i + e_{it}$$

where *wii10* is a dummy variable that indicates whether the household bought insurance in 2010 only or not, *wii12* is a dummy variable that indicates whether the household bought insurance in 2010 and 2012 or not, *2012* is an indicator variable for being in the 2012 time period (vs. 2009), *X* is a matrix of household-level time-varying control variables, *Z* is a matrix of time-invariant household characteristics, and *e* is a vector of idiosyncratic errors. Taking first differences (here, differencing the data by subtracting the baseline 2009 observations from the 2012-year observations) allows us to modify the specification as follows:

$$(y_{it} - y_{ib}) = b_1(wii10_{it} - wii10_{ib}) + b_2(wii12_{it} - wii12_{ib}) + b_3(2012_t - 2012_b) + b_4(X_{it} - X_{ib}) + b_5(2012_t - 2012_b)Z_i + (e_{it} - e_{ib})$$

where, for notational simplicity, the subscript *t* is being used to denote the 2012-year, and the subscript *b* is being used to denote the 'baseline' 2009-year. Controls *X* include: the value of all productive assets owned and the value of livestock owned.¹⁷ Controls *Z* include: an indicator for household head literacy, an indicator for spouse literacy, an indicator for female headed households, a variable for household size (# of household members), and woreda-level fixed effects, as appropriate for the crop under consideration. Since all controls *Z* are time-invariant, they are interacted with the *2012* time-period dummy variable in order to remain in the first differenced equation.

¹⁷ The value of productive assets owned and the value of livestock owned by the household are merged into one aggregate 'value of assets' variable.

APPENDIX C

Below is a list of all variables that measure the impacts of HARITA that we examined in the regressions.

Crop input and yield variables examined for teff, wheat, barley, sorghum, and a composite of all crops that included millet in addition to the above:

rainfed land planted

total land planted (includes rainfed and irrigated land)

yield from rainfed land

yield from rainfed land per timad of rainfed land planted

yield from all land (rainfed plus irrigated)

yield from all land per timad planted

quantity of traditional seeds used

quantity of improved seeds used

sum of traditional and improved seeds used

sum of traditional and improved seeds use per timad of land planted

quantity of fertilizer used

quantity of fertilizer used per timad of land planted

quantity of compost used

quantity of compost used per timad of land planted

quantity of pesticide used

quantity of pesticide used per timad of land planted

Asset variables:

quantity (number) of livestock owned (excluding poultry and bees)
value of livestock owned (excluding poultry and bees)
value of livestock owned (including poultry and bees)
quantity (number) of oxen owned
homestead land (in timad)
number of mobile phones
value of all assets (excluding livestock, and rented/family inherited houses)
value of all assets (including livestock, and rented/family inherited houses)
quantity of grain on reserve
cash savings value
land owned (timad)
land rented-in minus land rented-out
land shared-in minus land shared-out
land shared in
land shared out
land rented in
land rented out

Credit variables

number of loans taken
number of agricultural loans taken
number of non-agricultural loans taken
quantity (birr) borrowed
quantity (birr) borrowed for agricultural purposes
quantity (birr) borrowed for non-agricultural purposes

Demographic variables

number of income earners per household

proportion of household members earning an income

school attendance by household

number of income sources gained by household over past year

number of income sources lost by household over the past year

Labor input variables

hours of family labour

hours of hired labour

hours of own oxen used

hours of hired oxen used

hours of family labour used per timad of land planted

hours of hired labour used per timad of land planted

hours of own oxen used per timad of land planted

hours of hired oxen used per timad of land planted

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