Feed the Future Innovation Lab
for Collaborative Research on Assets and Market Access

University of California Davis

BASIS

ANNUAL REPORT 2013

EXECUTIVE SUMMARY

New Findings from the BASIS Research Agenda

Just over a decade ago, the BASIS Assets and Market Access research program launched a series of research projects focused first on understanding the causes and consequences of poverty traps in the rural areas of the developing world, and then later designing and testing solutions intended to create pathways from poverty. Key findings from that earlier work included the fundamental nature of risk as a cause of chronic poverty, the importance of a critical minimum asset bundles as the starting point for a successful pathway from poverty, and the importance of relaxing information and financial constraints to the adoption of improved technologies that enhance the returns to any given asset bundle.

With its refunding in 2012, BASIS has launched a mature research agenda that prioritizes work in these areas:

- *Financial Innovations in Risk Management*
- *Mechanisms for Adoption of Improved Technologies*
- *Synergistic Packages of Financial and Technological Innovations*

At the date of this report, BASIS now has a full program with 17 projects spread nearly evenly across these three areas. While many of these projects are just now beginning, this past year has seen three especially important findings emerge from the BASIS research portfolio:

1. *Temporary Subsidies Can Permanently Boost Smallholder Technology Adoption and Living Standards*
2. *Risk Transfer through Insurance Can Significantly Reduce Reliance on the Costly Coping Strategies that underlie the intergenerational Transmission of Poverty*
3. *Well-designed Insurance can Crowd-in Smallholder Investment in Remunerative Technologies and Market Opportunities*

As detailed later in this report, this first finding emerges from a 5-year study of a voucher coupon scheme in Mozambique. While voucher coupons or other subsidy programs have become a permanent, budget-draining feature in many countries, the program in Mozambique was a short-term, 2-year subsidy. Results from a BASIS randomized controlled trial show that these temporary subsidies were still boosting yields by an average of 20% in the two years after the subsidy period ended, with household living standards almost 10% higher for those who benefited from the voucher coupons. Learning seems to be an important part of this story, as voucher coupon users expect returns on fertilizer to be 40% higher than do non-voucher recipients. The implications of this work for the design of technology uptake and learning subsidies are many.

Finding 2 also emerged from another long-term BASIS research project. Launched in 2009, the Index-based Livestock Insurance (IBLI) project in the pastoral regions of northern Kenya had its

first payout in 2011. Exploiting the randomized research design, BASIS researchers showed that insurance more than cut in half the number of asset poor families that relied on meal reduction as a way to cope with the drought that swept across that region in 2011. Prior work has shown that meal reduction is an extremely expensive coping strategy as it permanently reduces the growth and capacity of the youngest household members, likely contributing to the intergenerational transmission of poverty. In addition, the BASIS work showed that the insurance payments nearly eliminated modestly wealthier households' reliance on animal sales as a form of coping. This shift should leave these households less vulnerable to the next drought and better able to sustain their standard of living.

Finding 3 emerged from a randomized controlled trial in Mali. In collaboration with private sector partners, BASIS researchers designed a novel form of small-farm friendly agricultural insurance that provided cotton farmers real protection. In response, those farmers offered insurance substantially increased their investment in cotton production, dedicating some 20% more land to cotton production and investing more in each hectare of land allocated to cotton. Uptake of this contract was surprisingly strong and lessons from this project have already been transferred to Burkina Faso where the new contract has met with a similarly strong response.

New BASIS Research Projects

In the next fiscal year, the BASIS AMA Innovation Lab will make final awards for research projects in identified priority areas. These awards will complete the BASIS research portfolio, and will be selected for quality of research, contribution to overall policy priorities, and geographic and topical balance.

For BASIS's new generation of research projects, proposals are being selected around the following established BASIS themes:

1. Financial instruments for risk management and resilience; and,
2. Interventions that reduce barriers to adoption of improved agricultural technologies

In addition to projects around these existing BASIS themes, we will also welcome proposals that fall under these existing themes, we strongly encourage proposal submissions for research that would deepen our understanding of poverty dynamics, especially insights and evidence that would assist the design of comprehensive social protection systems that protect the assets of chronically poor households as well as enable them to build and leverage these assets in pursuit of more resilient and rewarding livelihoods. Proposals might focus on impact evaluations of innovative graduation strategies or more basic research on fundamental mechanisms that constrain upward mobility.

Future Directions

The BASIS AMA Innovation Lab is at a point of transition. At the end of fiscal year 2012-2013, some BASIS projects are just beginning to end, and will end over the next year. Meanwhile, a separate tranche of projects have just been selected. These projects will begin in earnest over the next fiscal year, and the final projects in the BASIS portfolio will be selected. As such, over the next fiscal year the primary activities of BASIS will be outreach and dissemination of preliminary results from those projects coming to a close, as well as the initiation of a new generation of research.

MANAGEMENT ENTITY INFORMATION

Director: Michael Carter
Assistant Director: Tara Steinmetz
Financial Analyst: Diane Jellison
I4 Post-Doctoral Fellow: Thomas Barre

TECHNICAL AND/OR ADVISORY COMMMITTEE INFORMATION

Standing Board of Directors

- Craig McIntosh, University of California San Diego
- Jolyne Sanjak, Millennium Challenge Corporation
- Mary Mathenge, Tegemeo Research Institute, Egerton University
- Lena Heron, USAID Bureau of Food Security

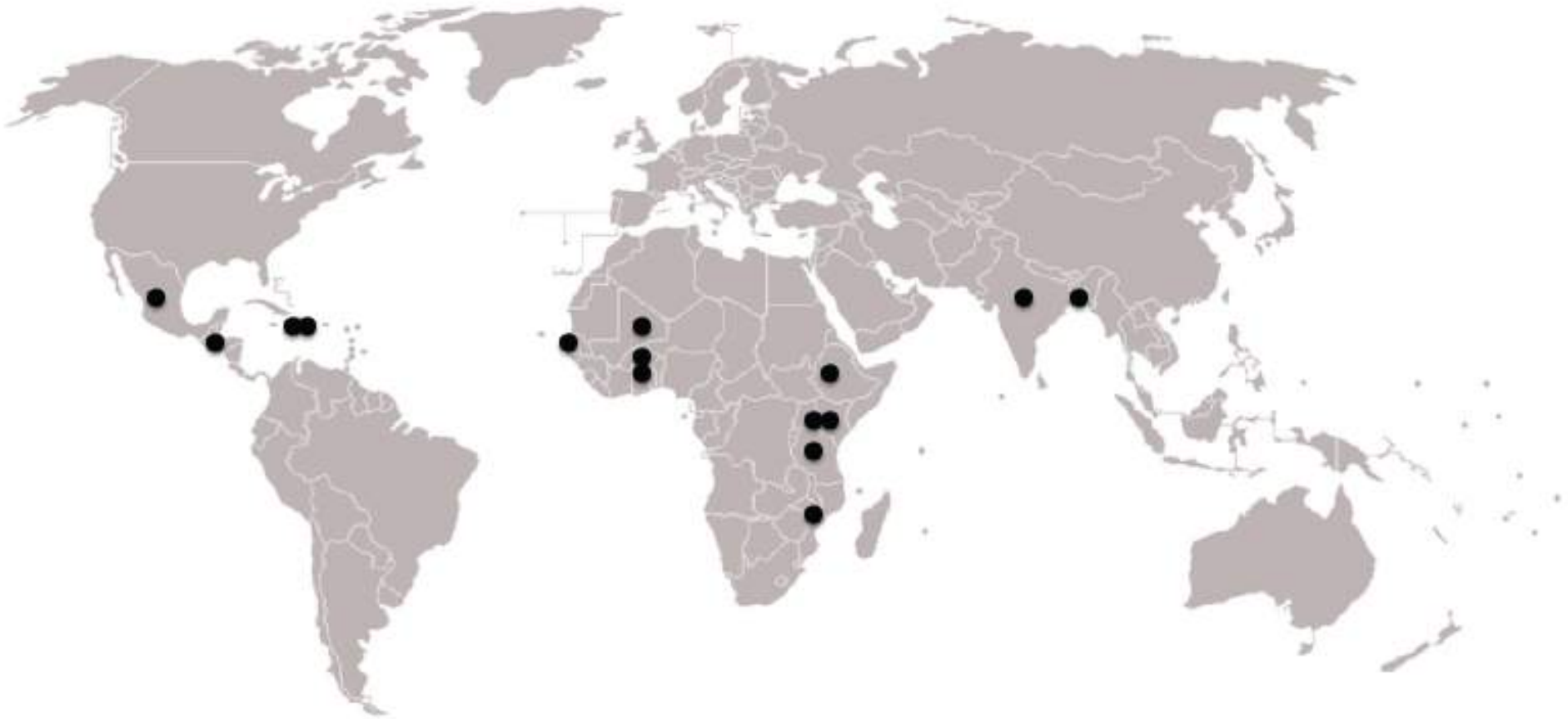
Ad-Hoc Advisory Panel (Fall 2012)

- Jennifer Alix-Garcia, University of Wisconsin Madison
- Sommarat Chantarat, Australian National University
- Rachid Laajaj, Paris School of Economics
- Travis Lybbert, University of California Davis
- Felix Naschold, University of Wyoming
- Laura Schechter, University of Wisconsin Madison
- Pilar Useche, University of Florida
- Renos Vakis, the World Bank

Ad-Hock Advisory Panel (Spring 2013)

- Andy McKay, University of Sussex
- Dean Yang, University of Michigan
- Mushfiq Mobarak, Yale University
- Xavier Gine, the World Bank
- Sommarat Chantarat, Australian National University
- Jonathan Conning, Hunter College
- Catherine Guirkinger, University of Namur

COUNTRIES WHERE BASIS WORKS



List of Countries

Bangladesh, Burkina Faso, Dominican Republic, Ethiopia, Ghana, Guatemala, Haiti, India, Kenya, Mali, Mexico, Mozambique, Senegal, Tanzania, Uganda

LIST OF PROGRAM PARTNERS

BASIS primarily contracts with United States universities, which then work with myriad research and implementation partners in their country of research. These collaborative partnerships play an essential role in BASIS's success.

United States University Partners

- Cornell University
- Duke University
- George Washington University
- Michigan State University
- Ohio State University
- Stanford University
- University of California Berkeley
- University of California Davis
- University of California Los Angeles
- University of California San Diego
- University of Colorado
- Yale University

International Partners by Country

Bangladesh: Bangladesh's Policy Research and Strategy Support Program (PRSSP), Palli Karma Sahayak Foundation (PKSF), Gram Unnayan Karma (GUK)

Burkina Faso: Planet Guarantee, Allianz Bank, SwissRe, Sofitext, Ecobank, Innovations for Poverty Action (IPA), Institut de l'Environnement et de Recherches Agricoles (INERA)

Dominican Republic: USAID, International Research Institute for Climate and Society (Columbia University), Swiss-Re, GuyCarpenter, CaribRM, REDDOM

Ethiopia: International Livestock Research Institute (ILRI), Oromia Insurance Company (OIC), AfricaRe, IFPRI's Ethiopian Strategy Support Program (a collaborative research partnership between IFPRI and the Ethiopian government), the Financial Innovations for Social and Climate Resilience (FISCR) project (conducted by the World Bank Social Development sector)

Ghana: African Center for Economic Transformation (ACET), Ghana Agricultural Insurance Programme (GAIP), University of Ghana (UofG), Innovations for Poverty Action (IPA), the Ministry of Food and Agriculture, International Food Policy Research Institute (IFPRI), Savannah Agricultural Research Institute.

Guatemala: KfW (Germany), International Fund for Agricultural Development (IFAD), Fedecocagua, La Ceiba

Haiti: Faculté d'Agronomie et de Médecine Vétérinaire (FAMV) at Université d'Etat d'Haïti, Oxfam America

India: Agricultural Insurance Company of India (AICI), Center for Microfinance (CMF),

Kenya: Center for Effective Global Action (CEGA), Tegemeo Institute (Egerton University), Western Seed Company, Maseno University, Mumias Sugar Company, Innovations for Poverty Action (Kenya)

Mali: Compagnie Malienne des Textiles (CMDT), PlaNet Guarantee, Allianz Bank, SwissRe

Mexico: Fertilab, Agroquímica, Qué Funciona para el Desarrollo

Mozambique: International Fertilizer Development Center (IFDC), Banco Oportunidade de Moçambique (from Opportunity International)

Senegal: Consortium pour la Recherche Economique et Sociale (CRES)

Tanzania: VisionFund (World Vision)

Uganda: Economic Policy Research Center (EPRC), BRAC

ACRONYMS

AMA: Assets and Market Access

BASIS: Building Access and Strengthening Input Market Systems (historic AMA Innovation Lab organizational name)

BFS: Bureau of Food Security

I4: Index Insurance Innovation Initiative

USAID: United States Agency for International Development

TABLE OF CONTENTS

PROGRAM ACTIVITIES & HIGHLIGHTS

BASIS researchers design, implement, and evaluate a new generation of financial innovations to mitigate uninsured risk and improve financial services for poor agricultural and pastoral households. Over the past year, BASIS AMA activities have generally clustered around two themes: development of financial innovations for risk management (index insurance), and mechanisms to encourage the adoption of improved technologies. A third subset of activities draws from both of the primary categories to study joint financial and technological innovations.

PROGRAM ACTIVITIES

Financial Innovations in Risk Management*:* In low-income agricultural economies, risk can be a driving force to keep small-scale agricultural households poor. Uninsured risk can:

- Cause people to shy away from high-return but potentially risky activities
- Force use of defensive strategies that impede sustained accumulation of productive assets
- Inhibit the development of rural financial markets
- Limit availability of the credit critical to make productive investments.

Further, in the face of disasters, such as droughts, these households often adopt costly coping mechanisms with long-term negative impacts. Stricken households may sell productive assets in order to smooth their consumption, or rely on international food aid. Without these productive assets, these households could fall deeper into poverty. BASIS is still continuing the work of the I4 Index Insurance Innovation Initiative to evaluate a new generation of livelihood optimized index insurance contracts for risk mitigation. These projects are designed to generate knowledge about what works and what doesn't in index insurance.

The following projects are studying financial innovations for risk management:

- *Index-Based Livestock Insurance: Adaptation and Innovations for Ethiopia*
  Chris Barrett, Cornell University
- *Developing a Satellite-Based Index to Predict Crop Yields in Smallholder Agriculture in Tanzania*
  Michael Carter, University of California Davis
- *Promoting Adoption of Improved Production Technologies Among Smallholders in Ghana via Coupled Credit and Index Insurance Contracts*
  Mario Miranda, The Ohio State University
- *Selling Formal Insurance to the Informally Insured (India)*
  Mushfiq Mobarak, Yale University
- *Group Insurance for Coffee Cooperatives in Guatemala*
  Elisabeth Sadoulet, University of California Berkeley
- *Insuring Against the Weather: Integrating Generic Weather Index Products with Group-Based Savings and Loans (Ethiopia and Bangladesh)*
  Carlos Martins-Filho, University of Colorado

***Mechanisms for Adoption of Improved Technologies**:* In much of the developing world, agricultural productivity continues to fall short of potential, in part due to low adoption of input technologies (improved seeds, fertilizer, etc.). Small-scale farmers face many prospective barriers to technology adoption (lack of info, liquidity, risk aversion, etc.), but there is limited evidence on the relative effects of these barriers and the impact of interventions designed to address them.

BASIS Assets and Market Access Research Program supports a variety of research activities designed to:

- Study the relative importance of different constraints
- Test innovative approaches to ease constraints
- Promote improved productivity for sustainable growth.

The following projects are studying mechanisms to encourage the adoption of improved technology:

- *Evaluating the Socio-Economic Impact of Western Seed's Hybrid Maize Program in Kenya*
  Michael Carter, University of California Davis
- *Demand and Supply Constraints to Improved Sorghum Technology Adoption and their Gender-Differentiated Effects in Burkina Faso*
  Andrew Dillon, Michigan State University
- *Household-Level Impacts of System of Rice Intensification (SRI) in Haiti: An SRI Intervention with Training, Insured Credit, and Coordination by Irrigation Bloc*
  Travis Lybbert, University of California Davis
- *A Multiple Interventions Approach to Increasing Technology Adoption with a View Towards Scaling Up: Evidence from Mexico*
  Aprajit Mahajan, University of California Los Angeles
- *Complementarities of Training, Technology, and Credit in Smallholder Agriculture: Impact, Sustainability, and Policy for Scaling Up in Senegal and Uganda*
  Stephen Smith, George Washington University
- *Savings, Subsidies, and Sustainable Food Security in Mozambique*
  Dean Yang, University of Michigan

Synergistic Packages of Financial and Technological Innovations: By simultaneously addressing risk management and barriers to the adoption of improved technologies, a third subset of activities aspire to achieve development impacts above and beyond what can be done by addressing these issues individually. For example, by expanding credit opportunities and subsidies to try new, risky opportunities, a farmer may become interested in testing these new technological interventions, but still be constrained by risk. If the farmer takes out a loan to try new innovations, and that happens to be a drought year, the farmer is left not only with the impact of drought, but also with the outstanding loan payments, which further compounds the risk. An intervention that offers interlinked credit and insurance might offer the farmer a loan, for example. Then, in the event of a drought, insurance payouts would cover the loan payments, so that the farmer would not be doubly impacted by the drought.

BASIS AMA activities are evaluating myriad activities that are combining approaches to simultaneously address issues around technology adoption and risk management to maximize development impact.

The following projects are studying joint financial and technological innovations:

- *Impact Evaluation of Index Insurance for Small Farmers in the Dominican Republic*
  Michael Carter, University of California Davis
- *Using Index Insurance to Enable to Adoption of More Profitable Agricultural Investments in West Africa (Mali and Burkina Faso)*
  Michael Carter, University of California Davis and Marc Bellemare, Duke University
- *Tailoring Contract Farming to Smallholders in Kenya: Experimental Evidence on Enrollment Impact, Insurance Provision, and Communication Technologies*
  Lorenzo Casaburi, Stanford University
- *Interlinking Weather Index Insurance with Credit to Alleviate Market Failures and Improve Agricultural Productivity in Rural Ethiopia*
  Craig McIntosh, University of California San Diego
- *Disseminating Innovative Resources and Technologies to Smallholders in Northern Region, Ghana*
  Chris Udry, Yale University

PROGRAM HIGHLIGHTS

Several projects from our I4 Index Insurance Innovation Initiative have already uncovered key lessons and released compelling preliminary results. Researchers from IFPRI and the University of Colorado, working in Ethiopia, have made significant progress in transferring insurance sales implementation activities to local partners, who believe they can take the insurance product to scale. As a result of an insurance pilot in Mali, insured households increased the area of cotton (a higher risk, higher profit crop) by 19%, as well as increasing use of productive inputs. This indicates the potential of insurance to encourage investment in agricultural technologies and in high risk but high return activities.

BASIS researchers also identified recommendations, sourced by experiences and lessons learned though studies of financial innovations for risk management, for a dynamic public-private reinsurance partnership model that would advance the promised impact of agricultural insurance and reduce contract failure rates.

This past year also saw the renewed BASIS AMA Innovation Lab begin selection of its new tranche of projects. Projects selected include exciting new activities with significant promise to inform the policy agenda for development impact. In addition, over the next year BASIS will complete assembly of its full research portfolio, ensuring overall portfolio coherence and maximizing the ability of results to inform the policy debates around risk management, resilience, and inclusive agricultural growth. The coming year will also see work begin in earnest for all new activities, including finalization of survey designs, finalization of interventions being tested, and collection of baseline data.

KEY ACCOMPLISHMENTS

Since the BASIS AMA Innovation Lab renewal in 2012, BASIS has had many accomplishments. In particular, the I4 Index Insurance Innovation Initiative is now seeing many projects complete or on the verge of completion. As such, many projects are adequately developed to have some initial results and draw

preliminary conclusions and make policy recommendations based on results analyses.

Insurance with Impact

Many promising I4 projects are beginning to have observable impacts for smallholder farmers. As a result of an insurance pilot in Mali, insured households on average increased the area of cotton (a higher risk, higher profit crop) by 19 percent, increased urea use by 15 percent, and increased seed use by 28 percent. This indicates the potential of insurance to encourage investment in agricultural technologies and in high risk, but high return activities.

Index-Based Livestock Insurance (IBLI) in Kenya had its first insurance payout in October 2011. A survey conducted at that time asked households to predict how insurance payments would change coping strategies. Compared to uninsured households, insured households were significantly less likely to employ costly coping strategies. Households with large asset bases – those most likely to sell assets to cope with shocks – are 64 percent less likely to do so when insured. Households with fewer assets – those most likely to reduce food consumption as a coping strategy – were 43 percent less likely to do so with insurance. These results suggest that insurance can have a large impact on both the productivity of the current generation and the human capital of the next.

Temporary Subsidies Accelerate Learning and Have Permanent Effects on Smallholder Technology Adoption and Income

Exciting results have also emerged from a project studying the efficacy of "learning subsidies" for smallholder farmers in Mozambique. Preliminary research results are indicating that the impacts of subsidies on adoption of improved agricultural technologies "stick", and continue to positively impact farmers after the subsidy has ended.

Evidence of Demand for Index Insurance

A related pilot in Burkina Faso had its first sales period this past year. In the cooperatives where the insurance product was advertised, 18.4 percent bought the insurance; this covered 466 farmers, 2,331 hectares, insured a total value of 233,100,100 CFA and collected

26,107,200 in premiums. A project in Ethiopia, led by researchers at the University of California San Diego, has shown that vouchers – even relatively small vouchers – can boost demand for index insurance from next to nothing to forty percent or higher. In Tanzania, despite initial design failures, BASIS researchers have nearly completed the design of a satellite-based yield prediction model that can be used to effectively design index insurance contracts.

Overall, in the most recent fiscal year, I4 research projects sold a total of nearly 9,000 insurance contracts to smallholder farmers and pastoralists, testing six different insurance technologies, including several that are ready for transfer. The next year will mark the completion of many of these index insurance pilot activities, so BASIS will focus on dissemination of the lessons learned and results from these activities, as well as outreach and dissemination of key lessons and results from these studies.

BASIS/I4 Project Awarded Grand Prize in First Pioneers Prize for Excellence in Science & Technology by USAID

A BASIS/I4 project was a grand prize winner of the first ever Pioneers Prize for excellence in Science and Technology by USAID. The project, which is developing Index-Based Livestock Insurance (IBLI) for pastoralists in Southern Ethiopia, builds off of prior research in Kenya. With partners that include the Bureau for Economic Growth, Education and Environment, the Global Climate Change Office, the Bureau of Food Security, Office of Markets, Partnerships and Innovations, the IBLI team, led by BASIS/I4 researchers, will work together to expand the reach of index insurance in the region.

Research Program Overview

The University of California Davis Management Entity manages the BASIS AMA Innovation Lab according to the following principles:

1. *Open competition* to select the highest quality research projects to create a portfolio that implements the vision of the BASIS AMA Innovation Lab;
2. *Engage USAID Missions* with dedicated outreach to identify innovative pilot activities that complement their strategic goals and programming under Feed the Future;
3. *Project Monitoring* to ensure sound technical progress, achievement of impact, and contribution to program and agency goals;
4. *Commitment to Innovative, High Quality Research* that generates policy relevant results, with lessons drawn out for maximum utility by policymakers and programmers; and,
5. *World-Class Leadership* by an established faculty member with the global reputation, knowledge, and commitment needed to mobilize and mold the highest quality research program.

Management Structure

Management Entity

The BASIS AMA Management Entity currently includes of 5 individuals. The office includes 2.9 FTEs, including a 50% Director, full-time Assistant Director, 40% Financial Analyst, and a full-time post-doctoral fellow. The office also contracts the services of an off-site editor for the production of some materials for outreach and dissemination activities.

The Director will take primary responsibility for the composition of the research portfolio, oversight and review of technical plans and outputs. He has the final say in all budgeting decisions, including modifications, special requests, etc. He serves as the direct supervisor of the Assistant Director, the Financial Analyst, and Post-Doctoral Fellow, as well as the off-site editor.

The Director takes primary responsibility for the technical oversight of the projects. He closely reviews all proposals and work plans of the selected projects for technical soundness, and continually reviews the projects through both Technical Committee meetings and direct communication with researchers throughout the life of the project. The Assistant Director is responsible for the day-to-day operations of the AMA CRSP. She is responsible for budget monitoring and providing the Director with necessary information to make funding decisions. She ensures that all projects meet reporting requirements, and are making progress toward specific benchmarks that were approved at the beginning of the project. This is done to make sure that each project continues to make progress towards demonstrable impact.

The Financial Analyst provides contracts and grants administration, including taking the lead on managing outgoing subcontracts, modifying existing subcontracts, and working with University of California Davis offices on their oversight. She is also responsible for invoice approval and tracking of subcontract spending. The Post-Doctoral fellow works in collaboration with the Director and USAID staff to engage in outreach to USAID missions in response to demands for technical analysis of possible index insurance solutions and project design.

Board of Directors

The BASIS AMA Innovation Lab also has a standing Board of Directors, which consists of four members recognized for their expertise in the areas relevant to the work of BASIS, including international development, economics, sociology, and other development-related social science disciplines. The Board includes Craig McIntosh (University of California San Diego), Jolyne Sanjak (Millennium Challenge Corporation), and Mary Mathenge (Tegemeo Research Institute, Egerton University). The Board also includes the AMA CRSP's AOR, Lena Heron to ensure that the direction of the AMA CRSP remains compatible with the goals of USAID and Feed the Future.

Since the funding start of the BASIS AMA Innovation Lab, the Board has met twice via telephone conference (to accommodate geographic diversity of board members) and has also had important email correspondence to review, advise and consent on management matters. The two telephone meetings were to select research projects for the BASIS AMA project portfolio. With the advice of an ad hoc proposal evaluation panel, the board selected a portfolio of research projects that allow for topical and regional balance. The board also focused on identifying proposals that had clear policy relevance and had the potential to identify recommendations that can increase development impact in the areas of focus.

Technical Committee

The Technical Committee is comprised of the U.S. and host country PI for all BASIS AMA activities. This committee is responsible for peer review of all projects, including annual review of work plans. The committee meets approximately once each year to present most recent findings, discuss methodologies, and get feedback and suggestions on the next phases of their research. These committee meetings are an excellent opportunity for researchers to communicate with each other, to identify potential synergies between their projects and get constructive input into their work.

Ad Hoc Proposal Evaluation Panel

Whenever research proposals are solicited, BASIS forms an outside panel of reviewers. In order to insure the integrity of the review process, reviewers will remain anonymous to the proposal authors. Members of the panel will be given guidelines for the reviews, and will be assigned proposal that are relevant to their area of expertise. At least two members of the panel read and review each proposal, and the Director and Assistant Director read all proposals. Once the reviews have been completed, the information is passed on to the Board who, with BASIS management staff, make final decisions.

BASIS would like to thank our participating ad-hoc panelists for the two rounds of proposal reviews conducted during this reporting period.

Ad-Hoc Panel (Fall 2012)

- Jennifer Alix-Garcia, University of Wisconsin Madison
- Sommarat Chantarat, Australian National University
- Rachid Laajaj, Paris School of Economics
- Travis Lybbert, University of California Davis
- Felix Naschold, University of Wyoming
- Laura Schechter, University of Wisconsin Madison
- Pilar Useche, University of Florida
- Renos Vakis, the World Bank

Ad-Hock Panel (Spring 2013)

- Andy McKay, University of Sussex
- Dean Yang, University of Michigan
- Mushfiq Mobarak, Yale University
- Xavier Gine, the World Bank
- Sommarat Chantarat, Australian National University
- Jonathan Conning, Hunter College
- Catherine Guirkinger, University of Namur

RESEARCH PROGRAM REPORTS

In the course of accomplishing its mission, the BASIS AMA Innovation Lab has assembled a portfolio of projects generally organized around three major themes. Together, these projects will assemble a critical assembling of evidence around mechanisms for risk management and the adoption of more productive technologies and packages to promote growth.

While several of these projects are well developed and nearing the end of their project period, many more are only just get started this year. We look forward, in the next year, to disseminating the results of those projects that have begun to gather preliminary evidence, and to initiating a host of new activities.

The BASIS project portfolio has largely fallen into three different themes, and is organized in that way in this report.

- *Financial Innovations in Risk Management*
- *Mechanisms for Adoption of Improved Technologies*
- *Synergistic Packages of Financial and Technological Innovations*

RESEARCH THEME A: FINANCIAL INNOVATIONS IN RISK MANAGEMENT

In low-income agricultural economies, risk can be a driving force to keep small-scale agricultural households poor. Uninsured risk can prompt protective self-insurance strategies that eschew remunerative, but risky, opportunities. In the face of disasters such as drought, these households often adopt costly coping mechanisms with long-term negative impacts. Stricken households may sell productive assets in order to smooth their consumption, or rely on international food aid. Without those productive assets, these households may fall deeper into poverty. Also, after a disaster households may reduce meals, which could compromise the next generation through long term negative health impacts including underdevelopment for children under five.

Researchers at BASIS have designed, implemented, and are now evaluating a new generation of livelihood optimized index insurance contracts. Potential impacts may include improved technology uptake by farmers, increased farmer incomes, attraction of more lenders into rural markets, reversal of the dynamics that create destitute families, and reduction of the massive costs of direct aid programs. BASIS AMA Research Program assembles leading researchers from around the country with research projects around the world to generate knowledge about what works and what doesn't in index insurance.

Projects Under Theme A

- *Index-Based Livestock Insurance: Adaptation and Innovations for Ethiopia*
  Chris Barrett, Cornell University
- *Developing a Satellite-Based Index to Predict Crop Yields in Smallholder Agriculture in Tanzania*
  Michael Carter, University of California Davis
- *Promoting Adoption of Improved Production Technologies Among Smallholders in Ghana via Coupled Credit and Index Insurance Contracts*
  Mario Miranda, The Ohio State University
- *Selling Formal Insurance to the Informally Insured (India)*
  Mushfiq Mobarak, Yale University
- *Group Insurance for Coffee Cooperatives in Guatemala*
  Elisabeth Sadoulet, University of California Berkeley
- *Insuring Against the Weather: Integrating Generic Weather Index Products with Group-Based Savings and Loans (Ethiopia and Bangladesh)*
  Carlos Martins-Filho, University of Colorado

Map of Projects: Financial Innovations in Risk Management

INDEX-BASED LIVESTOCK INSURANCE: ADAPTATION AND INNOVATIONS FOR ETHIOPIA

PRINCIPAL INVESTIGATORS

Christopher B. Barrett
Cornell University
Rejeev Gupta
BASIX, India
Andrew G. Mude
International Livestock Research Institute, Kenya

This project builds on lessons learned from a highly innovative pilot venture underway in Northern Kenya, adapting it to the Ethiopian context. The project will design and introduce new group-based and/or credit-linked Index Based Livestock Insurance (IBLI) products, aimed to crowd-in productive investment opportunities. Furthermore, the project explicitly incorporates Intergovernmental Panel on Climate Change (IPCC) predictions of climate change and associated rangeland biomass dynamics to investigate linkages between conditional insurance transfer programs and climate change adaptive behavior. Because of the similarity of the IBLI product with the existing Kenya pilot, this project will allow for cross-border learning and comparative assessment of IBLI performance in varying institutional and economic contexts, laying the foundation for dissemination to other regions.

COLLABORATIONS

- *Australian National University (Canberra, Australia):* Dr. Sommarat Chantarat
- *BASIX (Jaipur, India):* Mr. Satheesh Arjilli
- *Cornell University (Ithaca, New York, USA):* Ms. Elizabeth Bageant, Mr. Chuan Liao, Prof. Steve DeGloria, Dr. Brian Dillon, Mr. Teevrat Garg, Mr. Matt Hurst, Mr. Nathan Jensen, Prof. Natalie Mahowald, Ms. Cynthia Mathys, Ms. Sarah Pedersen, Mr. Andrew Pike, Mr. Marc Rockmore, Ms. Asha Sharma, Ms. Megan Sheahan, Ms. Joanna Upton, Prof. Joshua Woodard, Ms. Jenni Zambriski
- *Institute of Developing Economies (Japan):* Dr. Kazushi Takahashi
- *International Livestock Research Institute (Nairobi, Kenya):* Mr. Eddy Chebelyon, Dr. Munenobu Ikegami, Mr. Diba Galgallo, Mr. Wako Gobu, Mrs. Racheal Mwaura, Mr. Samuel

Mburu, Mr. Oscar Naibei, Dr. Apurba Shee, Mr. Mohamed Shibia, Mr. Birhanu Taddesse (Addis Ababa), and Mrs. Brenda Wandera Gache
- *University of Sydney (Australia):* Dr. Russell Toth
- *USDA-Agricultural Research Service (Boise, Idaho, USA)*: Dr. Pat Clark
- We have partnered with Oromia Insurance Company (OIC) for the commercial sales of the IBLI product in Borana.

OUTPUTS

I4 Update, "Index Based Livestock Insurance for Pastoralists in Ethiopia," February 2013 (http://www.basis.ucdavis.edu/i4/publications/files/I4%20Update%20-%20IBLI%20Ethiopia.pdf)

Journal articles
- Christopher B. Barrett and Michael R. Carter, "The economics of poverty traps and persistent poverty: Policy and empirical implications," *Journal of Development Studies*, volume 49, number 7 (July 2013), 976–990.

Working papers
- Christopher B. Barrett and Paulo Santos, "The Impact of Changing Rainfall Variability on Resource-Dependent Wealth Dynamics," June 2013.
- M. Ikegami, C. B. Barrett, and S. Chantarat (2011) "Dynamic Effects of Index Based Livestock Insurance on Household Intertemporal Behavior and Welfare" Working Paper, presented at Africa Growth Forum "Enhancing Agricultural Productivity for Shared Growth in Africa" at Brookings Institute, USA on January 19-20, 2011
- Hurst, Matthew, Nathan Jensen, Sarah H. Pedersen, Asha Sharma, Jennifer A. Zambriski (2011). "Climate Change Adaptation Strategies of Boran Pastoralists in Southern Ethiopia," CCAFS working paper.

Presentations
- "Can earth system models be used for impact studies?" presented by Natalie Mahowald and Fiona Lo (Cornell), Laura S. Harrison and Chris C. Funk *(*USGS EROS/UCSB Geography)
- "Financial Innovation for Famine Prevention," presented by Chris Barrett at Cornell University Trustee Council Annual Meetings in Ithaca, NY, Oct. 27, 2012.
- "Index-Based Livestock Insurance: Protecting Pastoralists Against Drought-Related Livestock Mortality," presented by Andrew Mude at the World Food Prize, Feed the Future Innovating for Impact Session, in Des Moines, Iowa Oct 18, 2012.
- "Index-Based Livestock Insurance in Northern Kenya: An Analysis of the Patterns and Determinants of Purchase," presented by Andrew G. Mude and Christopher B. Barrett at the 10th International Conference on the Ethiopian Economy, Ethiopian Economics Association, in Addis Ababa, Ethiopia, July 19, 2012.
- "Index-based Insurance: Financial Innovations for Development and Conservation," presented by Christopher B. Barrett in a seminar at Monash University, May 20, 2012.
- "Climate Change, Climate Variability And Poverty Traps: The Role (and Limits) of Index Insurance for East African Pastoralists," presentation by Christopher B. Barrett to the Brown International Advanced Research Institute on Climate Change and Its Impacts, Providence, RI, June 13, 2011.

- "Training and Education of Purchasers: Insights and Challenges from IBLI in East Africa," presentation by Andrew Mude and Chris Barrett to the I4 Technical Meeting, Washington, DC, 13-14 May 2011.
- "Index Insurance to Enhance Productivity and Incomes for Small-scale Agricultural and Pastoral Households in Kenya & Mali," presentation by Michael Carter, Andrew Mude and Chris Barrett to the USAID Agricultural Sector Council Seminar Series, Washington, D.C., 11 May, 2011, also web screencast on Agrilinks of KDID.
- "IBLI in Borana: Protecting pastoralists against mortality losses due to severe forage scarcity," presentation by Andrew Mude at The Future of Pastoralism in Africa conference, Addis Ababa, March 2011.
- "Index-based Insurance: Financial Innovations for Development and Conservation," presentation by Christopher B. Barrett to Cornell International Institute for Food, Agriculture and Development, March 16, 2011.
- M. Ikegami, C. B. Barrett, and S. Chantarat (2011) "Dynamic Effects of Index Based Livestock Insurance on Household Intertemporal Behavior and Welfare" presented by Nobu Ikegami at Africa Growth Forum "Enhancing Agricultural Productivity for Shared Growth in Africa" at Brookings Institute, USA, January 19-20, 2011.
- "On Climate Variability And Resource-Dependent Wealth Dynamics: The Case of Ethiopian Pastoralists" presented by Christopher B. Barrett at Africa Growth Forum "Enhancing Agricultural Productivity for Shared Growth in Africa" at Brookings Institute, USA on January 19-20, 2011.
- "Design and Development of IBLI for Southern Ethiopia," presentation by Andrew Mude at the I4 partners workshop, Addis Ababa, December 2010.
- "Issues to Consider in the Design of Index Insurance Products," presentation by Andrew Mude at the I4 partners workshop, Addis Ababa, December 2010.
- "Index-based Insurance: Financial Innovations for Development and Conservation," presentation by Chris Barrett at the Johnson Graduate School of Management Executive MBA Program, Cornell University, Ithaca, NY, July 2010.
- "Adapting Index-based Livestock Insurance (IBLI) for Ethiopia: Logic and Design?" presentation by Chris Barrett at I4 exploratory workshop at the International Livestock Research Institute, Addis Ababa, Ethiopia, July 12, 2010.

CAPACITY BUILDING

Student and Post-Doc Training

Several Cornell graduate students have been trained in data entry and cleaning, working in the field with focus groups and in the herd collaring exercise, as well as codebook construction (Liz Bageant, Joanna Upton, Marc Rockmore, Ellen McCullough, Chuan Liao, Nathan Jensen). Nathan Jensen also helped field the March 2013 household survey. A Cornell undergraduate (Andrew Pike) has worked with IBLI and its commercial partners on production of clear financial education and marketing materials. A Kenyan student (Diba Galgallo) has been getting training in field survey methods and project management.

A group of NSF-supported students in the Cornell-run Food Systems and Poverty Reduction IGERT program (Matt Hurst, Nathan Jensen, Sarah Pedersen, Asha Sharma and Jenni Zambriski) undertook a three-week field research project in Borana to inventory and assess existing climate risk management strategies among the Boran. Post-docs Brian Dillon and Kazushi Takahashi, grad student Teevrat Garg, and assistant professor at the University of Sydney Russell Toth have been

supporting the project with survey design and implementation on handheld computers, as well as data cleaning and documentation.

Partner Training and Capacity Building
Following an exposure visit that CIFA Ethiopia and Trocaire organized for community representatives from Borana to visit Marsabit, a reflection workshop was held in Yabello. The workshop presented an update on IBLI roll out progress, looked into the potential for expansion and the challenges from all organizations involved. The workshop also identified the clear roles of NGOs in the smooth expansion of livestock insurance in Borana.

ILRI held a workshop in Yabello from July 16-20, 2013 to train Development Agents (DA's), Cooperative managers and bookkeepers, and Kebele (Village) managers. They were trained on the product; how it works, the benefits as well as how to approach the community. A total of 38 DA's, 102 Cooperative managers and bookkeepers and 130 Kebele managers were present.

ACTIVITIES & ACHIEVEMENTS

After spending close to two years developing the IBLI Borana agenda, the Cornell-ILRI team designed a suitable NDVI-based contract to help pastoralists manage the risks of severe forage shortage, including widespread livestock loss. In preparation for this contract launch, the IBLI team engaged stakeholders at both national and local levels and undertook household- and community-level survey work. The product launched successfully in July 2012.

Our partner, Oromia Insurance Company (OIC), seems very committed to making this product work. They had realistic aspirations for the first year marketing campaign, hoping to sell 1,000 policies, learn from the experience, and then expand it within the Borana zone. Within two years, OIC hopes to scale IBLI out elsewhere in Ethiopia, since it has a nationwide license and mandate. OIC and ILRI have developed a thorough training program. The development agents serve as promotional agents, working closely with the IBLI Ethiopia team.

Following the launch, ILRI and OIC jointly trained Development Agents (DA) chosen for

extension activities from over 70 kebeles in 8 IBLI target woredas. Two groups were trained for three full days each, from July 23-28, 2012, in Yabelo. At the end of both training sessions DAs reflected on the training and developed plans for reaching the target communities. Those end-of-training reflections gave us considerable hope that many contracts would be sold.

The first IBLI-Ethiopia sales window was to span August and September 2012. Unfortunately, OIC was delayed in dispatching its sales team. OIC's coordination with local partner OCSSCo was also not effective and many DAs either did not return to their duty stations, or did not actually undertake extension training. Furthermore, livestock and rangeland conditions were good in September 2012, which may have discouraged clients from buying insurance. In the end, sales were low, with just 270 policies sold, covering 530 tropical livestock units (TLU).

Consequently, quite a few adjustments were made. OIC worked more closely with OCSSCo to get the local extension training redone and with the IBLI team to get added assistance with financial education. The result was a 29% increase in sales (349 policies). The average premium payment was US$37 to insure 1.3 TLU with an insured value of US$399. There was also significant variation between the two rounds in the geography of sales, which helps explain why we observe a decrease in TLU insured per policy.

In preparation for the August-September 2013 round, the strategy focused on the two key challenges from the previous sales rounds. Access to sales outlets continues to be one of the greatest challenges as OCSSCo only has three satellite offices. Given the vast coverage area, this makes it very difficult and expensive to conduct vigorous sales campaigns and appears to dampen their commitment. As such, they have now agreed to identify other avenues for agency. For August-September, in collaboration with other NGO's working in the area led by Trocaire and supported by CIFA, we worked to identify cooperatives and savings and credit groups that fit the necessary prerequisites. A number were identified and tried to act as extension channels with a few given the rights of agency.

A second, related issue has to do with improving the marketing and extension. The DAs have not proved satisfactory and neither ILRI nor OIC have the comparative advantage for training, monitoring and motivating the extension system. As such we worked to identify and develop a formal relationship with organizations to fulfil this need. In January 2013, a team from the Trocaire-led consortium visited IBLI sites in Marsabit. The group were positive and upon return led a workshop in Yabelo in mid-April, in which ILRI and OIC participated, and it was resolved that they would marshal funds to support IBLI extension and marketing by working through their related programs in the area. Trocaire then led the development of a proposal which came too late to support the August-September 2013 sales. We expect the partnership to support the January-February 2014 IBLI sales window.

We completed a baseline household survey of 525 households in Borana in March 2012 using a new handheld electronic data collection platform. Those households were revisited in March 2013. A codebook explaining the data collection protocol, survey instrument, and variables has now been compiled and data analysis has begun. Our first priorities are analyzing demand patterns and, especially, understanding the gender dimensions of IBLI demand. Focus groups were conducted in August 2013 to help frame the statistical analysis.

We also completed our second year of 5-minute interval GPS data collection on 60 collared cattle in Borana. The collars were initially mounted in August 2011, along with companion semi-annual surveys of those animals' herders. In both 2012 and 2013, we

executed two collared herd surveys, in late February and in late August, bringing the total panel observations in the semi-annual herder survey to five. The collars have all been checked, refitted, and batteries replaced. A Cornell graduate student has been working on compiling an extensive complementary dataset of waterpoints across the Borana plateau, a key input to analyzing movement activity.

Combining herd collaring with detailed socio-economic data collection is an activity not previously attempted among pastoralists' livestock herds. Thus we have had to overcome a number of technical obstacles. In early rounds, we had problems with SD cards not recording, antennas, and battery corrosion. Fifty four of 60 collars remained operable, allowing a minimum of two collars to be replaced in each of the 20 sample households. In the most recent, August 2013, collar maintenance round we found most batteries had failed well before anticipated. We now expect semi-annual battery replacements. We nonetheless are gathering valuable data and analysis of the linked GPS.

Because we found it difficult to establish a strong statistical link between remotely sensed vegetation measures (e.g., NDVI) and livestock mortality rates, unlike in northern Kenya, we began exploring the hypothesis that greater prevalence of non-palatable (or even toxic) plant biomass might be the reason. A Cornell graduate student, in collaboration with ILRI and USDA-ARS, is undertaking a plant inventory. He is recording their palatability forlivestock, and linking those to time series imagery data of the Borana plateau to establish patterns of woody plant encroachment and lay the foundation for identifying the spectral signatures of palatable and non-palatable species. We will use this data to construct an improved IBLI index.

FINDINGS & LESSONS LEARNED

For the January/February and August/September 2013 sales periods, ILRI played a bigger role in supporting the commercial partners to make marketing and extension more effective. The training of trainers included more interactive curriculum and extension workers had to go through a more stringent selection process. A local chief, Abagadas, and opinion leaders from different locations were also brought to Yabello and trained on the product. They were to endorse the product and post product information in their offices. The sales platform also improved.

We continued supporting extension/financial education efforts, extending partnerships with NGOs and government agencies. We are working to help integrate extension and commercial providers' responsibilities in marketing and branding to design processes and develop partnerships to appropriately catalyze informed demand. In this regard, ILRI entered into partnerships with Trocaire and SIFA in Ethiopia.

The IBLI team wrote an operations manual that codified processes required for successful implementation. This manual will be reviewed by insurance practitioners, academics, and other NGO partners that would use the manual. The manual will make the process of scaling up faster and more efficient as interested organizations can use it to implement the product in other areas without having to wait for ILRI leadership.

Extension targeted groups. Focus group discussions with the communities showed that the group members had a better understanding of the product. The purchases within the groups were also significant. We

are working with Trocaire to try and use some of the primary cooperatives they are supporting.

We have continued to build a large-scale, detailed household panel survey database from the 528 households in Ethiopia (baseline in February-March 2012 and first repeat survey in February-March 2013). This is an important data source in systems of rapidly growing interest in the donor community. In the survey, 27% bought IBLI in the August-September 2012 sales period, 20% bought IBLI in the January-February 2013 period, with 5% purchasing in both periods, for a total of coverage rate of 42%. While the true population uptake rate is unknown, it is surely much smaller as a disproportionately large share of IBLI sales appear to have occurred within our sample. This likely reflects the demand inducement effects of both (i) the randomized discount coupons, and (ii) the financial education campaigns. We also suspect that the commercial sales activity has been heavily concentrated around the few locations where OCSSCo operates or those places where the IBLI team could assist with logistics. IBLI product awareness is a prerequisite to purchase and with the challenges of extension and marketing, the mere fact that a large fraction of our sample is made aware of IBLI and, through discount coupons, encouraged to buy almost surely reconciles the high uptake rates observed in sample with the relatively modest sales in the broader population.

While we had expected more aggressive sales, the fact that over 200 contracts were sold is indicative of concrete interest that we need to help the insurance company serve better in the future. An important recognition is that despite their interest and stated commitment, OIC is beset with considerable capacity constraints. For the program to succeed, or to at least be able to effectively assess its potential and impact, we will need to provide a heightened level of support and the push for rapid achievement of commercial sustainability needs to be reconsidered

DEVELOPING A SATELLITE BASED INDEX TO PREDICT CROP YIELDS IN SMALLHOLDER AGRICULTURE

PRINCIPAL INVESTIGATORS

Michael Carter
University of California, Davis

We are developing an innovative satellite based index that can reliably predict local crop yields. This work is the centerpiece of a larger project to design an index insurance contract that can successfully protect smallholder farmers against shocks such as droughts and floods. While several rainfall based insurance products are currently on the market, such contracts suffer from a lack of historical data, poor coverage for farmers and high scaling costs. Rather than relying on data from weather stations, our product utilizes satellite-based indicators of local yields, such as an index of vegetation density and plant transpiration, which have been shown to correlate well with observed biomass and crop yields.

The main advantage of using satellite data is the availability of risk density data over space and time at a very low cost. Thus the insurance risk can be priced very accurately, often a key requirement by reinsurance companies. The second benefit of using satellite data is the ability to better predict local yields resulting in lower basis risk for farmers. These data can be disaggregated to the size of a pixel (250x250m), which is equivalent to having a weather station for every 6 hectares, or more than 3,000 weather stations in a 20km by 10km area. Also, as opposed to rainfall, which is only indirectly related to yields, the satellite-based indicators are directly related to crop outcomes. Finally, a satellite-based contract is more easily scalable due to the high availability of data. If we are able to establish a strong correlation between our satellite based index and crop yields, we will be poised to design a crop index insurance contract that will provide far better protection for farmers than existing weather based contracts.

COLLABORATIONS

- Jon Einar Flatnes, PhD candidate at University of California Davis
- World Vision Tanzania's Market Led Agricultural Program

- VisionFund Tanzania provided administrative assistance for the retrospective yield surveys in Tanzania, including the hiring and processing of payments to enumerators and supervisors, and the coordination or transportation.
- John L. Kelly and Ryan A. Mercovich, SI Organization

OUTPUTS

Datasets

1. Retrospective yield survey dataset for Mtinko
    a. Sub-dataset 1: plot-level data, 392 observations, 18 variables
    b. Sub-dataset 2: plot/year-level data, 15,000 observations, 10 variables
2. Retrospective yield survey dataset for Magugu
    a. Sub-dataset 1: plot-level data, 383 observations, 18 variables
    b. Sub-dataset 2: plot/year-level data, 15,000 observations, 10 variables

Literature review

SI Organization, Inc., *Developing a Satellite based Index to Predict Crop Yields in Three Pilot Areas in Rural Tanzania: Literature Review*, submitted to BASIS I4 on 6/17/2013.

CAPACITY BUILDING

We conducted simple training for enumerators and supervisors prior to the implementation of the retrospective yield surveys in Tanzania. We also trained enumerators about effective interviewing techniques and the specific questionnaire designed for this project

ACTIVITIES & ACHIEVEMENTS

The primary innovation of this project will be to develop an index that reliably predicts crop yields at the local level. While previous work has attempted to do this using weather data, we plan to use a series of satellite-based indicators that have been shown to correlate well with observed biomass growth and yields. The process of developing a satellite based yield model will be divided into three phases: 1) creation of the index; 2) collection of actual yield data; and 3) estimation of the yield model.

Creation of the index

This work involves constructing a series of viable indices based on available satellite data for our three pilot areas. The majority of this work has been performed by the SI Organization, per the established contract between them and UC Davis. The SI Organization has undertaken the following activities:

- Procured and organized the relevant public domain satellite data (high resolution, high frequency data) required for the model. These consist of both raw and processed MODIS data and include existing vegetation indices such as Normalized Difference Vegetation Index (NDVI), EVI and ET.
- Created a series of models based on best practices and well-established methods. These models have been created specific to rice paddies in the

Makindube area, but could be adapted to sunflower in the Mtinko area and paddy in the Magugu area.
- Created a MatLab database and query for easy access to the finalized data.
- Produced a series of graphics showing how satellite based indices evolve over time in different areas. These graphs have helped us understand the relationship between the satellite data and severe weather conditions.

Despite having successfully completed the above activities, the SI Organization faced multiple challenges:
- The crop identification model and the season identification model proved to be more difficult to implement than anticipated. While the SI successfully completed these models, these led to some delays.
- The creation of the final database and the Matlab query also took longer than expected.

Collection of retrospective yield data
In order to obtain the detailed multi-year crop yield data to estimate our yield model, we had planned to collect our own historic yield data (based on recall) and corresponding map location of fields from farmers in several locations in Tanzania. We had already collected such yield data for rice in Makindube prior to this reporting year, and we conducted similar surveys in two new pilot areas in July 2013, for sunflower in Mtinko and for rice in Magugu. To collect this data we:
- Created a random sample of 400 sunflower farmers in Mtinko by obtaining village lists of all sunflower farmers for ten selected villages (out of 17).
- Created a random sample of 400 rice farmers in Magugu by obtaining village lists of all rice farmers for eight selected villages (out of 21).
- Conducted farmer interviews about their historic sunflower (Mtinko) or rice (Magugu) yields, going back as far as they could remember, but no earlier than 1997. The enumerators also collected information on location, acreage, and irrigation, and additional plot-year information such as fertilizer use and prevalence and severity of droughts or floods.
- Traced the boundaries of areas that contain only sunflower (Mtinko) or rice (Magugu) using a GPS device to ground truth the crop identification model which helps us separate our target crops from other crops or vegetation.
- Entered and cleaned the data into an electronic database using a data entry program created specifically for this survey.

Estimation of the yield model
Since the satellite database and the MatLab query functions had not been completed, we have not been able to perform any detailed analysis of the combined satellite and yield data. However, we have done some preliminary comparisons using the existing Makindube yield data and NDVI data available online.

FINDINGS & INTENDED IMPACTS

We only have summary statistics of the data collected in Mtinko ADP and Magugu ADP, and some very preliminary analysis of the relationship between the yield data and the satellite data. In Mtinko, average plot size is 3.01 acres and 96% of farmers own their own plots. Average sunflower yield across all farmers and all years is 209kg/acre. Artificial fertilizer was used in 2.8% of all farmer-years. In Magugu, average plot size is 2.35 acres and 80% of farmers own their own plots. Average paddy yield across all farmers and all years is 1,170kg/acre. Artificial fertilizer was used in 23% of all farmer-years and 49% of all farmers use irrigation. Using satellite data found online and yield data from the Makindube retrospective yield survey, both aggregated for three zones in Makindube, we find a significant relationship between cumulative NDVI and rice yield in two of the zones, with an R^2 of .66, .40, and .16, respectively.

If we are successful at developing a satellite based yield model that accurately predicts yield shortfalls due to weather shocks, we are in a strong position to design an index insurance contract that can eventually be offered to farmers through local private companies not only in Tanzania, but also in other parts of the developing world. As a first step, we will present our findings at various policy and programmatic discussions with implementation partners, particularly USAID. Further, we will pursue opportunities to contribute to the ongoing dialogue in USAID and other organizations regarding tools and strategies to improve resilience and promote adaptation to global climate change.

PROMOTING ADOPTION OF IMPROVED PRODUCTION TECHNOLOGIES AMONG SMALLHOLDERS IN GHANA VIA COUPLED CREDIT AND INDEX INSURANCE CONTRACTS

PRINCIPAL INVESTIGATORS

Mario J. Miranda: The Ohio State University
Abdoul Sam: The Ohio State University
Francis M. Mulangu: African Center for Economic Transformation
Nicolas Depetris Chauvin: African Center for Economic Transformation

The Ohio State University (OSU) and the African Center for Economic Transformation (ACET), in collaboration with the University of Ghana, are conducting a three-year program of research, outreach, and education designed to promote the adoption of improved production practices among Ghanaian smallholders.

OSU/ACET is committed to rigorously testing financial technologies that promote the adoption of improved production practices among smallholders by using rainfall or area-yield index insurance to manage the default risk associated with agricultural production loans. Our primary hypotheses are that 1) exposure of lenders to the risk of widespread loan defaults due to recurring droughts, floods, and other natural events reduces the availability of agricultural credit and either raises the interest rates on loans or leads to more restrictive non-interest credit rationing, thereby undermining the adoption of improved, investment-intensive technologies; and 2) index insurance, properly designed and integrated into lender credit portfolio management and loan policies, can reduce the risk of widespread agricultural loan defaults during adverse systemic natural events, thereby allowing lenders to expand access to credit among smallholders and reduce the interest rates charge on loans, promoting broad-based adoption of improved production technologies.

OSU/ACET will use as its laboratory the index insurance initiatives being introduced by the Ghana Agricultural Insurance Programme (GAIP), an organization of 19 Ghanaian insurance companies whose primary mission is to assist members in creating, designing, rating and implementing crop insurance products in Ghana. OSU/ACET will build capacity in Ghana through extensive outreach aimed at agricultural insurers, agricultural lenders, value chain participants, farmer groups, and agricultural policymakers and through educational initiatives involving the University of Ghana's PhD program in Applied Agricultural Economics and Policy.

COLLABORATIONS

- Ghana Agricultural Insurance Programme (GAIP)
- University of Ghana (UofG)

OUTPUTS

- BASIS Brief no.2013-07. *Promoting Technology Adoption with Credit and Insurance in Ghana.*

CAPACITY BUILDING

First, OSU/ACET intends to develop technical capacity among Ghanaian and African policymakers, GAIP and other insurer groups, and the lender and smallholder groups serviced by GAIP by implementing an aggressive outreach and education program to raise public awareness about the proper use of index insurance, covering current best financial risk management practices employing index insurance.

Second, OSU/ACET is committed to building institutional capacity by supporting a new University of Ghana doctoral program in Applied Agricultural Economics and Policy. The program, which is being implemented with major funding from the Alliance for a Green Revolution in Africa (AGRA), will begin in 2013 with approximately one-dozen students from Ghana and other Western African countries. OSU will serve as the University of Ghana's external academic partner. OSU faculty members will teach short-courses in existing graduate programs. We will also explore opportunities for distance education so that DAEA students could take OSU courses. OSU will also support the PhD program by mentoring students and involving them in project research. Students committing to dissertation research on project related topics will be invited to spend a semester or full academic year taking courses or conducting research at OSU during the latter stages of their studies. ACET will provide unpaid summer internships to two qualified doctoral students in each of the three years of the project.

Last, most of GAIP's staff are either part time doctoral students with index insurance as their dissertation topic or are aspiring to further their education by pursuing a doctoral education in the economics of index insurance. These aspirations were expressed formally and informally during the various meetings we have had with GAIP. The project will provide a platform for these budding scholars to polish their on-going and future research.

ACTIVITIES

Research overview

The OSU/ACET research program is scheduled to run for three years, starting in August 2013. During that period, OSU/ACET will conduct a randomized control trial, implemented in three distinct stages, starting in the summer of 2014. The study is expected to generate analytical findings that will help determine the proper uses of index insurance to promote a credit supply expansion among smallholders, leading both to policy prescriptions for developing countries and contributions to the scholarly literature.

OSU/ACET will build on the current and continuing activities of the Ghana Agricultural Insurance Programme (GAIP), a programmatic initiative that originated from the GIZ-facilitated Innovative Insurance Products for the Adaptation to Climate Change (IPACC). Under the GAIP project, which is being implemented in collaboration with the Ghana National Insurance Commission, a detailed agricultural insurance feasibility study was conducted in the first half of 2010. The study found "a major need in Ghana to improve farmers' access to rural finance if they are to invest in improved seed and fertilizer technology and to thereby increase their production and yields and farm incomes". The study further proposed introducing "crop insurance as part of a coupled program with production credit, seeds and fertilizers and preferably with output marketing assistance". The coupling of

agricultural insurance with credit through rural banks, micro-finance institutions, input suppliers, exporters, processors, and cooperatives has thus become the focus of current and planned GAIP activities in Ghana.

OSU/ACET, working directly with GAIP, and in collaboration with the University of Ghana, will carry out a program of impact assessment and experimentation of the GAIP index insurance initiatives. Our primary objective will be to investigate the impacts of crop insurance-continent agricultural loans on the agricultural credit system and on the technological transformation of Ghanaian smallholders. Specifically, we will evaluate the impact of index-insurance-contingent loans on a) the incidence of loan defaults and of losses from default during droughts and other systemic events that reduce aggregate yields; b) the adoption of higher yielding agricultural technologies among smallholders, c) loan provision terms (interest rates and loan amount) offered by lenders to smallholders, and d) an expansion of rural lender portfolios, including provision of loans to customers who historically did not qualify.

RESEARCH QUESTIONS & INTENDED IMPACTS

The GAIP project, which is on the verge of expansion, provides an exceptional opportunity for an evaluation of index insurance. The opportunity arises because product design and distribution have largely been settled, but the proper use of these instruments remains debatable. Outcomes and impacts of the coupling of credit and index insurance will depend on changes in lender and smallholder behavior. Index insurance will change the lender's terms of access to credit, but how the smallholder responds to index insurance will drive the level of effect. Consequently, smallholder outcome indicators will serve as proxies for lender behavioral responses.

We intend to investigate if index insurance:

- reduces the rate of loan defaults during widespread catastrophic weather events,
- increases lender profitability,
- reduces and stabilizes lender loan portfolio risk,
- encourages lenders to expand their rural loan portfolios,
- encourages lenders to lower interest rates or to alter loan recovery and principal repayment practices,
- strengthens the lender-borrower relationship,
- allows farmers to increase their average profitability either by itself or coupled with credit,
- allows farmers to reduce income risk, and
- affects the smallholder's wealth and saving and consumption behaviour.

We would also like to know if smallholders with access to coupled credit-index insurance contracts

- avoid the abandonment of improved production technologies more often than those without access, and
- adopt improved, investment-intensive technology at higher rates than those without access?

Finally, we hope to determine whether the benefits of index insurance depend on factors such as production practices and opportunities, education, geographical location, proximity to weather stations, degrees of access to financial markets, and the farmers' initial asset base.

SELLING FORMAL INSURANCE TO THE INFORMALLY INSURED

PRINCIPAL INVESTIGATORS

Ahmed Mushfiq Mobarak
Yale University
Kolli Rao
Agricultural Insurance Company of India, Ltd.
Mark Rosenzweig
Yale University

Farmers face enormous production risks due to unpredictable rainfall, yet most do not have any formal insurance. One explanation for this is the existence of informal network-based risk sharing. Using a randomized controlled experiment, we study the demand for, and effects of, offering formal index-based rainfall insurance in an environment of tightly knit informal risk sharing networks: sub-castes in rural India. We partner with the Agricultural Insurance Company of India (AICI) to market a new insurance product to farmers for whom we have a rich history of their sub-caste's responsiveness to household and aggregate rainfall shocks. Our first rounds of data collection have shown that (a) When formal insurance carries basis risk, informal risk sharing covering idiosyncratic losses enhances the benefits of index insurance, and (b) Formal index insurance enables households to take more potentially profitable risk even in the presence of informal insurance. This current project will collect an additional round of data to understand the spillover effects of index insurance on other members of risk sharing networks. We plan to market the insurance product to both the original set of households and to households connected to the original set by their sub-caste identity and their village location.

COLLABORATIONS

Our main partner is Agricultural Insurance Company of India (AICI), a pan-Indian public insurance company offering a variety of index insurance products. Their role is to develop an index-based rainfall insurance product, similar to the one we previously sold ("Delayed Monsoon Onset" index-based insurance), to insure agrarian households in advance of the 2014 Kharif monsoon season.

We are also working closely with researchers from the Center for Microfinance (CMF), an India-based independent research organization which specializes in issues related to financial access to the poor. The research team developed a partnership with CMF in late 2009 to complete two rounds of surveying and insurance marketing. CMF teams have developed tremendous field research capacity in the process, as well a strong relationship with AICI.

OUTPUTS

BASIS Brief no.2013-05. *The Interactions between Formal Insurance Markets and Informal Risk Sharing in Developing Countries.* By A. Mushfiq Mobarak, Kolli Rao, and Mark Rosenzweig. November 2013.

Papers

- Mobarak, Ahmed Mushfiq and Mark Rosenzweig, 2013, "Labor Market Effects of Selling Rainfall Insurance to Cultivators and Landless Laborers," Working Paper, Yale University.
- World Bank. 2013. World Development Report 2014: Risk and Opportunity—Managing Risk for
- Development. Washington, DC: World Bank. doi: 10.1596/978-0-8213-9903–3. License: Creative Commons Attribution CC BY 3.0 Key findings from the spillover effects via labor markets are highlighted in this report, which focuses on risk management in developing countries.

Conferences and presentations

- Results from the working paper have been presented at the **Human Resources and Economic Development Conference** (24-26 June, 2013 Hong Kong), presented by Prof. Mark Rosenzweig.
- Mushifq Mobarak highlighted the results in his recent talk titled "Who Needs Crop Insurance? Experimental Evidence from India", given by at the **World Bank Development Report Brown Bag Lunch Series** (February 28, 2013).
- Prof. Mobarak also reported on the new spillover results at the **International Growth Center South Asia Growth Conference 2013** (18-19 July, 2013 Delhi India).

CAPACITY BUILDING

Dr. Kolli N. Rao attended a 5-day Executive Education course hosted in New Delhi by the Jameel Poverty Action Lab, South Asia. During the training, Mr. Rao received extensive training on randomized controlled trial-based research techniques and interacted with a variety of policymakers, government officials, domestic and international researchers and development practitioners who also attended the meeting. As a result of the training, Mr. Rao is well-equipped with the expertise to introduce and carry out rigorous evaluations in his organization and to collaborate in joint research projects.

Prerna Choudhury, a Research Assistant for this project, attended a bi-annual Staff Training in Delhi August 25-30, organized in collaboration with Innovations for Poverty Action, Jameel Latif Poverty Action Lab and Center for Microfinance. The goal of the training is to increase local research capacity in India, by providing rigorous training in research techniques and fieldwork.

ACTIVITIES & ACHIEVEMENTS

Our project began in March 2013 and through August 2013 we

- Delivered results on the spillover effects of selling formal index insurance on labor market outcomes

of cultivators and agricultural laborers;
- Explored an opportunity to broaden our research agenda to examine the interactions between informal risk-sharing networks, demand for formal rainfall insurance and seasonal migration.

Spillover effects from selling rainfall insurance (completed)

We analyzed the spillover effects from offering rainfall insurance to cultivators and landless wage laborers via labor market effects. We examined the effects of rainfall insurance on both the supply of and the demand for agricultural labor. Specifically, we analyzed the effects of risk and insurance on the determination of wages in the rural labor market, and also how availability of insurance effects labor supply and labor demand. We also were able to analyze the effects of *risk* and *rainfall insurance* on the determination of wages in rural labor markets, and the effects of rainfall insurance on both the supply of and the demand for agricultural labor, when landless wage workers are unable to easily adjust their work hours during the rainy season.

Introducing a seasonal migration intervention (ongoing)

Seasonal migration is an alternative risk mitigation strategy and may be a substitute for rainfall insurance. The new intervention will allow a richer and more complete characterization of the complex set of interactions between informal risk sharing and formal risk management tools. Specifically, we plan to provide a small financial incentive (equivalent to covering the round-trip costs to the migration destination) to encourage temporary migration after harvest when local labor market opportunities are scarce.

We will be able to ask new research questions on risk mitigation strategies and their interactions such as i) Do small financial incentives affect seasonal migration decisions? And how dependent is this on the extent of pre-existing informal risk sharing? ii) How does purchasing rainfall insurance interact with the risky but potentially profitable decision to seasonally migrate? iii) Does seasonal migration affect total migrant earnings and consumption? Does it have spillover effects on other members of the risk-sharing network?

Given the scope and depth of these policy questions, we will delay the rollout of rainfall insurance by one rainy season. A benefit to this delay is that more households will be able to purchase rainfall insurance because they will have more available cash after the fall harvest than they would in the late spring-early summer.

Phone-based seasonal migration survey

We also developed a strategy to explore seasonal migrations by gathering survey data using phone-based interviews. The goal of the phone-based survey was to better understand (1) how many people in the village migrate; when are the most popular migration periods during a year; what are the top destinations and occupations in these destinations, among migrants; transportation costs of migration; and reasons for not migrating, and (2) the main constraints household face due to seasonal migration.

The sample for the phone-based survey consisted of approximately 10% of our 7,000 sampled households. We had a high non-response rate, primarily due to outdated mobile phone numbers, but were able to reach 5% of sample households. The survey was administered by skilled and experienced interviewers who have extensive experience in conducting phone-based interviews. Each respondent was reimbursed Rs. 20 for participation.

FINDINGS & LESSONS LEARNED

Traditionally, in India crop and rainfall insurance is sold exclusively to cultivators, thus excluding landless laborers, but the incomes of agricultural wage workers are directly tied to rainfall outcomes. There is a concern that the effects of insurance adoption on cultivators' behavior may affect or "spill over" to wage workers via labor markets.

Results from our previous findings indicate that landless laborers, who constitute the poorest segment of the rural population and are often excluded from formal financial services, exhibit substantial demand for rainfall insurance. In addition, we found that rice farmers in Tamil Nadu choose higher-yield crops that are less resilient to drought.

Our new findings on the demand for hired male harvest labor during Kharif (monsoon) season show that the amount of labor used in this stage of agricultural production is much more sensitive to rainfall variation among cultivators (those engaged in farming who make decisions) who offered insurance. Thus, wage laborers (those engaged in farming who do not make decisions) benefit from higher but more volatile wages via labor demand effects. Hence, expanding weather insurance to more cultivators can make landless workers worse off: they may face higher but more volatile wages across weather states via labor demand effects because insured cultivators will increase risk-taking and raise wages but their demand for hired labor will be more unpredictable.

We also find landless laborers benefit from insurance, raising wages in bad times if there are payouts and decreasing wage risk. Results also indicate that when offered insurance, landless laborers are less sensitive to rainfall in terms of supplying labor hours and they are less likely to migrate in search of work. In other words, with insurance, they become less likely to use seasonal migration as a risk management tool.

In short, our findings have important policy implications, suggesting that offering insurance only to cultivators, and excluding landless laborers, potentially makes laborers even worse off, as they bear even larger uninsured risks. Our findings also suggest that groups who have traditionally been excluded from the formal insurance market can benefit greatly by insuring against weather-related risk that affects their employment opportunities and earnings.

Preliminary results from the seasonal migration survey

We have analyzed data from the seasonal migration survey from Andhra Pradesh and Tamil Nadu. Based on these preliminary findings, we can conclude that seasonal migration is an important income diversification strategy, but there are some constraints to seasonal migration such as transportation costs and ability to secure employment at the migration destination. We propose to offer a financial incentive to seasonally migrate to a sub-sample of households in our sample after in the end of the harvest season (November-December for AP and UP, and February in Tamil Nadu), when local employment opportunities are low. The size of the incentive will be calculated based on the average price of a round-trip train or bus fare to the most common migration destination for each state.

GROUP INSURANCE FOR COFFEE COOPERATIVES IN GUATEMALA

PRINCIPAL INVESTIGATORS

Elisabeth Sadoulet
University of California, Berkeley
Alain de Janvry
University of California, Berkeley
Craig McIntosh
University of California, San Diego

Risk reduction remains a major challenge in increasing productivity and enhancing livelihoods among smallholders in developing countries. Index-based weather insurance offers a new promise to lift smallholders out of poverty. However, individual uptake in pilot projects around the world has been disappointingly low. Thus, we explored the possibility of offering hybrid contracts to an entire coffee cooperative as well as to individual coffee growers in Guatemala. Interlinked transactions among members and ownership of collective assets suggest that group insurance can provide benefits in excess of the sum of benefits from individual contracts.

To further understand the impact of weather-based index insurance we completed a census of Guatemalan coffee cooperatives and a characterization of the agro-climatic risks they face. We designed an insurance product in collaboration with a private insurance company and through intensive marketing analysis. We also obtained a measure of the willingness to pay for the contracts under consideration. Finally, we conducted experimental games in order to understand the determinants group insurance demand.

COLLABORATIONS

- Felix Povel, KfW, GERMANY
- Tomas Rosada, IFAD
- Fedecocagua, GUATEMALA, a very large 2nd tier association of 60 coffee cooperatives,
- La Ceiba, GUATEMALA, a large private insurance company

OUTPUTS

- de Janvry, Alain, Craig McIntosh, Felix Povel, and Elisabeth Sadoulet. "Utility, Risk, and Demand for Incomplete Insurance: Lab Experiments with Guatemalan Cooperatives", Working paper. March 2013.

- de Janvry, Alain, Andrew Dustan, Hideyuki Nakagawa, and Elisabeth Sadoulet. "Financing as payment for coffee quality in Fedecocagua", June 2013.
- de Janvry, Alain, Vianney Dequiedt, and Elisabeth Sadoulet. "Group Insurance against Common Shocks". Forthcoming in the *Journal of Development Economics.*
- Povel, Felix. Regenfallversicherung für Kaffeekleinbauern in Guatemala – Kurzbeschreibung (Insurance against excess rainfall for coffee producers. A short description), 3 pages.
- Sadoulet, Elisabeth and Alain de Janvry. "Risk and demand for incomplete insurance: Lab experiments with Guatemalan cooperatives", Policy Brief 71, FERDI, July 2013.

Seminar and conference presentations

- "Utility, Risk, and Demand for Incomplete Insurance: Lab Experiments with Guatemalan Cooperatives", by Felix Povel, Seminar at the CERDI, France, April 5, 2013.
- "Risk and Demand for Incomplete Insurance: Lab Experiments with Guatemalan Cooperatives, by Elisabeth Sadoulet, Workshop on "Flexible financial products in microfinance to address risk", FERDI, Clermont-Ferrand, June 12-14 2013.
- "Risk and Demand for Incomplete Insurance: Lab Experiments with Guatemalan Cooperatives", by Elisabeth Sadoulet, I4 technical meeting at UC Davis, September 13, 2013.

CAPACITY BUILDING

- Andrew Dustan, PhD student at UC Berkeley, worked on the analysis.
- Aïssata Coulibaly, PhD student in Clermont-Ferrand, France, worked on a review of theoretical arguments for the paper prepared for the FERDI workshop.
- Andrew Abordonado, master student in Public Policy at Berkeley, worked on a literature review for the paper prepared for the FERDI workshop.
- Sikhandra Christian, PhD student at UC Berkeley, worked on the transactions data from Fedecocagua.
- Daley Kutzman, PhD student at UC Berkeley, helped with the GIS data.

ACTIVITIES & ACHIEVEMENTS

During the first year of the project we focused on constructing the index and the insurance product, implementing the base line survey, and completing theoretical work on the demand for hybrid contracts. During the second year, we developed and implemented experimental games in 80 cooperatives to analyze the demand for hybrid index insurance. The third and last year was spent (i) analyzing the data from the experimental games, and (ii) matching the cooperative survey to the institutional transaction data between the cooperatives and their second-tier association, and analyzing the process by which quality is rewarded in the context of typical cooperative contracts.

Analysis of the experimental games

The experimental games were designed to analyze the demand for an index-based insurance for excess rainfall. We focused on three core debates. The first is the role of basis and background risk in affecting demand for the insurance product. Basis risk is usually associated with the difference between the shock measured by the index and the actual loss that may have occurred. The source of basis risk can be due either to a

difference in weather at the weather station and at the plot, which can be large if the weather station is far away, or to sources of risk not covered by the insurance, such as pests. Background risk is usually associated with other sources of risk faced by households that are not related to the activity that the insurance is meant to cover. We argue that both are "uninsurable risks" and analyze how their severity affects demand, and if farmers perceive these two sources of basis risk differently.

Second, we explore the importance of 'contract non-performance' to see if demand for index insurance is reduced by the fact that the worst possible shock may occur without a payoff, and thus worsen the worst possible state of the world by payment of the insurance premium.

Finally, we examine the viability of a promising mechanism to help minimize the absolute amount of uninsured risk, namely the insuring of groups of producers who then implement loss adjustments with their individual members. If a group has low information costs on events affecting individual members and the ability to dynamically enforce contracts, internal loss adjustments will emerge as a welfare-enhancing contract relative to individual index insurance held by all members. However, delegation of loss adjustment to the group induces difficult questions of dynamic enforcement and internal differences, and in the end may prove too costly to implement to be advantageous. We measure the relative demand for group versus individual insurance in carefully controlled comparisons where the level of risk can be held constant. We introduce heterogeneity among members of a group, with some subject to more risk on average than others, and examine how this alters their willingness to participate in group insurance.

In order to answer these questions, we revealed the farmers "Willingness to Pay" in a series of 37 risk scenarios. The rule of loss adjustment was either pre-specified or left to be decided by the group. The index insurance is constant across these scenarios, with payout equivalent to the value of the purchased inputs in case of excess rainfall, which occurs about every seven years.

FINDING & LESSONS LEARNED

Lessons learned from the experimental games

Economic theory recognizes that willingness to pay (WTP) increases with background risk. One might think that WTP for partial insurance could be lowered by the presence of other sources of risk. Since the insurance is "more incomplete" it is not of much value. In contrast, when facing many risks, you should be more willing to insure. Theory thus predicts that WTP increases with background risk for people highly sensitive to loss. Our results show that the farmers are "risk vulnerable" and their WTP for insurance is higher the higher background risk they face.

This response is larger when a correspondence between the payout years and the remaining risk exists. This means that people have a higher WTP for an insurance that is partial but gives some payouts in the loss years, rather than for an insurance that

pays better in some states, but leaves some cases of losses with no insurance at all. And this is true even if, at the end, the remaining risk is the same. It shows that people are sensitive to the correspondence between payout and losses. Furthermore, the response of WTP to the benefit of insurance increases with risk aversion, when the insurance covers the worse cases of losses.

The demand for insurance is lower if the worst loss is not covered by insurance, but not differentially so for more risk-averse producers. This negative effect may occur when the farmer faces a loss while the index did not trigger a payout. Note that this only applies if no payout occurs and losses are very high, so that losses plus paying the premium add up to the worst possible outcome for the farmer.

The group games
In the group games, we proposed a hybrid insurance product, where the group gets payout based on the index, with individual payout among group members done according to actual losses. The group does not share all losses, only the payout, so that the insurance remains partial. If the group experiences widely differing losses, payout sharing does not erase the differences amongst group members.

Does the within-group loss adjustment mechanism increase the demand for index insurance?
We find that yes it does. WTP increases with sharing within the group.

Do people value groups in and for themselves?
The most surprising result is that producers expressed a distaste for group insurance. For a given risk scenario, the WTP for an individual insurance is higher than that for a group insurance not only when there is no sharing, but also when there is partial sharing which is superior in terms of pure loss coverage. Only when group insurance offers the maximum sharing of payout does it fetch a higher WTP than individual insurance.

Does heterogeneity affect demand for group insurance?
We find that there is also a real distaste for group heterogeneity. This amounts to a reduction of the WTP by about 20% for a given risk. Surprisingly this distaste for heterogeneity is expressed regardless of whether people are among the riskiest or the least risky members. We were expecting the opposite and thought that farmers would be willing to consider group insurance even if some members faced more risk, and would even better accept a de facto subsidy to the riskier member of the group rather than an equivalent payment to the insurance company in the form of a premium. This is not the case in the context of our study.

How much do people expect the group to be sharing if not imposed by the contract?
When sharing rules were not specified, the WTP was close to the no-sharing WTP, indicating that producers expect very little sharing to occur.

Will individuals change their preferences?
Comparing pre- and post-shock preferences, we clearly see that some people who have drawn a bad outcome change their preference towards more sharing. This suggests that groups may have difficulty ensuring a given commitment to share after shocks have occurred and individuals know their outcomes.

INSURING AGAINST THE WEATHER: INTEGRATING GENERIC WEATHER INDEX PRODUCTS WITH GROUP-BASED SAVINGS AND LOANS

PRINCIPAL INVESTIGATORS

Carlos Martins-Filho: University of Colorado
Daniel Clarke: University of Oxford
Stefan Dercon: University of Oxford
Ruth Vargas Hill: International Food Policy Research Institute (IFPRI)
Alemayehu Seyoum Taffesse: International Food Policy Research Institute (IFPRI)

This research project focuses on how to develop simple, flexible and inclusive index insurance products, and how to provide them to risk-sharing, savings and credit groups as a means to reduce basis risk. In particular, the project seeks to develop formal insurance products to insure shocks experienced by a community of farmers, and combine them with mechanisms that formalize group risk-sharing through group savings and loans.

In Ethiopia, we are working in three disparate sites in the Oromia region. Although the three sites have distinct agro-ecological characteristics, the major source of risk, drought, is shared. In all locations traditional funeral insurance societies, called iddir, have formalized in recent years and have begun providing other types of insurance and financial services to their members.

In Bangladesh we are working in Bogra district, a typical region of non-coastal Bangladesh. Within this one district the three main sources of agricultural risk are drought, flooding and outbreaks of crop pests and disease. However, flood risk is managed well leaving drought and pestilence as the main sources of uninsured risk.

COLLABORATIONS

In Bangladesh we continued our collaboration with Bangladesh's Policy Research and Strategy Support Program (PRSSP) which was set up by IFPRI in 2010 for food security and agricultural development with funding from USAID. Kaikaus Ahmed, a researcher at PRSSP, has been working on this project since 2012.

In Ethiopia, we continued close collaboration with IFPRI's Ethiopian Strategy Support Program (ESSP). ESSP is a collaborative research partnership between IFPRI and the Ethiopian government. Two of the IFPRI researchers on this project, Alemayehu Seyoum Taffesse and Guush Berhane, are researchers in ESSP.

We collaborated with the Financial Innovations for Social and Climate Resilience (FISCR) project conducted by the World Bank Social Development sector on research to better understand the welfare impact of insurance payouts.

OUTPUTS

- I4 Update, *Insuring against the Weather: Addressing the Challenges of Basis Risk in Index Insurance using Gap Insurance in Ethiopia,* April 2013.
- Guush, Berhane, Daniel Clarke, Stefan Dercon, Ruth Vargas Hill and Alemayehu Seyoum Taffesse. 2012. Financial innovations for social and climate resilience: Ethiopia case study. Report prepared for the World Bank. August.
- Guush, Berhane, Daniel Clarke, Stefan Dercon, Ruth Vargas Hill and Alemayehu Seyoum Taffesse. 2012. Insuring against the Weather: Using Traditional Groups to Promote Index-Based Weather Insurance in Ethiopia. Ethiopia Strategy Support Program, Conference Note.
- Guush, Berhane, Daniel Clarke, Stefan Dercon, Ruth Vargas Hill and Alemayehu Seyoum Taffesse. 2012. Sharing rules and demand in semi-formal groups.
- Presentation at the 2013 African Econometrics Association Meetings, Accra, Ghana, May 2013.

Databases generated

- Insuring against the Weather Follow-up III Household Survey, December 2012-January 2013: survey of 1,760 households in Oromia, Ethiopia.
- Insuring against the Weather Iddir Survey, Sept 2013: survey of 138 iddirs in Oromia, Ethiopia [in field].
- Insuring against the Weather Follow-up IV Household Survey, September 2013: survey of 1,760 households in Oromia, Ethiopia [in field].
- Insuring against the Weather Baseline Household Survey, May 2013: survey of 2,200 households in Bogra, Bangladesh.

ACTIVITES & ACHIEVEMENTS

Bangladesh

We formed a partnership with Palli Karma Sahayak Foundation (PKSF), which was established by the Government of Bangladesh in 1990 to alleviate poverty by generating employment, and works with microfinance institutions to implement development programs. We also signed a contract with Gram Unnayan Karma (GUK), a PKSF partner.

A baseline survey was fielded in May 2013. Data was collected from 2,200 households across 120 villages including demographic characteristics, agricultural practices and land use, perceptions of risk, morbidity, use of health facilities, and knowledge and perceptions of insurance products. The data is currently being analyzed.

In mid-May, GUK branch managers and their supervisors received index insurance product training on the main features of each index insurance product. The training also included logistical aspects of the sales and the main project objectives. A training manual was distributed and later updated with answers to frequently asked questions.

Insurance policies were sold from late May to late June 2013. As part of the sales process focus groups with 15-20 households were held in each village. During the discussion households were informed about the insurance policy, when it would pay out and when it would not, and if the village was a rebate village. Households also drew a lottery for rebate date. Each village had approximately 4 focus groups so a household had four opportunities purchase insurance. A

total of 2,779 policies were sold with an 89 percent take-up rate.

We are combining survey data with the actual sales data to understand whether and to what extent age, gender, education, level of income and degree of income diversification predict demand for insurance and how rebates and/or discounts affect the decision to purchase index insurance. We are also collecting borrowing data from our implementing partner and will use it to assess the impact of insurance on borrowing rates.

Ethiopia

Since supplemental funding was received from IFPRI we conducted two additional surveys: one immediately at harvest, and one in September 2013 during the lean season. We did this to (i) capture accurate data on input use and yields for insured and uninsured farmers in year 2, (ii) capture data on consumption and wellbeing both during a season of plenty and during the lean season, and (iii) collect data on input use behavior after insurance sales in year 3. We will assess the impact of insurance on behavior, and whether the year 2 insurance payouts had an impact on wellbeing, and if so whether this impact is bigger during the lean season.

We have discussed with our partners how to distill lessons learned and worked on a scale-up strategy. Despite this year's disappointing sales, our partners believe they can take this product to scale. However, marketing must occur before pre-season rains affect the decision to buy insurance. We have also been communicating our research results with a broad group of stake-holders and holding discussions with MiCRO and Mercycorps on future collaborations.

In October and November 2012, a crop-cutting exercise was undertaken in Shashemene to determine whether gap insurance would pay for haricot beans and wheat. Average area yields of both were found to be above the payout threshold, but the results were well accepted by farmers, indicating that this is a trusted and transparent product.

Insurance policy marketing was delayed by 1-2 weeks due to our implementing partner's capacity constraints. In normal years this delay would not have been problematic, but this year pre-season rains in much of the country signaled a rainfall deficit would not occur. The conditioning of expectations was so strong that we determined insurance sales need to take place from January-February rather than March-April in future implementation efforts.

FINDINGS & LESSONS LEARNED

Bangladesh

Are rebates or discounts more effective in increasing demand for insurance?
To answer this questions we randomly assigned half of the villages to receive rebates and the other half to receive a discount on the insurance premium. We learned that those offered the discount are 5 percentage points more likely to buy insurance than those in the rebate group. We also find that the average number of units bought by the discount group exceeds the rebate group by about 2.5 units. This implies that individuals value their liquidity constraint at the time of planting over future windfalls. It also suggests that a lack of savings is probably not an issue nor is relevant to the purchase decision.

We also offered a range of different discount/rebate levels to examine the effect on take-up. We find that on average there is a positive association between the discount or rebate level and the number of units bought,

but that the discount group is more responsive than the rebate group to the size of the discount.

Does the timing of a rebate affect its impact on demand?
Since farmers may be liquidity constrained before harvest, we randomized the timing of the rebate payment to learn if a liquidity constraint coupled with a rebate payment would encourage take-up. Rebate group households drew a lottery for when the payment would be made. The payment dates would occur either during the lean period or at the end of the season. Results showed that the size of the rebate did not affect demand among those offered the rebate at the end of the season, but it did affect demand among those offered the rebate in the lean period.

Ethiopia

2013 was the third year in which indexed policies were sold in new pilot sites with Buusaa Gonofaa and Oromia Insurance. Unlike the previous year when demand for insurance was high, this year take-up was very low, most likely due to late marketing and pre-season rains which reduced the need for drought insurance. Removal of price discounts may also have dampened demand. Analysis is forthcoming.

In 2011 we had three treatment arms (i) individual villages where insurance was sold directly to individuals; (ii) mandated villages where insurance was marketed through iddirs, which were asked to adhere to specific rules regarding distribution of payouts and increased group lending; and (iii) non-mandated villages where insurance was marketed through iddirs, but no specific rules were put in place regarding distribution of payouts and group lending; and a group of control villages. The groups were equally distributed across three study sites. In year 1 we found: (i) increased lending for non-covariate crop risk resulted from activities aimed at strengthening local groups' ability to do this, (ii) insurance payouts brought about widespread improvements in welfare outcomes in those villages where increased lending was encouraged as a result of implementation activities and (iii) payouts increased trust in financial institutions. However, we did not find sustained impact of the activities undertaken in year 1 to strengthen local groups lending for non-covariate crop risk.

What is the impact of insurance on investments in agricultural activities?
We compared farming practices in households in individual insurance villages with households in control insurance villages and found that households with insurance are significantly more likely to use fertilizer than households without insurance. We also find some evidence that households with insurance are more likely to use improved seeds and are more likely to hire labor rather than use oxen or pesticides.

The impact of group activities on purchases on insurance
We find that on average groups had little impact on take-up, but substantial variation in take-up existed between villages with clear by-laws and villages without. Results show that insurance purchases were higher in both individual and mandated villages, compared to the iddir villages that had no mandate nor sharing rules.

We also find that receiving a payout in a prior year increased demand, both for the individual receiving the payout and for others in the same village. This is consistent with our finding last year that payouts had a significant impact on a household's trust that "financial institutions would honor insurance policies". This provides evidence that nothing sells insurance like insurance payouts and that payouts encourage and sustain demand over time. This is an important finding for index insurance where policies are designed to cover extreme events and payouts are rare.

The impact of group activities on lending by iddirs and welfare outcomes

The impact of group activities on lending by iddirs and on welfare outcomes was assessed by comparing iddir villages with individual villages. As expected, mandating increased lending by iddirs. Respondents in iddir villages were more likely to report that their iddir had started making loans for crop losses. However, this was driven by changes in mandated iddir villages given that no difference was observed between the non-mandated iddir villages and the control villages. This suggests that the intervention did result in anticipated iddir rule changes in mandated iddir villages, and additional risk-sharing may have been crowded in. As a result, we find that the perceived and actual ability of individuals to receive transfers in times of need was higher in mandated iddir villages. We also observed higher consumption of durables and asset purchases in mandated iddir villages.

However, we also find evidence that suggests the impact of the intervention was short-lived. We found that the positive impact of group activities on lending and on welfare outcomes dissipated in the survey conducted 18 months after the initial intervention. We will test whether this is the case after the final round of data collection.

Analysis of the impact of insurance and demand for insurance for years 1 and 2 has been completed. We found that insurance has a significant and robust impact on the use of inputs, with insured farmers purchasing and using more fertilizer (and in some specifications more improved seeds). Price was also a significant determinant of demand across our treatment villages, as was the experience of having purchased insurance in a previous year.

RESEARCH THEME B: MECHANISMS FOR ADOPTION OF IMPROVED TECHNOLOGIES

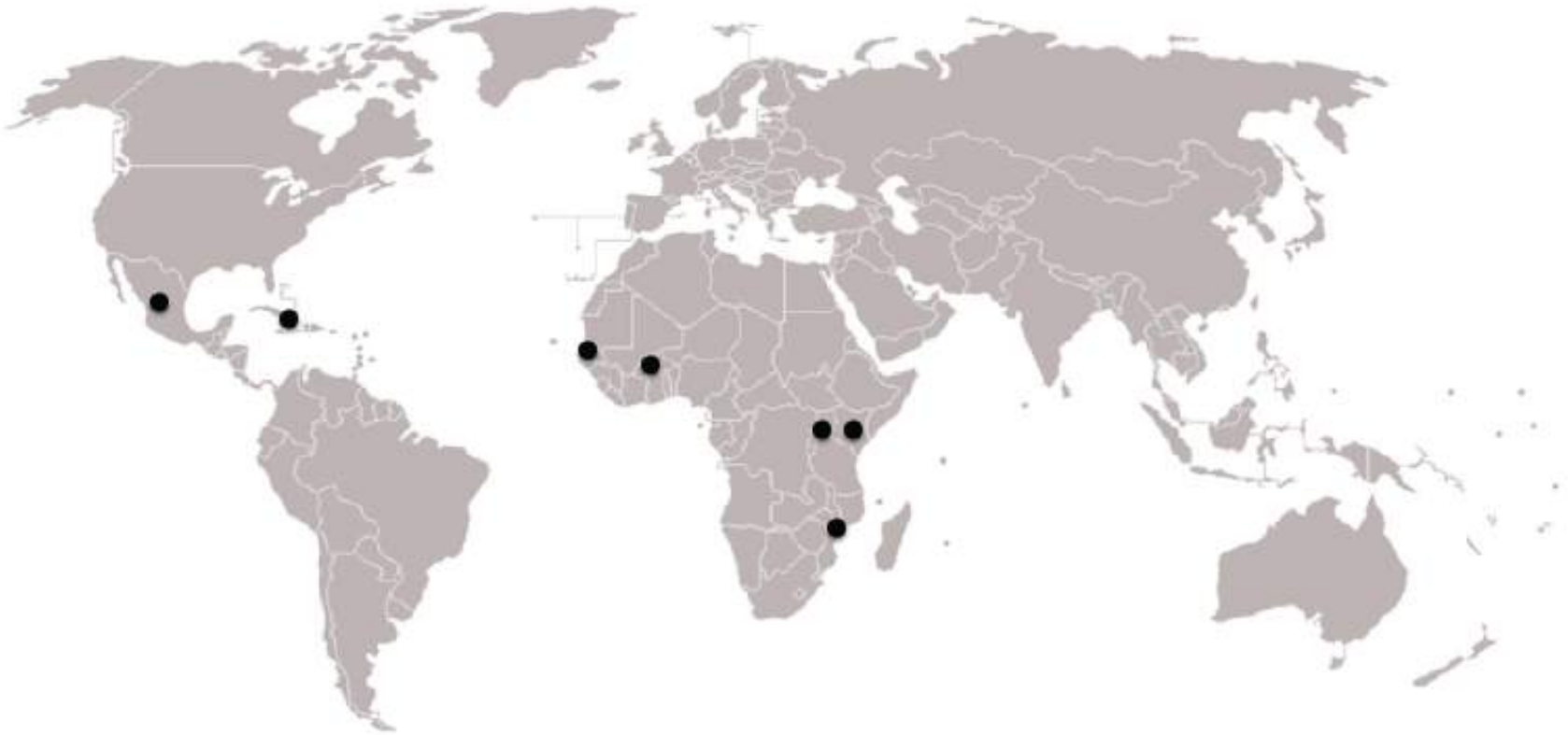
In much of the developing world, productivity continues to fall short of potential, in part due to low adoption of productive agricultural technologies that could improve yields, such as improved seeds or fertilizer. As a result, many smallholder farmers remain mired in poverty and do not take advantage of potentially profitable opportunities. Providing an avenue of upward mobility to small-scale farmers requires overcoming the barriers that prevent farmers from making the investments necessary to experience a jump in productivity and income.

While a broad consensus agrees that small-scale farmers face many prospective barriers to technology adoption, there is limited rigorous evidence on the relative effects of these constraints on technology adoption, and on the impact of financial technologies designed to address these barriers. The BASIS Assets and Market Access Research Program has assembled a portfolio of projects designed to generate critical knowledge around both the barriers to technology adoption that constrain small-scale farmers and potential solutions. BASIS is particularly interested in interventions that emphasize investigation of potential complementarities between financial and agronomic technologies, and to thoroughly evaluate these instruments for development impacts.

Projects Under Theme B

- *Evaluating the Socio-Economic Impact of Western Seed's Hybrid Maize Program in Kenya*
  Michael Carter, University of California Davis
- *Demand and Supply Constraints to Improved Sorghum Technology Adoption and their Gender-Differentiated Effects in Burkina Faso*
  Andrew Dillon, Michigan State University
- *Household-Level Impacts of System of Rice Intensification (SRI) in Haiti: An SRI Intervention with Training, Insured Credit, and Coordination by Irrigation Bloc*
  Travis Lybbert, University of California Davis
- *A Multiple Interventions Approach to Increasing Technology Adoption with a View Towards Scaling Up: Evidence from Mexico*
  Aprajit Mahajan, University of California Los Angeles
- *Complementarities of Training, Technology, and Credit in Smallholder Agriculture: Impact, Sustainability, and Policy for Scaling Up in Senegal and Uganda*
  Stephen Smith, George Washington University
- *Savings, Subsidies, and Sustainable Food Security in Mozambique*
  Dean Yang, University of Michigan

Map of Projects: Mechanisms for the Adoption of Improved Technologies



EVALUATING THE SOCIO-ECONOMIC IMPACT OF WESTERN SEED'S HYBRID MAIZE PROGRAM

PRINCIPAL INVESTIGATORS

Michael Carter
University of California, Davis
Mary Mathenge
Egerton University
Travis Lybbert
University of California, Davis

We will evaluate the impact of Western Seed Company's (WSC) hybrid maize program on the welfare of smallholder farmers in Kenya's mid-altitude regions. This locally-based and locally- focused seed company is currently expanding into new areas, powered by recent infusions of venture capital. By collaborating closely with WSC, we are exploiting this expansion with a two-year randomization design in parts of western and central Kenya, creating well-defined treatment and control groups. Because of differences between western and central Kenya, we expect the constraints, and ultimately the impacts in these two regions to be different. In particular, the western region is poorer, and farmers there are unlikely to reap the full benefits of WSC technologies in this liquidity-constrained environment. We therefore propose to relax these liquidity constraints for some farmers in western Kenya by providing fertilizer vouchers, randomized at the household level. In summary, we hope to learn about two key issues: the effectiveness of a local seed company in developing technologies fine-tuned to the local agro-ecological environment, and the impact of relaxing liquidity-constraints on the poverty-reduction potential of new agricultural technologies.

COLLABORATIONS

This project began when Acumen Fund approached the UC-Davis team through Center for Effective Global Action (CEGA) seeking an impact evaluation of Western Seed's maize program. Acumen, like AGRA, is intensely interested in learning the effectiveness of investments in Western Seed. Tegemeo Institute, with whom the UCD team had working relationships, was the obvious partner for this study given Tegemeo's extensive experience and its ongoing longitudinal survey of Kenyan farmers. In addition to their broad research experience on the maize value chain, Tegemeo routinely participates in the preparation and formulation of Kenyan government

agricultural strategy, and collaborates with numerous national and national entities, such as the World Bank, the Rockefeller Foundation, Kenya Agricultural Research Institute (KARl), the Food and Agriculture Organization (FAO), and Department for International Development (DFID).

To date, researchers from the two institutions have collaborated on both development and implementation of the research design, and Tegemeo's local knowledge proved invaluable in carrying out the sampling and seed distribution in a timely manner. While Tegemeo has ample experience conducting research on the welfare of rural agricultural households in general, and on the impacts of hybrid maize in particular, this will be their first field experience with a randomized control trial.

CAPACITY BUILDING

Following Tegemeo's field work model, enumerators and field work supervisors will be recruited from local university students. They, together with Tegemeo's permanent staff, will be extensively involved in the ongoing implementation of the randomized design, as well as the analysis of the impact data that emerges from it. By involving students and exposing them to the research process, we hope to provide a rewarding complement to their graduate studies.

ACTIVITIES

In both the Western and Central areas, farmers lack access, information, experience and perhaps trust in WSC seeds. In addition, the Western area is substantially poorer and preliminary work indicates that farmers adopt improved seeds dependent on their ability to purchase the fertilizers needed to make the seed purchase pay off. As part of our evaluation, we will therefore randomly provide fertilizer vouchers to households in the Western area.

In contrast to the Western area, Central Kenya has higher household incomes, higher asset values, and smaller land sizes. Maize in Central Kenya is mostly grown for home consumption, while coffee, tea, and dairy are the major income generators. These regional differences shape the expected impacts of high-yielding maize hybrids. We have therefore designed the evaluation to distinguish the regional impacts separately. We anticipate that households in Central Kenya may respond to higher yields by substituting land out of maize and into cash crop production, compared to Western Kenya, where we anticipate more direct impacts of increased maize productivity.

Preparing for the intervention
When WSC enters new districts, the marketing team establishes demonstration plots on local farmers' land, around which they define spatially explicit learning zones. At the beginning and end of the rainy season, WSC holds field days and distributes free trial seed packets to attending farmers. WSC does not expect farmers to adopt new varieties until they have witnessed successful demonstration plots, and have experimented with the seed on their own land. This business model keeps a learning window open long enough to permit rigorous evaluation.

For the long rains of March-May, 2013, WSC, in collaboration with the research team identified and GPS-marked potential 5 km-radius learning zones. The research team then selected 18 pairs of matched learning

zones, in 16 districts in Western and Central Kenya, and randomly allocated one learning zone in each pair to treatment and one to control. The pairs were matched by altitude, rainfall, and agro-ecological zone.

WSC has agreed to refrain from placing demonstration plots or conducting promotional activities within the control zones for the next two years. WSC will carry out demonstration plots, seed distribution, and field days in the treatment zones. At the end of a brief information session, WSC provided 250g sample packs of seed that were distributed to all sampled households in the treatment areas in February 2013. This last activity ensures that all households in the treatment areas have the opportunity to plant a small experimental plot with Western Seed hybrids during the 2013 long rains. Finally, WSC will create a direct-order system for farmers in the treatment areas, which should alleviate seed purchase problems due to distance and lack of supply.

In addition, with the support of WSC, the research team will distribute voucher coupons that will enable households to purchase—with a modest co-pay—hybrid seeds and fertilizer sufficient for a one acre plot. The voucher coupons not only provide liquidity, but also shift substantial risk away from the farmer. The fertilizer vouchers will be randomized at the household level, and explained to village elders as a lottery. For political reasons, in addition to the lottery that will determine whether our sample households receive vouchers or not, we will randomly draw non-sample households from the village census who will have a small chance of receiving a fertilizer voucher of the same magnitude as that provided to sample households.

Research timeline

The first survey will take place after the end of the main maize growing season, and before the onset of the second rainy season in August/September of 2013. The survey instrument will include a complete production and income module designed for agricultural households. The income module will enable us to identify substitution effects between crops and alternative economic activities. It will allow a more fine-tuned cost-benefit analysis, as it will capture direct and indirect costs to households. We will also measure educational completion ratio and enrollment data, as well as food security measures. Finally, one year from the initial

survey, a mobile phone yield survey will be conducted to limit recall bias in the intermediate outcomes (yields and input use). The end line survey will take place before the long rains of 2015.

RESEARCH QUESTIONS & INTENDED IMPACT

The research proposed here will speak to two issues:

1. The impact of "fine tuned" seed varieties (provided by local seed companies) on small farmer income and food security; and,
2. The additional impact of relaxing liquidity constraints on small farmer adoption of improved inputs on income and food security.

While both issues are tightly related to the overall goals of USAID's Feed the Future Initiative, dissemination of findings on each are probably best pursued though somewhat different strategies. On the first issue, we will collaborate with the Acumen Fund.

Acumen is not only co-financing this research, but together with AGRA has raised significant capital to help Western Seed expand their business. Acumen and AGRA will be natural partners for co-organizing dissemination events and making sure that the results are communicated to investors and other decision-makers positioned to use the results of our work.

On the second issue, we will target decision-makers in more conventional development circles, including the government of Kenya, as well bilateral and multi-lateral donors active in the East Africa region. For this purpose, there is probably no better-placed institution than Tegemeo, which has not only enjoyed prior support from USAID, but has built with its research a reputation as the go-to group on agricultural production and policy.

DEMAND AND SUPPLY CONSTRAINTS TO IMPROVED SORGHUM TECHNOLOGY ADOPTION AND THEIR GENDER-DIFFERENTIATED EFFECTS IN BURKINA FASO

PRINCIPAL INVESTIGATORS

Andrew Dillon: Michigan State University
Maria Porter: Michigan State University
Melinda Smale: Michigan State University
François Lompo: Institut de l'Environnement et de Recherches Agricoles (INERA)
Hamidou Traore: Institut de l'Environnement et de Recherches Agricoles (INERA)

In the West African Sahel supply and demand constraints reduce adoption of improved sorghum technology. Sorghum is the main food staple and most widely cultivated dry land crop in the region. Although pockets and periods of higher adoption are evident, national area shares, and yields, are generally far less than rice, maize or specialty crops. Recognizing that the private sector has not taken responsibility for seed supply, and the public sector has failed to supply improved seed in reasonable quantities, development organizations and donors have sought alternative means to strengthen the linkages between the formal and informal seed supply channel. Approaches include training and financing of local agro-dealers or seed traders, and enabling farmer unions to supply improved seed and fertilizer micro-packs. A complementary scheme has been to apply small amounts of fertilizer (micro-dosing) at planting to improve yields, which when applied to improved sorghum varieties raises yields considerably.

We will conduct a social network census to gather information on individuals who have little access to credit or knowledge-sharing. Our improved seed/micro-dosing intervention will be based on social network characteristics thus allowing us to estimate the effect of higher connectivity or influence within villages on knowledge diffusion and adoption. As information about technology is a primary constraint to adoption, the social network treatments will provide evidence on whether such approaches relieve demand side information constraints. The targeting of seed and micro-dosing packages based on social network characteristics will provide policy recommendations based on how new technology diffusion occurs and who benefits from different targeting strategies.

From a supply side perspective, consistent availability of technology is also a constraint to adoption. Prior to planting we will experiment with the provision of consistent supply from agro-input dealers in villages. This supply side treatment will be compared to three other marketing strategies which will test whether credit and commitment constraints are binding for small farmers by offering them options to purchase improved seed and micro-dosing packets either earlier or later in the season. This will test whether consistent market supply, credit constraints and farmer commitment explain low adoption and potential supply side marketing mechanisms to increase adoption.

Finally, we will examine the labor and gender dimensions of adoption. If technology adoption diverts women's labor from their own legume crops to sorghum fields, the household's dietary diversity, health and women's income may decline. Researchers will also look for potential impacts on women's bargaining power within the household and amount of time children spend in school versus working in the field.

COLLABORATIONS

Since the start of the award, we have been building relationships with our research partners in Burkina Faso. During Summer 2013 we brought Nicoló Tomaselli from Innovations for Poverty Action (IPA) on board our project. He will aid in implementing and designing our sampling framework, in building relationships with Agrodia, and in implementing our randomized control trial and all survey collection efforts.

We also further our partnership with INERA, working closely with two new partners: Isabelle Dabiré and Clarisse P. Kondombo-Barro. Dr. Dabiré is an agricultural economist and gender analyst, and is serving as our principal point of contact and facilitator with INERA co-investigators. Dr. Kondombo-Barro is a crop science expert with knowledge and experience breeding sorghum varieties in Burkina Faso.

CAPACITY BUILDING

We will work closely with scientists and field technicians at INERA in all aspects of the research design and implementation. Consultations with INERA leadership in Burkina Faso during a field trip conducted by MSU staff in March 2013 confirmed strong interest in socioeconomic research support to the extensive, on-farm trial and demonstration programs geared to fertilizer micro-dosing. These programs have been implemented with major contributions from International Crops Research Institute of the Semi-Arid Tropics ICRISAT and the Alliance for a Green Revolution in Africa (AGRA), but with no particular emphasis on social and economic considerations. The work we propose will initiate this research.

ACTIVITIES

BASIS began funding the project in May 2013. We have since completed the following work.

Designed Social Network Census and other questionnaires
We designed the Social Network Census questionnaires to be fielded in October 2013. We have also begun designing the Household Questionnaire for the Baseline Survey to be conducted in November-December 2013.

Sample frame preparation
We are confining the study area to the sudano-sahelian zone where rainfall and soil fertility differences are minimized. We believe the Northern-Central and Northern region is best suited to the study. Village identification is proceeding through administrative list verification. Agro-input dealers are being identified using International Fertilizer Development Center's (IFDC) recent ag-input dealer census data.

RESEARCH QUESTIONS & INTEDED IMPACTS

Increasing technology adoption and yields
The immediate goal of supplying improved seed to sorghum growers in Burkina Faso is to raise yields. With this goal in mind we plan to answer these five questions.

i) What is the productivity effect of the improved seed plus fertilizer plus training?
ii) Does targeting based on social network characteristics increase adoption spillovers and aggregate productivity gains?
iii) Do commitment mechanisms to relieve credit constraints induce higher adoption than price subsidies?
iv) What is the effect of supply side constraints on adoption and productivity?
v) Are demand side or supply side effects larger constraints to adoption and productivity gains?

Labor substitution effects of technology adoption
We will focus the second stage of our research on the welfare consequences of improved seed and fertilizer micro-packet use, particularly for women and children. Specifically, how does use of improved sorghum seed affect (i) the allocation of inputs such as labor and fertilizer to the production of other crops and to overall household productivity?, and ii) the allocation of women's labor among farm, household, and nonfarm income-earning activities, and does this impact their bargaining position within the household?

In the ethnically diverse Boucle du Mouhoun region of Burkina Faso men tend to farm sorghum among other crops on their plots, while women tend to use their individual plots for farming cowpea, other legumes, and vegetables for family consumption. Since our experiment is to randomly vary the provision of sorghum seed across households, we can attribute changes in production practices regarding other crops to this change in sorghum productivity.

An efficient input allocation would imply a reallocation of fertilizer to crops where an additional unit of fertilizer would have the highest marginal product. Yet, in 1996 Udry found that households in Burkina Faso do not necessarily allocate production inputs in this manner. He found lower yields for women's plots than those of men's plots, controlling for the crop and year. On the other hand, women's plots tend to be comprised of a variety of relatively high value crops, so that the total output per hectare is higher on women's plots than men's plots. The differences in yields are primarily attributed to a greater use of fertilizer and labor on men's plots. If such inputs were reallocated from plots controlled by men to those controlled by women, then agricultural production of the household could potentially increase. Given this we will consider:

i) How will households reallocate inputs such as labor and fertilizer to the production of other crops in response to potentially greater sorghum productivity? What about to plots controlled by the household head, other men and other women? What will be the overall effect on household productivity?
ii) Does take-up and use of the new seed differ by gender, age, and relation to the household head?
iii) Will those individual household members more closely tied to other villagers have higher take-up rates? Will they use the packet for their own individual plots or for the plot controlled by the household head?
iv) Would potentially higher productivity levels reduce cooperation across household members and across different plots? Would this offset any increases in

productivity due to the new technology adoption?

v) Is cooperation outside the household negatively related to cooperation within the household?
vi) Is one's position in the social network in the village related to security in land tenure, thereby affecting productivity decisions?
vii) Are women and other household members deterred from investing in productive inputs because of fear of expropriation or loss of control over their individual plots, or because of credit constraints?
viii) How does the packet affect the allocation of women's labor among farm, household, and nonfarm income-earning activities? How does this impact their household bargaining power, and the health and education of children?
ix) Does the packet reduce food availability from the gendered crop cultivation of women (vegetables, legumes); does it reduce household dietary diversity and women's income?

Anticipated Impacts

The challenges of promoting staple cereal seed market development in the West African Sahel are considerable. In Burkina Faso, we will engage with the national agricultural research institute (INERA), farmer associations, and seed sector actors during research design, in discussing preliminary findings, and in dissemination of final results. Our outreach activities, led by INERA, will include agricultural policymakers, donors and the Burkinabe agricultural research community. This engagement will enable local Burkinabe researchers and policymakers to better understand the project's final results, and be able to communicate these results correctly through dissemination conferences at the local and regional levels.

Our research also contributes to national projects that are part of a larger research and policy framework "Guiding Investments in Sustainable Agricultural Intensification in Africa (GISAIA)", which is funded by the Bill & Melinda Gates Foundation and managed by the Food Security Group at MSU. The vision of the project is to respond to the expressed need, by governments across Sub-Saharan Africa, for technical guidance in the design of input programs. Linking to this umbrella effort will enhance our potential to bring credible research findings into high-level policy discussions. By linking to GISAIA, we increase the potential impact of our research on policy processes. Our project also links closely to USAID's current program in Burkina Faso, which helps farmers market their products and expands their access to credit, while ensuring appropriate natural resource management under harsh growing conditions and high levels of food insecurity. In line with these challenges, our research considers how to tackle raising sorghum productivity in Burkina Faso and similar regions in Mali.

HOUSEHOLD-LEVEL IMPACTS OF *SYSTEM OF RICE INTENSIFICATION* (SRI) IN HAITI: An SRI intervention with training, insured credit, and coordination by irrigation bloc

PRINCIPAL INVESTIGATORS

Michael Carter
University of California, Davis
Travis Lybbert
University of California, Davis
Robers Pierre Tescar
Université d'Etat d'Haïti

Haiti is one of the poorest and most food insecure countries in the world, and improvements in productivity for staple crops such as rice are crucial to improve rural income and food security. The System of Rice Intensification (SRI) is touted as a high-yielding low external input rice cultivation method that can increase rice yields and improve household welfare, but these claims remain controversial and inconsistent with the widespread dis-adoption observed in some contexts. Evidence of SRI's impact on household income is mixed because the bundle of practices reduces easily quantified inputs such as seeds and fertilizer, but demands more labor, which is difficult to properly estimate. Additionally, SRI demands more precise water control, which often raises classic coordination problems with a shared local irrigation infrastructure. Addressing these coordination constraints may raise adoption rates and increase the benefits of SRI, but little is known about the magnitude of these constraints and their determinants.

Thus, in collaboration with Oxfam America as an implementing partner and the *Faculté d'Agronomie et Médecine Vétérinaire* (FAVM) as our research partner, we are conducting a randomized control trial of SRI to test the household-level impacts of SRI, the effect of coordinated SRI adoption these impacts and the mechanisms behind these coordination effects. The design of this intervention allows us to exploit a dose response approach to rigorously evaluating these effects. Several organizations, including both USAID and Oxfam, are planning to scale up SRI interventions in Haiti in the coming years. Elsewhere in the developing world, hopes are similarly high for massive gains due to SRI. This study aims to inform these programs and supporting policy work by providing a unique evidence basis for these expectations and intervention strategies.

COLLABORATIONS

- Faculté d'Agronomie et de Médecine Vétérinaire (FAMV) at Université d'Etat d'Haïti is coordinating fieldwork research activities.
- Oxfam America is our implementing partner and will fund the entire cost of the intervention

CAPACITY BUILDING

Implementation of the intervention will take place in conjunction with several local partners, including RACPABA, a comparatively large cooperative association of small-scale rice farmers, and several smaller rice cooperatives and associations, AILA, and MAFLPV. A direct impact of the intervention will be the strengthening of these associations.

In addition, the project builds a collaborative research relationship with faculty from FAMV, who will be in a position to continue such research on agricultural development in Haiti and incorporate impact evaluation into future agricultural programs. By working with the premier university in Haiti and Oxfam, who has substantial contacts and experience on the ground, this project builds a foundation for future research and development collaboration for SRI promotion and other agricultural development programs

ACTIVITIES

Our project was funded June 15, 2013 and thus has few activities to report. During Summer 2013 we completed some preparation work. From October 1, 2013 to September 30, 2014, our priorities will be finalizing details for project implementation and implementing the first round of the household survey. In October we met with our partners in Haiti to develop a detailed project implementation plan that includes farmer training, an insured credit program, and technical assistance/monitoring over the course of the season. We also plan to develop and test a household survey to be used for baseline data collection beginning in January 2014 as well as follow-up data collection over the course of the project. Following baseline data collection, we will be involved with Oxfam in program implementation throughout the planting season.

During our research trip to Haiti, October 13-25, 2013 we

- Participated in a three-day program planning meeting with Oxfam America Staff from both headquarters and the Haiti office to discuss program details, including:
    - Canal and drain cleaning in treatment and control blocs
    - Agricultural credit to support SRI production by linking farmers with local credit union
    - SRI training, information, and technical support
    - Support for intra-bloc water management and maintenance of secondary and tertiary canals
- Met with partners at FAMV (Faculté d'Agronomie et Médicine Vétérinaire) to discuss budget details, plans for mapping the study area, work that student interns have been conducting in the Barr blocs, and plans for the baseline survey.

- Discussed survey details and budget with one potential survey consultant.
- Observed field visit with OA field staff, staff from the Artibonite Valley Development Office, and local media representatives during which SRI yields were measured in the Barr blocs.

Evaluation of pilot program
From October to December 2013 we will, along with our faculty partner and two student interns, undertake a small evaluation of the Barr program implemented by Oxfam in 2013. Evaluation will include agronomic/yield assessment of SRI compared with traditional methods and a small household survey. This survey will provide preliminary information upon which to evaluate the household impacts of SRI as well as provide an opportunity to test a household survey before the larger scale baseline survey to be implemented in the four study blocs.

Mapping of selected study area
From October-November 2013 we will create maps of the two selected control blocs and two treatment blocs to identify each plot/farmer with the plot's location relative to irrigation canals and drains and with approximate land area of each plot. Land area will be used to determine the credit limit for each plot, based on SRI costs per hectare. Plot location will be important to answer questions about the dependence of adoption rates and success of SRI on proximity to canals/drains and on SRI adoption in neighboring plots.

Baseline survey
From January-March 2014 we will develop, test, and implement a household survey in treatment and control blocs.

Program implementation
From March to September 2014 we will train farmers in SRI using farmer trainer model, put in place technical assistance/follow-up program with farmers recruited from treatment blocs, and provide insured credit to farmers in treatment blocs (standard credit to farmers in control blocs). We may also undertake some water management activities such canal/drain cleaning provided (potentially rolled into credit), and training in water management to encourage farmers to manage and clean secondary and tertiary canals and drains in their blocs.

RESEARCH QUESTIONS & INTEDED IMPACTS

Informed SRI Scale-Up, Collaboration, & Research Capacity

Through collaboration with FAMV, Oxfam, and local farmers' associations, we have the

opportunity to influence future agricultural development policies and research in a region in Haiti where improving agricultural incomes is crucial for alleviating poverty and food insecurity. This project will inform future roll-out of agricultural development projects on a larger scale and build research and extension capacity of our partners in Haiti.

Strategies for program scale-up
Oxfam and its partners will continue promotion of SRI and associated efforts to improve production, processing, and marketing through the *Artibonite Valley Livelihoods Program* after this project concludes. Findings from this study will provide insight into the benefits of a concentrated intervention for targeted farmers and inform the feasibility of scaling up a similar intervention throughout the Artibonite Valley or in other regions of the country. The lessons learned and experience gained through will also be used to influence the activities and leverage the resources and experience of other development organizations, the government, private sector, and other applicable stakeholders. The complementary USAID WINNER project, which is promoting SRI in other regions of Haiti, is a likely beneficiary of this project.

This project's activities are already closely aligned with the goals of the Ministry of Agriculture's sectorial plan for developing the rice value chain, increasing productivity, and modernizing rice production processes. By demonstrating the effectiveness of the proposed interventions, the government could enact similar interventions backed by the more than $770 million it has planned for agricultural reconstruction. Other development actors could apply these methods, as could actors like RACPABA. Equally, if not more, important though, will be efforts to involve such actors (especially the government) in the project so that they have a say in program design, develop ownership of the activities, and learn from them first hand.

Finally, in part, our research design aims to elucidate mechanisms behind SRI impacts. Based on what we learn, there may be broader validity of these results beyond the Haitian context. For example, Oxfam America has a portfolio of SRI initiatives worldwide and is eager to learn how and where to modify these initiatives to improve the impact on rural household welfare. We anticipate this project spawning wide discussions within Oxfam on this topic. Moreover, our rigorous research design stands in contrast to much of the SRI literature, which often reads more like advocacy than research, we believe our work will have an important impact on SRI initiatives by contributing to a solid evidence base.

A MULTIPLE INTERVENTIONS APPROACH TO INCREASING TECHNOLOGY ADOPTION WITH A VIEW TOWARDS SCALING-UP: Evidence from Mexico

PRINCIPAL INVESTIGATORS

Aprajit Mahajan
University of California, Los Angeles
Enrique Seira
Instituto Tecnológico Autónomo de México
Xavier Giné
World Bank
Carolina Corral
Qué Funciona para Desarrollo (QFD)

Crop yields in much of the developing world remain below potential partly due to low adoption of profitable technological packages (e.g. improved seeds and fertilizer). In Mexico alone, average maize yields among smallholders without access to irrigation are below 2 tons/hectare, similar to those in Africa. We plan to implement an experimental evaluation of the Trust Funds for Rural Development's (FIRA's) Technological Guarantee Program (TGP) targeted at Mexican maize smallholders. The TGP hopes to increase maize yields among smallholders by simultaneously addressing the main barriers to adoption: risk aversion plus lack of formal insurance, credit constraints and lack of information. The program comprises five distinct interventions: a) a personalized soil analysis allowing for optimal input recommendations by agricultural extension workers (AEWs) who will monitor package application, b) credit to purchase recommended inputs, c) the provision of an income guarantee conditional on adoption intended to reduce adoption risk, d) financial incentives for AEWs based on farmer yields and finally e) the project will measure all inputs and non-farm activity in a comprehensive and detailed manner with multiple visits to farmers.

COLLABORATIONS

- We partnered with Fertilab to conduct the soil analyses. Fertilab is a top-tier soil laboratory in Mexico and is the only Mexican lab approved by the North American Proficiency Testing Program (NAPT).
- We also started a new partnership with Agroquímica who provided the foliar fertilizer package ECOVERT that is tailored for the needs of the soils in the region.
- QFD (Qué Funciona para el Desarrollo) is our research partner on the ground in Mexico. They have primary responsibility for the day-to-day project implementation.

OUTPUTS

- Qué Funciona para Desarrollo, "Baseline Report." September 2013.
- "A Multiple Interventions Approach to Increasing Technology Adoption: Evidence from Mexico," presentation by Aprajit Mahajan´s presentation to BASIS AMA Innovation Lab Technical Committee Meeting, September 12, 2013.

CAPACITY BUILDING

Each farmer in the treatment group received a soil analysis report as well as a 45-minute training on soil analysis and the importance of balanced nutrition. This information was conveyed during one-on-one meetings by one of our seven agricultural extension workers (AEWs) who were also in turn trained by the program on the use of conservational agricultural practices developed by CIMMYT. The AEWs and have been trained extensively on data collection and analysis. In addition, they have also spent time learning about the various characteristics of the agricultural production process for small farmers in Mexico. This schooling in agriculture has proved to an invaluable part of the students training and we expect some of them to further pursue issues related to agricultural research. In addition, we hired five students from Instituto Tecnológico de México to serve as research assistants. These students are responsible for the daily monitoring of the incoming data from the surveyors.

ACTIVITIES & ACHIEVEMENTS

Agricultural Extension Agent Intervention
QFD trained seven Agricultural Extension Agents (AEW) using CIMMYT`s Conservation Agricultural Protocols to perform six visits during the spring/summer cycle that were designed to help farmers implement season appropriate activities as well as monitor their progress. Each AEW is equipped with tablets that were custom programmed with CIMMYT's Maize Surveys for México. The Tablets also have GPS locators and cameras to monitor crop development and check on AEW presence at the plot.

The FIRA Technological Guarantee Program (TGP)
In January 2013, we started the implementation of an experimental evaluation of the Trust Funds for Rural Development's (FIRA's) Technological Guarantee Program (TGP) targeted Mexican maize smallholders in Tlaxcala. The TGP hoped to increase maize yields among smallholders by simultaneously addressing the main barriers to adoption: risk aversion plus lack of formal insurance, credit constraints and lack of information.

The program included six distinct interventions

1. Soil Analysis and Free Personalized Recommendations, performed by specialized technicians about using inputs such as seeds, fertilizers, pesticides, herbicides and conservation farming methods;
2. Credit at a low interest rate, to purchase the recommended technology package;
3. Contingency Insurance, which will cover the cost of credit acquired in case of total or partial loss contingencies harvest weather as frost or drought;
4. Frequent site visits by a trained technician on Conservation

Agriculture in order to verify the correct use of inputs and provide advise on how to improve crop quality and soil;

5. Contract Farming, to guarantee that farmers can sell their products at fair prices; and,
6. Guaranteed Income, enabling program participants to receive a guarantee of their income so that after harvest receives at least the same income that would have obtained using traditional farming methods.

Low Take- Up of the FIRA Technological Guarantee Program (TGP)

Although the TGP program had much diffusion through promotion sessions with farmers and local authorities and received attention of the local media through radio, television and the newspapers, the demand for the program was limited. Out of the 12,294 potential farmers, only 966 farmers attended the information sessions in January 2013. Moreover, only 234 farmers decided to register to the program in February 2013, and only 152 were approved by the National Bureau of Credit to receive the credit package of 1,250 USD in March 2013.

Given the low take up of the program due to income constrains and lack of appetite for large loans, the we decided we should consider alternative designs for our evaluation. We nonetheless carried out the activities financed by FIRA.

Extension Agent and Soil Analysis Program (EASA)

In response to the low uptake of FIRA program, we designed and implemented the Extension Agent and Soil Analysis Program (EASA), which addresses some of the barriers to the adoption of technology (information constraints, credit constraints, and risk constraints). Specifically, EASA offers:

- Free soil analysis and personalized recommendations;
- Frequent plot visits of agricultural extension workers; and,
- Subsidized foliar fertilizer (to address concern that farmers may not have necessary resources to purchase yield improving inputs).

For delivery of the foliar fertilizer intervention, we partnered with Agroquímica, an experienced fertilizer producer that develops packages adapted for different soils in Mexico. The seven extension workers trained by Agroquímica and QFD provided technical assistance and water pumps to the 90 farmers who participated in the foliar fertilizer intervention.

FINDINGS & LESSONS LEARNED

Low Take-Up of the FIRA Technological Guarantee Program (FIRA)

Examining the low take-up of the FIRA program, farmers were asked why they did not apply for the Technological Guarantee Program. The most common answer, among 22.4 percent of respondents, was that input packages are too expensive. The 2nd most common response, at 11.1 percent of respondents, was that they feared they would lose their collateral. Another 10.6 percent said that they didn't apply for fear that the insurance won't pay if they lose the crops due to poor weather.

Because of these identified constraints, the evaluation team designed the EASA program to respond to the barrier to technology adoption identified by those farmers who did not apply to FIRA; the small farmers do not adopt technologies for lack of information and credit or liquidity constraints.

Soil Testing and Analysis

In the first year we have carried out more than 362 soil analyses for small farmers in Mexico. The results from the soil analysis indicate that (a) there is considerable heterogeneity in the soil characteristics of plots even within relatively homogenous agro-climactic zones and that (b) farmer input use (fertilizers) is not based upon the specific needs of their plots. In following years, we plan to build on these two findings to help develop ways for farmers to improve their yields with this improved knowledge of their plot characteristics.

COMPLEMENTARITIES OF TRAINING, TECHNOLOGY, AND CREDIT IN SMALLHOLDER AGRICULTURE: Impact, Sustainability, and Policy for Scaling-up in Senegal and Uganda

PRINCIPAL INVESTIGATORS

Stephen Smith: George Washington University
Ram Fishman: George Washington University
Munshi Sulaiman: BRAC International
Sarah Ssewanyana: Economic Policy Research Center (EPRC)
Abdoulaye Diagne: Consortium pour la Recherche Economique et Sociale (CRES)

Many proven technologies and improved farming practices hold great promise for boosting agricultural production and reducing poverty in developing countries, but the adoption of such technologies by smallholder farmers, in particular in Sub Saharan Africa, has been slow. Barriers to technology adoption, such as up-front costs, absence of effective and reliable supply chains, and information gaps are prominent and often work in tandem. A farmer may be reluctant to make what she would consider risky and large investments needed to apply an unfamiliar technology. Combining an initial subsidization and easy supply of inputs and/or capital with training and demonstrations can, in theory, help address this obstacle. Once farmers have been convinced of the technology's benefits, and had a successful and affordable initial experience with it, they should be more willing to re-invest (some of) the profits in the inputs and maintenance required to continue using the technology effectively, thus making its usage financially self-sustaining. Our research will evaluate two programs' impacts on income and nutrition, and will focus on the degree to which participating farmers make the required investments sustainable; the financial, behavioral or other obstacles they face in doing so; and whether additional policies help farmers overcome these obstacles.

Senegal
We will evaluate the impacts of cooperative management on a program promoting drip irrigation for vegetable production. Drip irrigation is widely considered a promising technology for sustainable agriculture, as it can achieve a simultaneous increase of yields and a decrease in inputs such as water, fertilizer and pesticides, and has a high rate of return on investment. Its potential for poverty alleviation is high. However, efforts to introduce drip irrigation to smallholders in the region have often resulted in underperformance, thus leading to dis-adoption and abandonment.

Uganda
We will take advantage of a planned scale-back of a BRAC Uganda program designed to increase improved technology adoption with subsidies and training in a program promoting fertilizer with improved seeds use. We willwork directly with project implementers to randomize which villages are removed from the program when, allowing us to use a reverse-RCT methodology to assess program impacts.

COLLABORATIONS

Our model of linking field research with national policy making through close cooperation with the leading local policy think tanks, Economic Policy Research Center (EPRC) in Uganda and Consortium pour la Recherche Economique et Sociale (CRES) in Senegal, both of which have a long standing relationship with our partner, the Brookings Africa Growth Initiative (AGI) is based on close collaboration. Brookings AGI works with both EPRC and CRES, and is actively seeking opportunities to further assist with building their policy research capacities.

EPRC and CRES will both participate in the field research, and place it in the broader context of national agricultural policy thorough the preparation of policy papers to be conducted through interaction with and guidance from Brookings AGI and the George Washington University Economics Department.

CAPACITY BUILDING

Our local think tank partners, EPRC in Uganda and CRES in Senegal, will make substantial contributions to the overall product and will take an active part in all aspects of the research. As a result, they will gain in capacity in three main ways. First, they will learn about rigorous and effective policy analysis in a hands-on way. Second, as an aspect of its ongoing work with EPRC and CRES, Brookings will support their thinking on best practices on how to "translate" academic field research into policy impact papers. Third, EPRC and CRES researchers will gain experience in design and execution of impact evaluations. This experience will be complemented by formal training workshops, conducted by Yao Pan at EPRC in experimental design and econometrics in Kampala and by Ram Fishman at CRES in Dakar on research methods.

BRAC Uganda, which already has one of the best research and evaluation capabilities in East Africa, will gain enhanced capacity in research methods and field studies. BRAC Uganda has the solid foundations needed to benefit most from working with US researchers.

In Senegal, field research will be conducted in close cooperation with ANIDA (l'Agence Nationale d'Insertion et de Développement Agricole) and MASHAV (Israel's Agency for International Development Cooperation) with whom one of the investigators has a long-standing relationship (Pasternak). Researchers from ANIDA will take an active part in the experimental design, data collection and analysis, and will be invited to receive formal training in impact evaluation and statistical analysis from the co-investigator (Fishman).

ACTIVITIES

Planned research: Senegal

Our research will analyze the impacts and sustainability of PAPSEN, a project by the Israeli, Italian and Senegalese governments to promote irrigated vegetable cultivation in Senegal. At the heart of the program is the Techno-Agricultural Irrigation for Poverty Alleviation (TIPA) model, based on the African Market Garden (AMG), which combines drip irrigation with an input package, and has been proven in field trials to deliver high rates of return. Dov Pasternak, one of our co-investigators, developed the AMG while he was serving as principal

scientist at the ICRISAT Sahelian Center. By relaxing labor constraints of traditional manual delivery and distribution of irrigation water, this model may allow farmers to increase their cultivated area and revenue generated during the dry seasons fourfold or more.

The TIPA model combines intensive extension, supply of inputs and marketing services for rapid profitability. Over three years, a service center in Bambey will provide centralized training, demonstration, a reliable fertilizer supply, improved seeds and pesticides, and marketing support with PAPSEN funding. In addition, extension agents will make weekly visits to each village to monitor each plot. PAPSEN will provide low-pressure drip systems at no cost, to be installed on public land in participating villages.

Planned research: Uganda
Launched in August 2008, BRAC's agriculture program seeks to increase the usage of fertilizer and improved seeds and thus the productivity of low income, smallholder women farmers, by providing extension and supporting a network of model farmers and community agriculture promoters (CAP). The program operates in 41 districts in Uganda, engages 800 model farmers, who were selected among poor, marginalized women, and reaches 40,000 general farmers. Model farmers received six days of training in crop production techniques, new crop varieties and pest control, as well as follow-up refresher courses. Then, they were made responsible for providing a three-day training activity for other ("general") farmers in their villages. Community agriculture promoters (CAPs) were also selected from the same populations to procure and sell improved seeds and fertilizers in the villages.

RESEARCH QUESTIONS & INTENDED IMPACTS

Senegal

Encouraging input use
A customized package of complementary inputs like improved seeds, fertilizer and pesticides is key, but under-investment in these inputs has also been identified as a pervasive problem plaguing earlier AMG dissemination attempts. A low rate of input use can be the result of liquidity constraints, knowledge gaps, and behavioral factors. To deal with an initial lack of funds, PAPSEN will provide these inputs to farmers at no cost during the first harvest cycle, but later, costs will be recovered and farmers will be required to purchase the recommended package of inputs at full cost, or be excluded from further participation. By linking decisions on input use with overall participation in the project, and thus raising the costs of under-investment, project leaders expect that farmers will choose to follow expert advice instead of applying sub-optimal quantities of water and fertilizer. To track and measure input use we will conduct three field surveys of farmers' associations and individual households belonging to both treatment and control groups: a baseline survey, a midline survey two years into the project, and an end-line survey at the fourth year of the project, about a year after the intervention has ceased. In addition, we will also utilize detailed records of farmer specific input use and seasonal yields collected by the project staff.

Promoting lasting change
Drip irrigation is relatively inefficient and unattractive for smallholders with limited access to credit, and small plot size has been identified as a key factor leading to dis-adoption. A natural approach to overcoming this obstacle is to install collective AMG systems with farmers' associations, which are common in Senegal, especially with women farmers. Each group will enter a formal

agreement with PAPSEN, and nominate a Village Animator, who will be trained to manage and operate the water supply and irrigation system. Cooperative models of production have a long tradition in agriculture. Despite their advantage in economies of scale, these models can also introduce challenges. The coordination and collective action challenges related to system maintenance, which is crucial to the model's sustainability, are especially difficult once external intervention withdraws.

Collective action versus learning by doing
Two variants of the TIPA model will be applied in randomly assigned villages, the cluster and the communal models developed by Woltering, Pasternak and Ndjeunga in 2011. In the cluster model, water delivery infrastructure is cooperatively managed, but each farmer makes independent crop choices and controls the application of inputs and water. In the communal model, all farmers plant the same crops, as chosen by the group, and inputs and water are applied to all fields through centralized operation. The communal model places greater stress on farmer associations' capacity for coordination and collective action, and over time, may increase the chances of their disintegration. From that perspective, the sustainability of the model will depend on the ability of the farmers' group to develop institutions for collective action to replace the authority of the PAPSEN coordinators and to deal with free-riding behavior after the project ceases. Shifting input decisions from farmers with no experience in horticulture to an intensively trained field manager, may help uniform compliance with the extension agent's recommendations, and result in effective learning and habit formation.

We will evaluate the tradeoffs between these two approaches— collective action versus learning by doing— in terms of short-term and long-term impacts using a randomized control trial across villages.

<u>*Uganda*</u>

What strategies best achieve usage of improved inputs?
Not all areas participating in the program are served by both CAP and model farmers: some areas have only CAP, some have only model farmers, and some have both. In addition, BRAC Uganda also runs a microcredit program, and even though BRAC's financial services are formally separate, there is some geographical overlap between the two programs. One part of our research will attempt to exploit this spatial heterogeneity in coverage of the various program components to study and evaluate their complementarities. BRAC's own estimates indicate that the program has had substantial impacts on the usage of improved seeds and other farming practices. Preliminary results (village level intent-to-treat) of this RD analysis confirm some of BRAC's preliminary findings at the village level, but also suggest that results depend on strong complementarity with the presence of micro-finance services.

Are the effects of an agricultural extension program sustainable?
BRAC is now planning to withdraw CAP and model farmer support from certain randomly selected villages; this provides a unique research opportunity to both study the complementarities between the program's components (demonstration, training, and a subsidized, accessible supply chain) as well as the impacts of various forms of program withdrawal. Support will be phased out, with half the villages randomly selected to receive continued services for an additional two years. Accordingly, our second line of investigation will employ randomized control trial (RCT) methods to examine the impacts of scaling back support for either model farmers, who provide training to general farmers, community agriculture promoters, who provide advanced agricultural inputs, or both, as well the impact on long-term outcomes of prolonging the intervention by another two years.

SAVINGS, SUBSIDIES, AND SUSTAINABLE FOOD SECURITY IN MOZAMBIQUE

PRINCIPAL INVESTIGATORS

Dean Yang
University of Michigan
Michael Carter
University of California, Davis

What are the short and long run impacts of fertilizer subsidies on smallholder farmers? Do subsidies have greater long-run impacts when they are provided in combination with savings? Are savings matches effective at motivating farmers to begin saving, and do farmers continue saving on their own once matches end? How do group-based incentives for savings differ in their effects from individual-based incentives? The implementation of a program in 2010 that provided input support to smallholder farmers in rural Mozambique offered BASIS the opportunity to shed light on these questions using a field experiment among farmers in rural Mozambique. Fertilizer vouchers were distributed in a randomized fashion to a sample of farmers. In partnership with a local financial institution, we also randomized offers of savings accounts to farmers. Some savings accounts were ordinary accounts with standard interest rates, while others were matched savings accounts with match rates of 50%. A random lottery was used to determine the specific savings intervention offered to each farmer group.

Several sub-Saharan African countries have implemented large-scale fertilizer subsidy programs in an attempt to boost the productivity and food security of small farmers. With the recent global escalation of food prices, other countries in Africa and around the world are considering similar fertilizer subsidies. This is a key moment to quantify the short-term impacts such programs have on farm output, and also to investigate if there are ways to ensure that longer-term impacts endure after subsidies are phased out. Do farmers continue to invest in and utilize the improved technologies and the higher-yield inputs that were available to them under subsidies? The key to determining whether provision of subsidies leads to long-term growth, even after the subsidies are no longer in effect, is to discover if farmer practices change fundamentally or whether these practices change only in direct reaction to the availability of subsidies.

COLLABORATIONS

- The International Fertilizer Development Center (IFDC) works in close partnership with the University of Michigan. IFDC Mozambique provided their agricultural expertise, contributed to the completion of the randomization of the agro-input subsidy and banking services, and to the implementation of the surveys.
- Banco Oportunidade de Moçambique (from Opportunity International) is the local provider of banking services and financial trainings.
- The project evaluates an agro-input subsidy program funded by the European Union and implemented by the Ministry of Agriculture of Mozambique, the FAO, and IFDC.

OUTPUTS

- Carter, Michael R., Rachid Laajaj and Dean Yang. *The Impact of Voucher Coupons on the Uptake of Fertilizer and Improved Seeds: Evidence from a Randomized Trial in Mozambique*. American Journal of Agricultural Economics. 2013.
- BASIS Brief no. 2013-02. *Eyes Wide Open or Shut: Changing Decision Horizons amongst Poor Farmers*, by Rachid Laajaj. December 2013.
- BASIS Brief no. 2010-04. *Subsidies and the Consequences of Drought: a Field Report,* by Rachid Laajaj and Aniceto Da Fonseca Matias. July 2010.
- BASIS Brief no. 2010-02. *Savings, Subsidies and Sustainable Food Security in Mozambique,* by Michael R. Carter, Rachid Laajaj and Dean Yang. May 2010.
- Carter, Michael, Rachid Laajaj and Dean Yang. 2011. *Savings, Subsidies and Sustainable Food Security: A Field Experiment in Mozambique*. Working paper, University of Michigan.
- Laajaj, Rachid. *Closing the Eyes on a Gloomy Future: Psychological Causes and Economic Consequences.* Working paper, Paris School of Economics.

Presentations

- Dean Yang, Rachid Lajaaj, and Michael Carter. "The Heterogeneous Impact of Agro-Input Subsidies on Maize Production: A Field Experiment in Mozambique. American Economic Association Annual Meeting. 5 January 2013.
- Rachid Laajaj. *Closing the Eyes on a Gloomy Future: Psychological Causes and Economic Consequences*. The Pacific Conference for Development Economics (PacDev) 2012. University of California Davis.

CAPACITY BUILDING

- Rachid Laajaj, a PhD student at the University of Wisconsin, participated actively in these research activities as part of his studies.
- The IFDC office in Mozambique had limited experience in conducting a rigorous impact evaluation prior to this research project; through collaboration with the BASIS researchers, their ability to conduct future evaluations was greatly enhanced.

ACTIVITIES

75 villages were selected based on their location in the Manica Province and access to Banco Opportunidad for the savings intervention. Farmers were selected on four criteria:

- Small scale farmer (between 0.5 and 5 hectares of maize)
- "Progressive farmer" (aiming for modernization)
- Access to the extension and input and output markets
- Ability and willingness to pay for the remaining 27 percent of the cost of the package (subsidy covered 73 percent).

Farmers were randomized within each village, with half of participants selected to receive a voucher. In partnership with a local financial institution, Banco Opportunidad, we also randomized offers of savings accounts to farmers. Some savings accounts were ordinary accounts with standard interest rates, while others were matched savings accounts with match rates of 50%. A random lottery was used to determine the specific savings intervention offered to each farmer group.

During March-April 2013, the second follow-up study of the pilot sample was completed, with 338 farmers responding to a questionnaire (against a target of 361).

Maize seed (6 kg per household, of the variety PRIS 601) was distributed to all respondents in the pilot survey of March-April 2013 and the main survey of June 2013, to thank them for their participation to the study and as a compensation for farmers in the control group who answered multiple waves of survey, knowing that they have not be chosen to benefit from the survey. They have all been thanked for their patience, answering the four waves of surveys. Many farmers manifested a curiosity to know the main results from the study.

The third follow-up survey occurred from June 2013 to August 2013. Of the 1,589 households that were included in the study, we managed to survey 1,479 households. This means that the attrition rate was only 6.9%. It is lower than in the second follow-up survey (10% attrition) because the coupling of the survey with the seed distribution increased the participation of the households in the study.

December 2013 marks the end this impact evaluation. It is a successful cooperation between IFDC and University of Michigan as well as with Banco Oportunidade. The team manager has done a remarkable work in the management of the survey teams and all other operations.

IFDC is implementing other voucher interventions and is eager to know the long-term impact of the program. Discussions in the Maputo IFDC office have contributed to the learning from their previous experience in order to adapt the future implementations. A large-scale communication event, drawing lessons from the Mozambique's voucher program is planned for 2014.

FINDINGS

The preliminary results show that being selected to receive a voucher for the agricultural season 2010-2011 led to a 23% increase in maize yield during the year in question, but also that this increase was persistent over time even if the voucher was only for one agricultural season. The average maize yield in the two following seasons was 19% higher than the farmers who did not benefit from the voucher in 2010. The

beneficiaries also increased their production of crops other than maize by 62%, which indicates that the maize voucher increased the diversification of their livelihood. The program also allowed beneficiaries to increase the value of their assets over time (by 22%), and to increase their consumption (by 9%). They are also 4 percentage points more likely to have made improvements in their housing (walls, ceiling, etc.) during the following two years.

Despite these positive welfare impacts, however, overall uptake was quite modest. This suggests that there are other constraints at work preventing the target population of farmers from adopting the improved technology.

The matched savings intervention also appears to have increased yield and livelihood substantially. The analysis of the matched savings intervention will be pursued in the following months.

Additional research by the project's associated PhD student, Rachid Laajaj, examined the results of this study to try to gain a deeper understanding of what causes the poor to be reluctant to plan and save for their financial future. Without understanding these causes, interventions may only address the symptoms, rather than the source of the issue, thus limiting lasting change. The evidence indicated that interventions which improve the economic prospects of the poor led to a substantial increase in his time horizon.

Beneficiaries of the agro-input subsidy and the matched savings intervention who were among the poorest increased their planning horizon as a result of their improved economic prospects. Poverty dynamics show that patience is fundamental for an individual to make the investments and sacrifices required to transition toward a higher financial equilibrium. Thus, changing financial practices is key to allowing the poor to make long-term plans and conceive exist strategies

RESEARCH THEME C: SYNERGISTIC PACKAGES OF FINANCIAL AND TECHNOLOGICAL INNOVATIONS

Upward mobility for small-scale farmers may not only require risk mitigation and connections to markets, it may also require access to the financial resources that would allow farmers to invest and experience a discrete jump in income and productivity. In much of the developing world, productivity continues to fall short of potential, in part due to low adoption of input technologies that could improve yields. While a broad consensus agrees that small-scale farmers face many prospective barriers to technology adoption (including lack of information, lack of technical knowledge, risk aversion, liquidity constraints, etc.), there is limited rigorous evidence on the relative effects of these constraints on technology adoption, and on the impact of financial technologies designed to address these barriers.

By simultaneously addressing financial constraints and other constraints to the adoption of improved technologies, a multiple interventions approach have development impact far greater than either of these categories of interventions would have in isolation.

Projects Under Theme C

- *Impact Evaluation of Index Insurance for Small Farmers in the Dominican Republic*
  Michael Carter, University of California Davis
- *Using Index Insurance to Enable to Adoption of More Profitable Agricultural Investments in West Africa (Mali and Burkina Faso)*
  Michael Carter, University of California Davis and Marc Bellemare, Duke University
- *Tailoring Contract Farming to Smallholders in Kenya: Experimental Evidence on Enrollment Impact, Insurance Provision, and Communication Technologies*
  Lorenzo Casaburi, Stanford University
- *Interlinking Weather Index Insurance with Credit to Alleviate Market Failures and Improve Agricultural Productivity in Rural Ethiopia*
  Craig McIntosh, University of California San Diego
- *Disseminating Innovative Resources and Technologies to Smallholders in Northern Region, Ghana*
  Chris Udry, Yale University

Map of Projects: Synergistic Packages of Financial and Technological Innovations

IMPACT EVALUATION OF INDEX INSURANCE FOR SMALL FARMERS IN THE DOMINICAN REPUBLIC

PRINCIPAL INVESTIGATORS

Michael Carter: University of California, Davis

This objective of this project is to offer Dominican farmers new tools to cope with climate risk. The intervention program will include trainings and new weather stations for farmers to access to climate and weather information; trainings and a shared investment program to help farmers implement "climate smart" agricultural practices; trainings and an index insurance product to increase access to risk transfer mechanisms; and trainings and a linked index insurance product to increased access to credit for small farmers. The I4 team will implement a project impact evaluation with a focus on the index insurance.

COLLABORATIONS

This program is a collaborative project that involves USAID, IRI (Columbia University), Swiss-Re, GuyCarpenter, CaribRM, REDDOM (local partner) and BASIS I4 (with significant input from I4 Post-Doctoral Fellow, Thomas Barre). Our primary role is to implement a project impact evaluation with a focus on the index insurance component. In addition, we have been active in several other dimensions of the project. In particular, we are involved in the technical design of the product, data collection, and will be involved in value chain development. Also, we will soon start its training activities with farmers to help them become familiar with the product. These training sessions are also an opportunity for us to distribute discount coupons that are known to help farmers try insurance products, and measure some risk preference parameters that are important for further analysis insurance demand.

CAPACITY BUILDING

Under CRII, the Fundación REDDOM Team will focus primarily on working with three US based service providers, local insurance intermediaries, local financial institutions and national partner organizations, including agriculture clusters, Ministry of Agriculture agencies, Ministry of Environment agencies, international donor community and national

NGOs. Fundación REDDOM will overlay their day-to-day project implementation responsibilities with capacity building activities to establish learning objectives tied to their project implementation responsibilities. Fundación REDDOM will ensure that its technical staff becomes one of the primary and direct beneficiaries in implementing, providing training, designing and evaluating all aspects of an insurance index program, thereby strengthening its capacity, readiness and availability to provide such services when the time for expansion arrives. Specifically, Fundación REDDOM will develop the capacity to access funds through proposing follow up activities on a larger scale for Climate Change Adaptation, Index Insurance programs, poverty alleviation that will increase the circle of direct and indirect beneficiaries, funds, and other national or international donor funds, as well as from national and international private donors and foundations

ACTIVITIES

Beginning in February 2013 we devoted time to choosing the most appropriate crops for this project among coffee, cacao, banana, pineapples, cassava, dairy, and other crops. I4 emphasized the potential development impacts that could be expected for each crop. In May 2013, the group agreed on banana and dairy as the two commodities for which a product would be developed, with the hope that at least one would reach the market. The initial idea was that banana farmers would be vulnerable to hurricanes while dairy farmers would be vulnerable to drought.

In August 2013, I4 organized a trip with REDDOM to meet both dairy and banana farmers/associations. This trip was taken to help us better understand how associations are organized so that we could design an impact evaluation tailored to the local situation. This trip revealed that banana farmers were not very interested in hurricane insurance. The two main risks they identified were “tornados” (these are different from the US definition of tornados, and cannot be tracked by satellite) and a banana leaf disease, *Sigatoka Negra*. The banana side of the project has been abandoned by other partners to focus on the dairy sector due to difficulties in establishing an effective index for the risks identified for banana farmers.

This trip also allowed us to obtain very useful yield data from both dairy and banana associations. I4 took charge of the data cleaning/reformatting so that the data can now be used for index testing. The production dataset obtained from Parmalat, a milk processing company, allowed GuyCarpenter/CaribRM to verify that rainfall records are not good predictors of milk production, but satellite imagery (NDVI) offers a good fit. NDVI maps have been combined with land use maps to focus on pasture areas. The project team is now devoted to the development of an NDVI-based index for dairy farmers. The index has been developed and is currently being discussed with farmers.

GuyCarpenter has hired a local associate to collect information to inform our due

diligence around partner selection. If time permits, his second duty will be to collect additional data from farmers' associations so that the index design can be refined. The most pressing questions that remain unanswered about the design are:

1) Will insurance be offered at a micro or meso-level? In a micro framework, the farmer is the insured entity; in a meso-framework, it could be a lender (bank, input supplier, etc.) or a farmers' association.
2) Will insurance be tied to loans? I4 believes it is very important to improve farmers' access to credit. Otherwise, insurance cannot by itself unlock investment.
3) Will insurance be mandatory? If insurance is tied to loans, will it be an option? Or will it be mandatory?
4) Will we be able to come to an agreement with the delivery channel so that some areas are excluded from the program this year? If no group is excluded, it will be difficult to construct a control group.

Upcoming activities

Researchers still have to define the geographical target of the pilot project. Do we try to reach farmers nationwide or do we first concentrate on specific regions and expand to other areas following a roll-out phase-in planned in advance? REDDOM's activities are concentrated in the Noroeste region. Even if the insurance product is offered nationwide, it will be difficult for us to make the impact evaluation at the country level. We recommend, therefore, doing the impact evaluation only in the Noroeste region, while allowing the insurance to be offered nationwide if the project partners have the capacity to expand to other regions.

EVALUATION DESIGN & POTENTIAL LESSONS LEARNED

We have now a good idea of what the final index will look like, but we still have not determined precise delivery channels. Given this, our impact evaluation is still in the planning stage and will likely be modified. There are 59,000 farmers in DR with 2,000 farmers in our study area in the Noroeste Region. REDDOM has strong relationships with groups of farmers/associations called "clusters". We will probably survey the entire sample in REDDOM's cluster. These farmers are organized in about 40 associations. REDDOM's activities fit very well in our evaluation strategy, and we should be able to estimate the impact of index insurance and adoption of climate change adaptation technologies for both banana and dairy pooled together. Hence we will be able to measure the average effect of our interventions on production strategies and livelihoods, but we might not be able to measure these effects for banana and dairy separately as it would require a too large sample of farmers.

Evaluation Design

The proposed impact evaluation plan is built on the idea that three constraints may limit farmers' investment in climate change adaptation technologies: (i) they lack information on the existence or effectiveness of such technologies, (ii) they believe it is too risky to invest in such costly technologies; and, or, (iii) they are liquidity constrained, have limited access to credit and cannot afford to invest. The interventions developed in this project propose to tackle these issues. In particular, REDDOM's climate change resilience program is designed to primarily address the information constraint and secondarily address risk issues. The index insurance program is designed to reduce the second two constraints (risk and liquidity). Evaluating the efficacy of the program interventions to relax these different

constraints and boost climate change adaptation requires two important elements.

Quasi-random placement of REDDOM co-financed investment
Given the small number of shared investment projects (five to ten) that REDDOM can conduct, we will not be able to evaluate the impact of this specific treatment. However, we will be able to measure the *demonstration effect* that these investments can have on other farmers' choices by comparing *close* and *remote* farmers. Indeed, nearby farmers will presumably learn more than farmers located longer distances from the projects.

Randomized offer of credit-insurance packages
Access to credit for dairy farmers in the Dominican Republic is close to nonexistent today. This impact evaluation plan builds on this fact to estimate the effects of (i) insurance, (ii) credit and (iii) insured credit. The research approach consists of dividing the intervention area into groups (farmers are chosen at random within each group):

- Group 1: No intervention (control group)
- Group 2: Offered standalone index insurance (with discount coupons for insurance) and standard loan conditions (standard conditions tends to mean no loan due to credit market limitations)
- Group 3: No index insurance but improved access to credit (marketing and reduction of interest rates)
- Group 4: Interlinked credit/insurance product (with both marketing and interest rate reduction, as well as discount coupons for insurance)

Potential Lessons Learned
The proposed impact evaluation design will allow us to disentangle the channels through which these programs causally impact farmers' behavior and situation. Our main outcome variables could be measures of investment, income, and variance/stability of income and assets. Indeed, we expect to see that treated farmers invest more on their farms to anticipate climate risk and improve productivity; these investments are supposed to impact their income positively; and with these improved technologies, production risk should be reduced, making income and assets less volatile. Over the longer term, this greater stability could have important welfare benefits for families, such as more consistent investment in schooling for children, but detecting these longer-run effects will likely be beyond the scope of our evaluation.

If farmers don't adopt climate change technologies because they don't have the necessary financial resources to do so, we have to work with lenders to make sure that our index insurance product helps increase the supply of credit. Interlinking credit and insurance offers a solution by providing lenders with the assurance that loans will be repaid if a covered disaster happens. Our evaluation plans allows us to measure this credit supply/demand effects to determine if the treatments are effective in isolation or if they are more effective together. This is the sort of information that can guide future program design.

USING INDEX INSURANCE TO ENABLE ADOPTION OF MORE PROFITABLE AGRICULTURAL INVESTMENTS IN WEST AFRICA

PRINCIPAL INVESTIGATORS

Michael Carter
University of California Davis
Catherine Guirkinger
University of Namur
Marc Bellemare
University of Minnesota

Cotton farming in West Africa is a potentially lucrative, but highly risky opportunity for small-scale farmers. Given cotton's high cost of cultivation, as well as its vulnerability to the region's extreme weather patterns, events such as droughts can be devastating to farmers. As a result, farmers often choose to minimize their exposure to risk by limiting their cotton cultivation. While this risk management strategy reduces income fluctuations, it is a very expensive form of insurance as it reduces their annual income.

Farmers also organize into cooperatives to help informally insure one another, as well as to gain access to loans. If a farmer has a bad year, the others in the cooperative can help by lending money or, if a farmer has an outstanding loan, by helping with payments. In years with a weather shock that severely diminishes the yield of all those in the cooperative, the collective losses may, however, exceed the capacity of the cooperative to cope. Thus, additional risk management tools are needed to protect them in years with extreme weather and meager harvests and so that they can invest more heavily in production without fear of losing household assets.

Index insurance is a promising form of insurance that can reduce risk while allowing farmers to pursue higher income opportunities. Thus, the I4 team, in conjunction with partners in Mali, initiated an index insurance pilot program in 2011. The team implemented one sales period and a survey before a coup disrupted all activities in Spring 2012. In 2013, the program restarted in Burkina Faso.

COLLABORATIONS

- Planet Guarantee is our implementation partner on the ground, assisting in the provision of education around the product and sales agents.
- Allianz Bank is a financial partner on this project, and the primary insurer.
- Swiss RE is the reinsurer for this product.
- Sofitex (BURKINA FASO) is the government owned cotton company.
- Ecobank (BURKINA FASO) is the largest cotton financer in the country.

OUTPUTS

Print Outputs

- I4 Brief Series, no 2013-01. *Sharing the risk and the uncertainty: public-private reinsurance partnership for viable agricultural insurance markets,* by Michael Carter, March 2013.
- Carter, M., Gelade, W. & Guirkinger, C., 2013 "Analysis of burn costs contracts Swiss-RE and I4".
- Carter, M., Gelade, W. & Guirkinger, C., 2013 "Analysis of New Proposed Strike points".
- Carter, M., Gelade, W. & Guirkinger, C., 2013 "An Optimized Area Yield Insurance Contract for Cotton Farmers in Burkina Faso".
- Elabed, G., Bellemare, M. F., Carter, M. R., & Guirkinger, C., 2013, "Managing basis risk with multiscale index insurance". Agricultural Economics vol 44 (4-5) p 419-431.
- Elabed, G. and M. Carter, 2013, "Compound-Risk Aversion and the Demand for Microinsurance: Evidence from a Willingness-to-Pay Experiment in Mali", working paper.

Presentations

- Carter, M. International Association of Agricultural Economists, Foz de Iguazu, Brazil, August 2012.
- Elabed, G. "Basis Risk and Compound-Risk Aversion: Evidence from a WTP Experiment in Mali". Agricultural & Applied Economics Association Annual Meeting. Washington, DC. 2013.
- Elabed, G. "Compound-risk Aversion and the Demand for Microinsurance: Evidence from a WTP Experiment in Mali". 2013 Symposium on Economic Experiments in Developing Countries (SEEDEC). Norwegian School of Economics, Bergen.
- Elabed, G. "Basis Risk and Compound-risk Aversion: Evidence from a Willingness-to-Pay Experiment in Mali". Pacific Conference for Development Economics (PacDev) 2013. San Francisco State University.
- Elabed, G. "Compound-risk Aversion and the Demand for Microinsurance: Evidence from a WTP Experiment in Mali". Northeast Universities Development Consortium Conference 2013. Kennedy School, Center for International Development, Harvard University.

CAPACITY BUILDING

Three PhD students have been associated with the project. Ghada Elabed at UC Davis has been using the data she helped collect in Mali to conduct analyses and has co-authored several papers. Wouter Gelade at the University of Namur has been heavily involved in contract design and survey preparation. He has traveled to the field

several times and conducted the statistical analysis on the yield data to design insurance contracts. Elena Serfilippi joined the project in 2013. She has been to the field twice and has designed appropriate games to be tested and implemented in the coming months.

ACTIVITIES & ACHIEVEMENTS

Obtaining yield data
To design an appropriate insurance contract for Burkina Faso cotton producers we assembled data for the cotton producer groups (GPCs) in our study region. We acquired the necessary data and estimated contracts for the Provinces of Bale and Tuy located within the Regions Boucle du Mouhon and Hauts-Bassins. Sofitex provided cotton yield data for most GPCs of the Provinces of Bale and Tuy for 12 years from 2000 to 2012. Only GPCs who obtain cotton loans from the bank Ecobank are eligible for a total of 450 GPCs or about two thirds of all area GPCs.

Establishing partnerships with local institutions
Over the past year we strengthened our partnership with PlanetGuarantee (PG). PG established a multilateral agreement involving all institutions: Sofitex, Allianz Africa (the local insurance company), the union of cotton producer (official insurance subscriber), Swiss Re (the reinsurance company for the 2013 distribution).

Computing baseline risk

We analyzed the Sofitex data and designed various insurance contracts that we presented to our partners.

Selecting GPCs as part of the control and treatment groups
We decided to collect base-line data for GPC's that will be presented with a new and more satisfactory insurance contract next year. Specifically, we have selected 35 for treatment and 35 as controls. Insurance was not distributed in 2013 and only treatment GPCs will be eligible for insurance in 2014.

Pricing the insurance contract
Swiss Re proposed high prices for the insurance product and wanted changes in the triggers. Thus, we considerably reduced the area of the project to select 97 GPCs where Swiss Re's proposition was viable.

Assigning GPCs to control or treatment groups
We randomly assigned villages to either the treatment or the control group and then randomly selected GPCs within the villages to be interviewed. The randomization was done by constructing pairs of villages with similar locations, size and historical yields. For each

pair, one village was put in the control group and one in the treatment group.

Preparing fieldwork
Two consultants are assisting us with the selection of enumerators and data collection logistics.

Developing relationships with local institutional partners
We have strengthened our relationships with Planet Guarantee and Sofitex. We have a good working relationship with the company managers and their research department takes an interest in our research activities.

Experimental games
We have decided to add an experimental component to the survey. Specifically, we will play games with farmers to better understand their risk attitude and purchase decision. We want to find out if farmers are deterred from buying insurance given the asymmetry arising from the certainty of having to pay a premium and the uncertainty of receiving a payout.

Challenges that arose during the last year
Some difficulties arose when working with Swiss Re as we disagreed on the pricing of the insurance contract. Swiss Re proposed prices we considered too high and different payout triggers very late in the course of the year and did not share any details on their pricing procedure. We were transparent in our data analysis and contract design, sharing and discussing with them every step of our analysis. Thus, we only offered the product to 97 GPCs and are now in discussion with other reinsurance companies for next years' campaign.

FINDINGS & LESSONS LEARNED

Mali

Low uptake of index insurance
We analyzed the interlinked concepts of ambiguity and compound-lottery aversion and used the experimental games played with cotton farmers in Mali to illustrate the impact of compound-risk aversion on farmers' willingness to buy index-insurance products. Since the presence of basis risk makes index insurance a compound lottery, we derived an expression of the willingness to pay (WTP) to eliminate basis risk. Empirically, we implement this WTP measure using the framed field experiments we conducted in Mali. In our sample, 57% of the surveyed farmers reveal themselves to be compound-risk averse to varying degrees. Using the distributions of compound-risk aversion and risk aversion in this population, we simulate the impact of basis risk on the demand for an index insurance contract. Compound-risk aversion decreases the demand for index insurance relative to what it would be if individuals had the same degree of risk aversion but were compound-risk neutral. In addition, demand declines more steeply as basis risk increases under compound-risk aversion than it does under risk neutrality. Our results highlight the importance of designing contracts with minimal basis risk if buyers are compound-risk averse.

Multiscale index insurance
Multiscale index contracts efficiently reduce basis risk and can increase the demand for insurance. Agricultural index insurance indemnifies a farmer against losses based on an index that is correlated with, but not identical to, her or his individual outcomes. In practice, the level of correlation may be modest, exposing insured farmers to residual, basis risk. We study the impact of basis risk on the demand for index insurance under risk and compound risk aversion. We simulate the impact of basis risk on the demand for index insurance by Malian cotton farmers using data from our field experiments that reveal the distributions of risk and compound risk aversion. The analysis shows that compound risk aversion depresses demand for a conventional index insurance contract 13 percentage points below what would be predicted based on risk aversion alone. We then analyze an innovative multiscale index insurance contract that reduces basis risk relative to conventional, single-scale index insurance contract. Simulations indicate that demand for this multiscale contract would be some 40% higher than the demand for an equivalently priced conventional contract. Finally, we report and discuss the actual uptake of the multiscale contract we introduced in Mali. In the first year of the program, 16 out of the 58 treatment cooperatives (30%) agreed to purchase the index insurance contract. This uptake rate is significantly below that predicted, but well above up-take rates in some other pilot projects.

<u>*Burkina Faso*</u>

Uptake of the insurance product

The contract was distributed from May to July 2013. Roughly 15% of the farmer groups offered the insurance purchased it. A total of 446 farmers have insured 2,331 hectares of cotton. Problems with the reinsurance company led to a restricted sales scope. Feedback from the field was that many of the village groups that did not buy insurance said that they did not because the contract structure was unfavorable.

In 2014, the research team, along with implementation partners, will significantly expand the pilot area in Burkina Faso. In this second year, the research team will also work to improve the offered product in the existing sales areas (Boromo, Hounde). In the next sales period, the product will also be offered in the Dedougou region. In the first round of sales, uptake was about 20 percent of the total target population. As the new sales area is a potential population of approximately 35,000 farmers, researchers expect to insure 7,000 farmers. In subsequent years, the team hopes to expand sales to additional areas, and to increase uptake to insure 50 percent of the target population.

TAILORING CONTRACT FARMING TO SMALLHOLDERS: EXPERIMENTAL EVIDENCE ON ENROLLMENT IMPACT, INSURANCE PROVISION, AND COMMUNICATION TECHNOLOGIES

PRINCIPAL INVESTIGATORS

John Shoven
Stanford University
Lorenzo Casaburi
Stanford University
Michael Kremer
Harvard University
Alphonce Odondo
Maseno University

We are conducting three field experiments in Kenya to evaluate the potential of contract farming schemes to increase smallholder welfare. In the first intervention, a large contract farming company will randomly enroll new farmer outgrowers. In the second, we will pilot tailored insurance products for outgrowers that reduce basis risk and provide innovative premium payment options. In the third, we examine the role of mobile phones to reduce communication problems along the contract farming supply chain.

These interventions are developed in partnership with one of the largest agribusiness companies in East Africa, which runs a contract farming scheme with about one-hundred thousand outgrowers. The evaluation will rely on the rich farmer-level administrative data provided by the company, as well as on agricultural household survey data, with accurate information on agricultural and non-agricultural income, input choices and technology adoption.

COLLABORATIONS

- *Maseno University* (Kenya), the leading academic institution in Western Kenya
- *Mumias Sugar Company* (Kenya), one of the largest agribusiness companies in East Africa
- *Innovations for Poverty Action* (Kenya), has managed several agricultural interventions, focused on fertilizer and index insurance
- *Stanford Institute for Economic Policy Research (SIEPR)* (United States), providing grant administration and dissemination support

CAPACITY BUILDING

Peer Research Collaboration
Juma Alphonce Odondo, a lecturer at the Department of Economics at Maseno University, will play a key role in implementation, data analysis, academic paper writing, and result dissemination.

Academic Capacity Building

- *Academic Course on Evaluation.* In 2014, the researchers will hold a course on development program evaluation methodology at Maseno University. The course will target around ten faculty members and twenty doctoral students.
- *Ph.D. Training and Research Funding.* We will hire at least three Kenyan students to collaborate on field activities and data analysis. Researchers will provide mentoring and provide each doctoral student with research seed grants.
- *Master Student Training: Academic Course on Research Methods.* In 2015, the research team will teach a short course on household survey methodologies for master students at Maseno. We expect about thirty students from three universities in Western Kenya.
- *Degree Scholarships.* The project will provide two promising PA local project staff members with a scholarship to partially cover the cost of a graduate degree in social science.

Policy Capacity Building

- *Course on Randomized Evaluations.* In 2015, the research team will offer a course on randomized evaluations, targeted to about twenty practitioners from Kenyan NGOs focusing on agriculture.
- *Workshop on Contract Farming Evaluation.* Toward the end of the project, the research team will hold a workshop on the impact of contract farming schemes. The workshop will target both NGOs and local government departments working on agricultural value chains and smallholder market linkages.

Partner Capacity Building
Course on Data Management and Analysis. IPA research staff will provide a data management and analysis course for company staff. We expect the course to consist of five sessions with about five company members participating, primarily from the outgrower service department. The goal will be to identify effective ways to manage and analyze outgrower recruitment, input provision, and harvesting services.

ACTIVITIES

Our project received funding in Fall 2013 at which time we began discussions with our partners and drafting contracts. Development of the survey instrument will begin in early 2014. We are planning to implement the survey to determine a baseline from April to November 2014. Randomized enrollment of farmers in the contract farming scheme will begin in June 2014.

Contract Farming Enrollment, Technology Adoption and Agricultural Income
Mumias Sugar Company runs an outgrowing scheme involving approximately 100,000 farmers. The company's standardized outgrower contract commits to purchasing all cane produced on the plot under contract and the farmers commit to selling their cane only to Mumias. The company provides smallholders with inputs on credit, including land preparation, seedcane, fertilizer,

harvesting, and transport of cane to the mill. Input charges (plus interest) are subtracted from farmer payments. The company has agreed to select a subset of farmers following a randomization protocol. The research design will allow us to explore channels through which participation in contract farming arrangements could affect farmers.

First, we will study the impact on household agricultural and non-agricultural income by collecting detailed agricultural labor and wage data. Second, we will assess how enrollment in the contract farming scheme affects technology adoption. In particular, we will measure fertilizer usage in all crops cultivated by the farmer. Third, we will study whether joining the contract farming scheme has an impact on food security. Fourth, we will test whether the likelihood the farmer defaults on the contract (to side sell) depends on the details of the contract, such as the amount of inputs a farmer receives from the company and thus the amount owed at harvest.

Interlinking insurance and contract farming
In partnership with the company, we will design and pilot two interventions to assess insurance terms, distrust, liquidity constraints, and basis risk. First, we will compare insurance take-up when it is either unbundled or bundled with the farming contract. In the unbundled case, the farmer pays for the product at the beginning of the planting cycle. In the bundled case, at harvest time, the company deducts the insurance premium (plus interest) from the payment to the farmers. Second, because our partner company collects accurate data on plot yields we will use these to develop both a rainfall insurance and area yield insurance product.

Farmer hotlines and SMS-based interactive scheme
Large mobile phone penetration amongst rural populations in Kenya provides an important opportunity. In East Africa, mobile phones have proven effective for services such as mobile money transfers, health service delivery, and education. Our research will shed light on how mobile phone usage affects interactions amongst all actors in the farming supply chain (company, farmers, input providers).

Efficient communication is an important determinant for contract farming schemes. The company needs to monitor the plots, for instance by checking whether the farmers have completed crucial tasks such as weeding, and to be able to diffuse information cheaply. The farmers must provide timely feedback to the company about whether land preparation was completed properly or whether fertilizer was delivered at the right time. This is particularly relevant as third-party contractors are in charge of delivering inputs and delays are quite common.

In the first intervention, the company will select a random sample of farmers to access a hotline service for queries about company services, agricultural practices, and other contractual details. Access to hotline records may allow the company to better monitor contractor performance. Increased efficiency in input provision would benefit both the farmers and the company as timely fertilizer delivery could increase yields thus affecting both farmer revenues and company profits.

The second intervention consists of a SMS-based interactive scheme where farmers will be asked to provide feedback on crucial tasks, such as fertilizer application, and weeding. Product design will include testing on prices and message content to identify the most effective way to engage farmers in mobile interactions. Finally, we test the cost effectiveness of mobile-based marketing campaigns relative to the standard in-person agricultural extension approach.

RESEARCH QUESTIONS & INTEDED IMPACTS

Our interventions will assess: i) the impact of farmer participation in these schemes on farmer wellbeing, including income, investment, and agricultural technology adoption; ii) the potential of tailored insurance products to raise uptake among smallholders, and iii) the role of modern communication technologies in improving coordination across different links in the agricultural supply chain. By providing rigorous evidence, we expect to achieve widespread diffusion among academics, policymakers, and private sector agricultural operators.

The role of contract farming, agricultural microinsurance products, and information communication technologies have each received considerable attention in the current agricultural policy debate. Over the last few years, key players in the agricultural sector, such as the Syngenta Foundation and Financial Sector Deepening Kenya, have devoted increasing resources to agricultural microinsurance products. Finally, USAID and others have high hopes for applications that use communication technologies in agriculture to improve farming practices and increase production and welfare.

Our project will contribute to these policy discussions in several ways. First, we expect our experimental analysis to be an important innovation in the understanding of the impact of contract farming on smallholder welfare. Second, both the proposed insurance products and the mobile phone interventions display high scalability potential. Should the pilot prove successful, the partner company has the potential to scale these up to their entire contract farming scheme over a relatively short time horizon. As the prevalence of these schemes is growing in the developing world, the results will be relevant for a large set of players. For instance, we will present our results to the *Kenya Sugar Board* and to other contract-farming companies in Kenya. Even more broadly, other organizational forms— for instance, large farmer cooperatives— could easily adopt the interventions for their members. For example, providing insurance products through deduction at payment time will be easily adaptable to different settings.

INTERLINKING WEATHER INDEX INSURANCE WITH CREDIT TO ALLEVIATE MARKET FAILURES AND IMPROVE AGRICULTURAL PRODUCTIVITY IN RURAL ETHIOPIA

PRINCIPAL INVESTIGATORS

Craig McIntosh
University of California, San Diego
Rene Gommes
Joint Research Center of European Commission (JRC)
Alexandros Sarris
University of Athens
Ahmed Shukri
Food and Agriculture Organization (FAO)

Smallholder farmers are beset by an interlocking set of market failures, and when credit and insurance markets are missing farmers can become trapped in a low-investment equilibrium. Risk-driven reluctance to invest in inputs such as fertilizer and improved seeds may be largely responsible for the fact that Africa has not undergone a 'green revolution'. The obvious policy intervention to protect farmers against such risks would appear to be insurance indexed to local weather conditions, but such products have typically been met by surprisingly low uptake. This project seeks to test whether a simultaneous provision of credit and insurance can solve this puzzle, thereby using innovation in financial services to spur a meaningful expansion of agricultural technology.

We are providing insured credit to smallholder farmers in Ethiopia. Rather than addressing only a credit constraint (in which case risk rationing can remain a barrier) or insurance failures (which reverse the time-inconsistency problem and ask farmers to pay now in faith of a future benefit), we will test a form of rural credit that is interlinked with weather index insurance. The purchased insurance acts as a collateral substitute to receive credit. To this end, we have implemented a two-armed randomized trial in collaboration with Ethiopia's largest private-sector bank and largest private insurance company. One arm offers a standalone index insurance product, and the other arm offers state-contingent loans, interlinking the provision of insurance with the provision of credit.

COLLABORATIONS

- Nyala Insurance S.C (NISCO) in collaboration with UNFAO. ETHIOPIA
- Ethiopian Economic Association (EEA), ETHIOPIA
- Dashen Bank, ETHIOPIA

OUTPUTS

- BASIS Brief no. 2013-02. *Demand for and Productivity Impact of Weather Index Insurance in Ethiopia,* by Craig McIntosh, Alexander Sarris, and Fotis Papadopoulos. December 2013.
- Ahmed, Shukri, Craig McIntosh, and Alexandros Sarris, "Interlinking insurance with credit to enhance smallholder agricultural productivity: a pilot application to Ethiopia", prepared for the FERDI Policy Brief Series.
- Carter, Michael, Lan Cheng, and Alexandros Sarris. "The Impact of Interlinked Index Insurance and Credit Contracts on Financial Market Deepening and Small Farm Productivity",
- Gommes, Rene. Development of yield indices for crop insurance in four zones in Amhara region: N. Shewa and the woredas of Tehu Ladare (S. Wollo), Guba-Lafto (N. Wollo) and Bahir Dar Zuria (W. Gojjam),
- Gommes, Rene. Beyond Simple, One-Station Rainfall Indexes,
- McIntosh, Craig. Determinants of Willingness to Pay and Actual Uptake for a Standalone and Interlinked Weather Index Insurance Product,
- McIntosh, Craig, Alexander Sarris and Fotis Papadopoulos. 2013. "Productivity, credit, risk and the demand for weather index insurance in smallholder agriculture in Ethiopia", *Agricultural Economics (44)*.

Software presented and distributed to project collaborators by Rene Gommes:

1. "PrecProb" (which was "transferred" to Nyala): the programme which computes rainfall probabilities over crop phases as required by the Nyala index. Here are several variants, including one I passed to a colleague working in West Africa. The relevant attachments are PrecProb_20120924, harp_read-me_20120530 and watreq_p_20120223. Harp is the most sophisticated version. It looks similar to the two others, but it was completely rewritten to improve internal logic and efficiency. It is to be used as a rainfall probability mapping tool (used by JRC in the bulletins on the Horn of Africa)
2. a couple of applications of the "Birr family" to compute average payouts for the standard Nyala index using historical and stochastic weather information data (see birr_20120329). I think Birr is a "new" tool in the index-insurance business.
3. other tools (such as the yield indices of 2011) and wb_eth (a water satisfaction based index "technology", which I demonstrated during my latest mission to Ethiopia) did not appeal to Nyala. I guess you still have the documentation about the first. The "manual" of the second is attached: wb_eth_20120221).
4. two notes: one on phenology (phenology_20120210) and the other on spatial variability of rainfall (spatial_variability_20120425; this was the base for the presentation at the Ispra workshop: see above)

ACTIVITIES & ACHIEVEMENTS

The core result that emerged from our first year's sales was that small subsidy vouchers are a very effective way of inducing uptake of weather index insurance. In fact, uptake of almost 40% could be induced by distributing a price voucher worth as little as 100 birr ($6). However, because no vouchers were distributed to the broader membership of the cooperatives, uptake as a whole remained very weak. For this reason we approached BASIS for additional funding to conduct a voucher experiment within the roughly 15,000 farmers who are members of the 34 treatment cooperatives.

Using this money, we distributed price vouchers worth 100 birr ($6) to a random third of the cooperative membership, 200 birr ($12) to a different third, and the final third received no vouchers. As a part of the 2013 Round 3 (R3) survey, the Ethiopian Economics Association (EEA) was asked to construct a list of all active members of the treatment cooperatives, and then using a list randomization in front of the cooperative leaders, to assign the voucher amounts. After the R3 survey, marketing teams traveled to the study villages to present the insurance products and to register sales. All cooperative members could purchase the standalone insurance, those with vouchers could purchase using only the voucher or could also add money to increase the scale of coverage, and members of the interlinked arm were supposed to also have access to a loan from Dashen Bank that would finance the inputs covered by the insurance. In the end we were unsuccessful in the second sales year at getting the Interlinked product implemented. All sales of insurance in the second sales year are therefore for standalone insurance.

We recorded 5,295 subsidized sales and 180 unsubsidized sales of insurance. Farmers typically buy insurance in very small amounts, much less than either the inputs that they actually use or than the recommended amount for the land that they own. Thus, it appears that farmers are still taking a very conservative approach to this index product, experimenting with its use in very small quantities rather than rushing to fully insure. Due to exorbitant factor loadings imposed by Swiss Re the product is costly. Nonetheless, thanks to the vouchers we have obtained a take-up rate of 54% in the subsidized sample.

We are awaiting detailed records from the EEA to measure exact take-up, but from the sales data received in late August 2013, it appears that the vouchers have been a huge success. We sold only 180 contracts to people without vouchers, indicating an uptake rate no higher than 3% for completely unsubsidized insurance. Uptake with the vouchers, by contrast, was slightly higher than the 40% predicted from the Year 1 subsidy exercise. Because the sample given subsidies was so much larger than in Year 1 due to USAID funding, the overall number of contracts sold went from just over 200 in Year 1 to over 5,000 in Year 2. With complete digital records, we can calculate uptake by subsidy amount for each group, and can also estimate the lagged effect of subsidies from the first year in order to try to understand what the knock-on effect of this one year of subsidies for the coming year will be.

We have completed an analysis of the baseline data, looking at how smallholder factor productivity relates to insurance demand, as well as testing how well we did in predicting the actual demand evidenced by the experiment. At present we are analyzing the impact of insurance uptake from the first year using data from the R3 survey, exploiting both the cross-village experiment as well as the within-village experiment generated by the randomized distribution of price vouchers.

FINDINGS & LESSONS LEARNED

Subsidy vouchers are found to be an extremely effective way of inducing large numbers of people to experiment with insurance at a relatively low cost. We have found demand among peasant farmers to be small for index insurance *unless* they are offered an initial subsidy. This suggests that building demand-driven index insurance markets in Ethiopia will be a challenge, particularly as our project has a team, study location, and product specifically designed to be a promising initial commercial market.

We encountered further problems in our attempts to implement the interlinked arm. Despite an ATAI-funded conference held in Bahar Dar in July 2013 specifically intended to bring the Cooperative Union membership together with the management of Dashen Bank, we were not successful in implementing interlinked insurance in the second year. While many of the remaining obstacles appear slight on paper (such as the reluctance of Union management to open an account with Dashen Bank) there is no question that the effort to marry state-driven institutions such as the Cooperative Unions with Dashen Bank has been an uphill effort. The uncertainty over the credit environment in smallholder agriculture has compounded these problems; the government repeatedly has threatened to cut off credit for smallholder fertilizer (in which case our product becomes critical for farmers) and yet has relented later in the season, opening the credit spigot and virtually eliminating demand for private credit.

With these caveats in mind, the project has logged some notable successes. We have now put weather index insurance into the hands of over 5,000 smallholder farmers. The marketing efforts were much more successful on the ground in the second year, and we now recorded sales in every one of the treatment cooperatives. The collaboration with the Ethiopian Economics Association continues to be excellent, and we have three rounds of cleaned panel data on 1,189 smallholder households. Stakeholder support appears to remain strong on all sides, and so the center of our efforts for the third year of implementation will be completing all the requisite financial paperwork early so as to allow the Interlinked arm to be a success. Only time will tell whether the largely subsidy-driven initial successes of the project can translate into a more durable market-driven product as understanding of its potential benefits expands.

DISSEMINATING INNOVATIVE RESOURCES AND TECHNOLOGIES TO SMALLHOLDERS IN NORTHERN REGION, GHANA

PRINCIPAL INVESTIGATORS

Mathias Fosu
Savannah Agricultural Research Institute
Dean Karlan
Yale University
Shashidhara Kolavalli
International Food Policy Research Institute
Christopher Udry
Yale University

In Ghana's Northern Region, smallholder farmers cultivate rain fed crops, face significant risk of weather shocks, chronically underinvest in input technologies, achieve just a fraction of potential yields, maintain limited liquid savings and may be food insecure. The Disseminating Innovative Resources and Technologies to Smallholders (DIRTS) project is examining the barriers to smallholder farmer adoption of intensified cultivation practices and risk management tools, and measuring the impact of three innovative, potentially scalable programs on farm production and profitability, consumption and food security, intra-household labor allocation, asset holdings and rural household resilience. DIRTS is using a randomized controlled trial to measure the impact of providing access to (a) improved information flows through Android-based extension applications, (2) improved-yield input technology packages at varying prices, and (3) commercial drought index insurance at varying prices.

COLLABORATIONS

The DIRTS project has maintained partnership with Innovations for Poverty Action (IPA), the Ministry of Food and Agriculture, the Ghana Agricultural Insurance Pool, the International Food Policy Research Institute and the Savannah Agricultural Research Institute.

OUTPUTS

BASIS Brief no.2013-06, *Disseminating Innovative Resources and Technologies to Smallholders in Ghana* by Chris Udry, Saa Dittoh, Mathias Fosu, Dean Karlan, and Shashidhara Kolavalli, June 2013.

CAPACITY BUILDING

So far DIRTS' main capacity building consists of internal field staff training and the participants in the pilot extension exercise. Participants in these trainings gained professional skills in addition to skills specific to our research. DIRTS also hold regular capacity building and trainings for MoFA M&E leaders and extension agents.

In addition, DIRTS takes special care to involve local institutions—the government institution, MoFA, the academic institution UDS, and the research institution SARI—in the program, in order to build capacity for local institutions to continue implementing effective programs.

By working with researchers like Dr. Mathias Fosu at SARI and Dr. Saa Dittoh at UDS, DIRTS encourages local researchers who are embedded in academic and government institutions to incorporate evidence-based design and technical tools into their own programs. IPA also builds capacity in SARI, UDS and the Ministry of Food and Agriculture to incorporate monitoring and evaluation components into programs.

ACTIVITIES

Since January 2013, the Disseminating Innovative Resources and Technologies to Smallholders (DIRTS) project has accomplished: (1) community and respondent selection (2) piloting and refinement of data collection instruments and (3) testing interventions to prepare for scaling DIRTS in 2014. Interventions will begin in November 2013 for the 2014 agricultural season. So far DIRTS interventions have been rolled out on a pilot scale.

Community and respondent selection
A total of 187 communities in nine Northern Region districts were censused between January and March 2013, each community containing an average of 161 compounds with 1 to 2 households per compound. Census data will allow for selection of sample communities and households, in addition to randomized assignment into treatment groups. The census instrument asked all adults in a household about occupations, access to land, and relationship to other household members. Upon the conclusion of data collection, twenty sample households were randomly selected per community. Within sample households, two members were selected to be respondents for annual and bi-monthly surveys.

In 2013, forty-four of the censused communities received insurance marketing, allowing researchers to study the effect of ongoing marketing on uptake. We plan to stratify community selection and assignment to treatment groups by geographic location, size of community, average household size in the community, gross premium for insurance, and whether or not insurance was marketed in 2013.

Testing data collection instruments
DIRTS has designed several data collection events to fully capture the effects of interventions on household members. Data collection in DIRTS includes qualitative focus groups, comprehensive household surveys administered by IPA staff, bi-monthly labor surveys administered by community-based enumerators, and a harvest survey for insurance policyholders. Since January 2013, DIRTS has held focus groups related to extension and community-based data collection, developed a comprehensive household survey, and piloted semi-monthly surveying by community based enumerators in ten communities.

Focus group discussions have been conducted in non-sample pilot communities to ensure appropriate extension material content. Information on comprehension of content, community-level perceptions of recommended practices, and feedback on appropriate language and media for effective communication of extension messages have been gathered in discussions. A total of eight focus groups have been completed.

The DIRTS survey interviews female heads of household in addition to male heads of household, allowing researchers to understand how interventions impact both males and females. The DIRTS survey will also examine issues of land tenure, labor use, farm investment and profitability in addition to capturing data on household characteristics and welfare. Data from comprehensive household surveys will be complemented by semi-monthly labor surveys administered throughout the agricultural season by community-based enumerators. DIRTS has piloted the use of various methods to capture data on labor use, including the use of labor diaries and annual surveying, and has settled on the use of community based enumerators for scale up due to improvements of data quality with use of this method in pilot communities. Bi-monthly surveys will also chart the adoption of extension and improved technology in treatment communities, allowing researchers to track the causal chain between interventions and effects on yields and profits. Use of community based enumerators to collect labor data was piloted from March until July 2013. Preliminary findings indicate use of community-based enumerators, with sufficient training and a simple instrument yields quality data.

Testing interventions

DIRTS is currently piloting extension and insurance interventions, to inform design of treatments and expected uptake for DIRTS scale up. Extension pilots refined the content of extension and explored the capabilities of android-based extension models; insurance piloting will allow researchers to study the effect of subsequent years of marketing, randomization at the individual level, and use of satellite data on demand. This pilot allows researchers to better understand a community-based extension model, effective use of android technology, and refinement of extension content.

Each pilot community contained a community-based extension agent, who made weekly visits to 20 randomly selected households. During extension visits, extension agents disseminated web-based extension content and completed surveys to inform future content and extension dissemination platforms. Extension agents completed twelve visits to each household, totaling 7,200 visits in all pilot communities. A team of IPA staff and Ministry of Food and Agriculture extension agents provided monitoring and support to community based

extension agents, completing routine spot checks and back checks in pilot communities. Extension agents also completed short monitoring surveys on open data kit, providing researchers with feedback on extension content. Preliminary findings indicate preference for longer, more complex extension messages with detailed step-by-step instructions. CEA's have also voiced technical difficulties with current platforms, thus alternative strategies are under development.

Marketing insurance to 44 sample communities will allow researchers to study the effect of subsequent years of marketing on uptake, while expansion to 37 non-sample communities allows extensive data collection on the effect of individually randomized price and use of satellite rainfall data on demand. Approximately 1,500 community members attended insurance marketing sessions; disappointingly, demand in the 2013 season has been low. A total of 67 policyholders were registered, insuring a total of 43 acres. Qualitative data collection from marketers and community members will inform strategies for stimulating insurance uptake. A series of focus group discussions were hosted in DIRTS pilot communities, indicating that credibility and timing of sales adversely affected demand. DIRTS plans to integrate community members more fully in the marketing of insurance to address credibility issues, and to market in the harvest season when farmers are likely to be less cash constrained. The DIRTS team has reached out to other index insurance providers in Sub-Saharan Africa, most notably Tropical Applications of Meteorology using Satellite Data (TAMSAT), to share lessons learned. TAMSAT and the DIRTS team hosted a workshop on remote sensing and index insurance.

FINDINGS

Findings from DIRTS are gleaned from pilot activities, and are intended to improve operations. Interventions have been refined through pilot activities, assessed through a series of focus group discussions and field monitoring visits. Quantitative results are limited, given the pilot stage of this study. Qualitative findings include methods to improve (1) insurance marketing and (2) methods of extension provision.

Demand for 2013 insurance products was uncharacteristically low, threatening the implementation of DIRTS. A series of focus group discussions, interviews with marketers, and consultation with other insurance providers in Northern Ghana indicates that credibility issues must be addressed to maximize uptake. The DIRTS team will work with GAIP to devise methods of enhancing credibility in future marketing efforts. DIRTS is currently discussing individually-randomized partial insurance subsidies and the use of community-based marketers.

The provision of extension via community members equipped with android phones demonstrated the difficulty of relying on network in remote communities. Extension agents voiced difficulties in accessing extension messages due to poor network coverage. The DIRTS study plans to circumvent these issues by pre-loading extension material onto android phones, eliminating the need for network coverage.

HUMAN & INSTITUTIONAL CAPACITY DEVELOPMENT

Human and institutional capacity development is the hidden gem of the BASIS Assets and Market Access Innovation Lab. In the course of conducting quality innovative research, BASIS researchers make significant contributions to the development of students, collaborating research and implementation partners, and project participants.

While the most obvious pathway to capacity building is to bring individuals from a host country to the institution of the researchers in the US, this is often a costly, logistically challenging, and limiting approach. The BASIS AMA Innovation Lab encourages researchers to creatively assess and design opportunities for human and institutional capacity building as a necessary component of all projects.

Most BASIS AMA Innovation Lab projects have a small group of degree-seeking students involved in the project to provide direct support to principal investigators. This typically includes extensive hands-on experience, particularly with on-the-ground surveys and other skills for students seeking a degree in economics and related fields.

However, given the expense and duration of many long-term training programs (especially in economics Ph.D. programs), these are typically difficult to insert in the context of most research programs. As such, the BASIS AMA Innovation Lab encourages the development of other complementary ways of achieving training goals.

Perhaps the most durable and dynamic mechanism for capacity development emerges from the deep relationship between United States and host country researchers. The intellectual partnership that emerges leads to significant gains for not only the host country researcher, but for the future generations of students and colleagues that he or she might train. For some projects, junior researchers are also involved in training at local or regional universities. In such arrangements, participation in an ongoing research project can be especially powerful. These junior researchers get the benefit of the ample resources of a United States university, as well as an in-depth, focused interaction with US faculty members and other graduate students.

SHORT- AND LONG-TERM TRAINING

In the first year of the BASIS AMA Innovation Lab, most activities were just being selected and awarded, with most training and capacity building activities slated to begin in the FY 2013-2014 fiscal year and continue beyond. As such, the training numbers for this fiscal year are low relative to our expectation for the coming years. As projects begin in earnest in the next year and beyond, we anticipate significant increases in these numbers.

In this reporting period, BASIS researchers had involved approximately 10 students in long-term training activities (evenly split between males and females). These were students who were significantly involved in the research project in myriad ways. Nearly 5,500 individuals were involved in short-term food security training, mostly farmers and pastoralists being offered innovative financial or other services to promote growth. Given the nature of the projects that have yet to fully begin operations, we anticipate that these numbers will drastically increase, both for short- and long-term training.

INSTITUTIONAL DEVELOPMENT

The BASIS AMA Innovation Lab model for institutional capacity building typically is established through the creation of sub-contract relationships with partner institutions. BASIS AMA research awards will contribute to partners' institutional competence and experience, and help to empower these institutions to manage other similar contracts in the future, helping them acquire the skills necessary to accept and manage funds from international sources and secure additional funding in the future.

Researchers will also conduct direct capacity building at partner research institutions, typically through activities such as short courses on such topics and impact evaluation methodology. (Participants in this kind of training are included in the "Short Term" column in the "Training by Country" table, above.)

When pilot activities are included as part of the

research design, training and financial education both for implementation partners, typically service providers, can also build capacity. For example, acting in cooperation with the World Bank, BASIS AMA Innovation Lab researchers offered technical training to the East African insurance industry.

INSTITUTIONAL PARTNERS BY COUNTRY

Bangladesh: Bangladesh's Policy Research and Strategy Support Program (PRSSP), Palli Karma Sahayak Foundation (PKSF), Gram Unnayan Karma (GUK)

Burkina Faso: Planet Guarantee, Allianz Bank, SwissRe, Sofitext, Ecobank, Innovations for Poverty Action (IPA), Institut de l'Environnement et de Recherches Agricoles (INERA)

Dominican Republic: USAID, International Research Institute for Climate and Society (Columbia University), Swiss-Re, GuyCarpenter, CaribRM, REDDOM

Ethiopia: International Livestock Research Institute (ILRI), Oromia Insurance Company (OIC), AfricaRe, IFPRI's Ethiopian Strategy Support Program (a collaborative research partnership between IFPRI and the Ethiopian government), the Financial Innovations for Social and Climate Resilience (FISCR) project (conducted by the World Bank Social Development sector)

Ghana: African Center for Economic Transformation (ACET), Ghana Agricultural Insurance Programme (GAIP), University of Ghana (UofG), Innovations for Poverty Action (IPA), the Ministry of Food and Agriculture, International Food Policy Research Institute (IFPRI), Savannah Agricultural Research Institute.

Guatemala: KfW (Germany), International Fund for Agricultural Development (IFAD), Fedecocagua, La Ceiba

Haiti: Faculté d'Agronomie et de Médecine Vétérinaire (FAMV) at Université d'Etat d'Haïti, Oxfam America

India: Agricultural Insurance Company of India (AICI), Center for Microfinance (CMF),

Kenya: Center for Effective Global Action (CEGA), Tegemeo Institute (Egerton University), Western Seed Company, Maseno University, Mumias Sugar Company, Innovations for Poverty Action (Kenya)

Mali: Compagnie Malienne des Textiles (CMDT), PlaNet Guarantee, Allianz Bank, SwissRe

Mexico: Fertilab, Agroquímica, Qué Funciona para el Desarrollo

Mozambique: International Fertilizer Development Center (IFDC), Banco Oportunidade de Moçambique (from Opportunity International)

Senegal: Consortium pour la Recherche Economique et Sociale (CRES)

Tanzania: VisionFund (World Vision)

Uganda: Economic Policy Research Center (EPRC), BRAC

PLAN OF ACTION

By helping impoverished households in developing countries access improved financial services for risk management and growth, the BASIS AMA Innovation Lab is helping to improve resilience and agricultural growth in the Feed the Future countries and beyond. By prioritizing research of possible pathways to resilience and growth, the BASIS AMA Innovation Lab is fomenting financial innovations with high potential for development impact.

To this end, BASIS has finished assembling its portfolio of research projects built around pilot activities of new policies and technologies. As preliminary information begins to be collected on the impact of these activities, BASIS and its partners will work together to promote these results and prepare effective technologies and practices for scaling activities.

STEPS TAKEN

As part of the scaling process, BASIS AMA Innovation Lab seeks projects that have well designed partnerships with Implementation partners that have the capability to scale out projects, if proven promising in the pilot and evaluation phases. By working alongside these partner organizations, BASIS researchers will be able to facilitate or assist with the scale up.

When feasible and appropriate, these implementation partners are private sector partners. This helps to advance opportunities for scaling up in several ways.

First, by partnering private sector partners who may not have any experience with the intervention with experienced researchers, the research team can work with the private sector partners to identify any potential problems and develop solutions for effective implementation.

Second, private sector partners are often reluctant to adopt and take to market ideas for interventions (such as index insurance) that have not yet been proven in the field. By embedding the start-up of a new financial innovation with an impact evaluation, that provides proof to private sector partners that there is a feasible, cost-effective way to implement the intervention. Finally, by integrating the launch of a product with an impact evaluation, once the intervention is over and the private sector takes over full implementation, a market has already begun to be developed for the product or intervention. These factors will benefit both private sector partners and the target populations by increasing opportunity for sustainable scaling of proven interventions.

BASIS also maintains a budget for project-end dissemination activities. This is so that as research projects have demonstrated that there is value in a certain technology, BASIS researchers and the Innovation Lab can work with those organizations that have potential to adopt and scale the technologies developed in the BASIS-supported research phase. This includes two evidence summits for the last two years of the current BASIS award, as well as annual budget for mission/USAID outreach, and a large meeting to discuss Index Insurance in Africa.

PARTNERSHIPS MADE

In each project that pilots a financial or other innovative technology, BASIS looks for collaborative partnerships with appropriate private sector partners that will enable scaling of the project after the completion of the pilot research and evaluation. Though this varies based on country and nature of the project, in general this includes insurance companies, microfinance organizations, farmers' cooperatives, reinsurance corporations and/or banks. As described above, when possible BASIS researchers prefer to work with private sector partners who can sustain the intervention beyond the duration of the impact evaluation, if successful.

TECHNOLOGIES TRANSFERRED

The BASIS AMA Innovation Lab is still relatively early in its current funding cycle. As such, only a few technologies have been transferred to date. Most projects are still implementing initial pilot projects, with an intention to try to transfer these technologies post-evaluation at the end of their project period. In the next year, a few projects will begin to complete the research project implementation and we will be able to assess whether the interventions were successfully transferred to project partners. For most BASIS projects, however, this will not be able to occur until between 2015 and 2017, depending on the specific project.

TECHNOLOGIES SCALED

Though most technologies under investigation have not yet been scaled for the reasons of evaluation timeline mentioned above, some have been successful in expanding the scale of the pilot study. Others are planning to scale the technology in the next year. The West African Cotton Project, led by Michael Carter at the University of California Davis, will expand their pilot area from approximately 90 farmer cooperatives

The intervention designed and tested in Ethiopia by researchers at the University of Colorado and IFPRI, for example, is expected to continue even though the project has closed as of the end of FY 2012-2013. In the final year of the project, researchers worked closely with implementation partners to transfer responsibilities before the close of the research project. In this past year,

researchers were only minimally involved in implementation activities, as their implementation partner took on the bulk of operational work. One of the principle investigators met with project partners in Addis Ababa shortly after the completion of the BASIS supported research project. The plan at that point was to target all villages (including the control villages and those not included in the study) in three of the study sites in the coming year, and to target new sites the following year.

TECHNOLOGIES READY TO SCALE

Several projects initially funded as part of BASIS's I4 Index Insurance Innovation Initiative have developed and evaluated technologies that are now ready to scale.

One I4 project that is now entering its final year is the Index Based Livestock Insurance project in Ethiopia. Building on lessons learned from a successful pilot in Kenya, this extension to Ethiopia is the early stage testing of its potential scalability. Researchers are optimistic that after the next and final year of the project, the insurance companies that have been serving as implementation partners on the project will be able to more broadly and sustainably sell the insurance product that has been developed.

GOVERNANCE AND MANAGEMENT ENTITY ACTIVITY

RECRUITMENT AND HIRING OF MANAGEMENT ENTITY STAFF

Since the award was made to the University of California Davis in April 2012, BASIS has hired an assistant director, a financial analyst, and an I4 post-doctoral fellow (focused specifically on the I4 Index Insurance Innovation Initiative).

- Tara Steinmetz, Assistant Director
- Diane Jellison, Financial Analyst
- Thomas Barre, I4 Post-Doctoral Fellow

SELECTION OF BOARD OF DIRECTORS

Before selecting any new projects, BASIS put in place a board of directors selected for their geographic, topical, and technical expertise.

- Lena Heron, AOR for BASIS, Bureau of Food Security, USAID
- Jolyne Sanjak, Deputy Vice President, Technical Services, Millenium Challenge Corporation
- Craig McIntosh, Professor of Economics, University of California San Diego
- Mary Mathenge, Director, Tegemeo Institute of Agricultural Policy & Development, Egerton University, Nairobi, Kenya

SELECTION OF NEW SUB-AWARDS

In the year and a half since BASIS received funding, we held two calls for new research proposals. Projects selected include exciting new activities with significant promise to inform the policy agenda for development impact. Over the next year BASIS will complete assembly of its full research portfolio, ensuring overall portfolio coherence and maximizing the ability of results to inform the policy debates around risk management, resilience, and inclusive agricultural growth. The coming year will also see work begin in earnest for all new activities, including finalization of survey designs, finalization of interventions being tested, and collection of baseline data.

BASIS/I4 TECHNICAL COMMITTEE MEETING

The BASIS AMA Innovation Lab held its first BASIS/I4 combined Technical Committee Meeting on September 12 and 13, 2013 at the University of California Davis. This meeting brought together both researchers from historic I4 projects that have made significant progress in their research with newly selected researchers. This provided the opportunity both for I4 researchers to present preliminary results and papers for

feedback from a new group of researchers, as well as for new researchers to present their project proposals for constructive feedback from the experienced I4 researchers.

This meeting also provided the opportunity for all researchers to learn more about the comprehensive BASIS portfolio so they can better see how they fit into the broader BASIS learning agenda, and to share lessons learned and identified best practices. This meeting also provided an opportunity for management and USAID to discuss the importance of outreach and dissemination of results and findings.

CONSULTATIONS WITH USAID MISSIONS

The BASIS AMA Innovation Lab has consulted with several USAID missions about possible research projects around financial innovations or other mechanisms to promote growth opportunities or alter poverty dynamics in their country. While most of these did not progress into full research opportunities, these consultations were an opportunity for missions to learn more from BASIS's experience and lessons learned, to develop improved relationship with mission personnel, and for BASIS to better understand how to develop projects and materials that will be useful and relevant for missions, especially those in Feed the Future priority countries.

In November 2012, BASIS began working with the USAID Global Climate Change Office and the Dominican Republic mission about a possible impact evaluation of an index insurance intervention. Since then, BASIS has continued to work with the Global Climate Change Office, mission, and on-the-ground implementation partners to develop the intervention, design the evaluation, and implement the project in country. This process is still ongoing. More details are available in the full project description.

In December 2012 BASIS was approached about the possibility of conducting an impact evaluation in Rwanda of the flagship Orphans and Vulnerable Children (OVC) savings-led livelihood development project. The project, called Higa Ubehu, was going to be expanding to new communities and enrolling new beneficiaries, which would open the opportunity for an impact evaluation. Over the next seven months, BASIS worked closely with USAID personnel in offices in Washington DC (the Bureau of Food Security and the Office of HIV/AIDS) and Rwanda mission, as well as with Higa Ubehu's implementing partner (Global Communities), about a possible impact evaluation. Ultimately, the study proved infeasible because the time frame in which the expansion would occur would not allow for the time it would take to put in place a rigorous evaluation.

OUTREACH AND DISSEMINATION

In October 2012, BASIS researcher Andrew Mude (of the International Livestock Research Institute) represented BASIS and the work he has done on the Index-Based Livestock Insurance project in Kenya and Ethiopia at meetings at the World Food Prize. In addition to speaking on a panel hosted by USAID, he was interviewed and videoed by USAID for use in a series of videos talking about successes of USAID supported projects at the world food prize.

Among the many BASIS AMA outreach and dissemination activities, we have

collaborated with the other Innovation Labs around specific Innovation Lab meetings. The first of these meetings in this reporting period was connected to the events of the World Food Prize in Des Moines Iowa in October 2012. The Assistant Director represented BASIS at this meeting, including participation at a side event of the conference specifically focused on the Innovation Labs (then Collaborative Research Support Programs), including a poster session.

When these projects were held overseas, as they were twice in 2013, the Innovation Labs have invited USAID-Washington staff, along with host country and regional mission staff and other in country and regional partners. In March 2013, the meeting was held in Tanzania, and the Assistant Director presented new developments in innovative BASIS research relevant to Eastern and Southern Africa. In addition, she helped to lead breakout discussion sub groups on public-private partnerships and their role in scaling of proven technologies. In July 2013, the Assistant Director represented BASIS at the Innovation Labs meeting in Ghana, and participated on the planning committee for this event, contributing to agenda setting. She also represented BASIS with a presentation on activities relevant to West Africa at this event.

Further, BASIS has continued to collaborate with the other Innovation Labs on outreach and dissemination activities through the CRSP Digest project, run by Cultural Practices. This project seeks to synthesize the work being done by all the innovation labs, aggregate the projects into a single searchable database, and to promote the both individual and communal Innovation Lab successes and highlights. We have worked with Cultural Practices to maintain an up-to-date and accurate database of our projects so that they can easily be accessed by the general public, and have worked to them to highlight important developments in our research projects.

ISSUES AND CHALLENGES

Start-Up Delays

Originally, the BASIS AMA Innovation Lab at the University of California Davis was set to receive Year 1 funding in October 2011. Unfortunately, delays in the contracting process meant that the contract was not signed and the Year 1 funding received until April 2012. As a result, the management needed to run the Innovation Lab at full operational levels was not in place until August 2012. As a result, first round project selection and full functioning of BASIS did not occur as originally planned until the fall of 2012. This put BASIS nearly a year behind our originally intended schedule.

Sub-Contracting Delays

In the current reporting period, the BASIS AMA Innovation Lab held two competitive selections for new research projects. Though projects were quickly reviewed by external reviewers, voted on by the board of directors, and selected, there were significant delays in the award processes for several U.S. university recipients. In the contracting processes for these universities, the recipient university took far longer than expected to review and approve the contract language and the USAID standard provisions, which led to projects falling behind their originally scheduled implementation timelines. Because several projects missed the intended planting season, they were delayed by a year and cannot begin in earnest until next year.

Host Country Stability

When BASIS selects research projects and identifies relevant performance targets, one of the underlying assumptions is continued stability of the host country such that it will allow continued work in the country for the duration of the research project. For the most part, this has not proven to be a significant issue for BASIS, but the major exception is the research project that we initially funded for work in Mali. After the first year of intervention and the first follow-up survey, the spring 2012 coup d'état disrupted work and made continuation of the project in Mali infeasible. The research team decided to restart the same work in Burkina Faso, but having to build partnerships, research plans, and implementation plans from scratch led to significant delays.

Identification of High-Quality, Appropriate Projects

In the period under reporting, BASIS held two calls for proposals. Unfortunately, BASIS, the ad-hoc review committees, and the Board of Directors were all disappointed in both the number and quality of proposals received in these two calls. As such, BASIS plans to hold an additional, unplanned third call for proposals in the next reporting period.

FUTURE DIRECTIONS

The BASIS AMA Innovation Lab is at a point of transition. At the end of fiscal year 2012-2013, some BASIS projects are just beginning to end, and will end over the next year. Meanwhile, a separate tranche of projects have just been selected. These projects will begin in earnest over the next fiscal year, and the final projects in the BASIS portfolio will be selected. As such, over the next fiscal year the primary activities of BASIS will be outreach and dissemination of preliminary results from those projects coming to a close, as well as the initiation of a new generation of research.

OUTREACH AND DISSEMINATION

Several research projects under the I4 Index Insurance Innovation Initiative are beginning to release preliminary results, the BASIS AMA Innovation Lab is moving from management of these awards to outreach and dissemination activities.

The I4 Index Insurance Innovation Initiative was designed to learn more the impacts of uninsured risk, and the potential of index insurance projects to mitigate those risks and alter poverty dynamics. I4 designed and implemented a new generation of livelihood-optimized index insurance contracts. Preliminary results from this tranche of research are promising. When effectively designed and implemented, index insurance has the potential to increase incomes, attract lenders into rural markets, and reverse the dynamics that create poverty traps. This could also have the impact of reducing the massive costs of direct assistance programs in the face of widespread disasters, such as drought.

The BASIS AMA Innovation Lab will take what has already been accomplished in two directions. The first will be to engage stakeholders (including policy makers, nongovernmental partners, private sector partners, etc.) to disseminate lessons learned from the research that has been conducted to date. The second will be to develop a new tranche of projects that both builds on the existing research and lessons from the first group of I4 projects, and to go a step further to research additional mechanisms not only to mitigate risk, but to promote sustainable growth and development.

NEW AWARDS

In the next fiscal year, the BASIS AMA Innovation Lab will make final awards for research projects in identified priority areas. These awards will complete the BASIS research portfolio, and will be selected for quality of research, contribution to overall policy priorities, and geographic and topical balance.

For BASIS's new generation of research projects, proposals are being selected around the following established BASIS themes:

1. Financial instruments for risk management and resilience; and,
2. Interventions that reduce barriers to adoption of improved agricultural technologies

In addition to projects around these existing BASIS themes, we will also welcome proposals that fall under these existing themes, we strongly encourage proposal submissions for research that would deepen our understanding of poverty dynamics, especially insights and evidence that would assist the design of comprehensive social protection systems that protect the assets of chronically poor households as well as enable them to build and leverage these assets in pursuit of more resilient and rewarding livelihoods. Proposals might focus on impact evaluations of innovative graduation strategies or more basic research on fundamental mechanisms that constrain upward mobility.

APPENDICES

The BASIS AMA Innovation Lab is pleased to include three success stories of our work from this reporting period. These success stories highlight exciting innovations to mitigate uninsured risk and improve financial services for poor agricultural and pastoral households. Here, we highlight three projects from which results are just beginning to emerge:

- Using Index Insurance to Enable the Adoption of Higher-Profit Crops in West Africa (Mali)
- Temporary Subsidies Accelerate Learning and Have Permanent Effects on Smallholder Technology Adoption and Income (Mozambique)
- Coping with Drought through Index-Based Livestock Insurance (Kenya)

As of the date of this report, many more projects are only just beginning. In future reports, we look forward to highlighting results from this promising research portfolio.

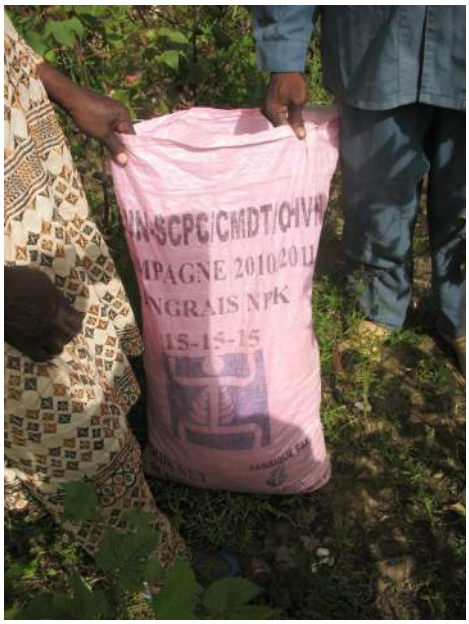
SUCCESS STORY: Using Index Insurance to Enable Adoption of More Profitable Agricultural Investments in West Africa

Cotton production in the Sahel region of central Mali is a costly and uncertain operation. Farmers exposed to the extreme weather variations of the semi-arid climate have adapted and developed risk coping mechanisms, including self-insurance strategies and limiting cotton cultivation. Farmers also organize into cooperatives to help informally insure one another, as well as to gain access to loans. If a farmer has a bad year, the others in the cooperative can help by lending money or, if a farmer has an outstanding loan, by helping with payments.

In years with a weather shock that severely diminishes the yield of all those in the cooperative, however, the collective losses may exceed the capacity of the cooperative to cope. Additional risk management tools for cooperatives are necessary to protect them in years with extreme weather and meager harvests, to give farmers the opportunity to invest more heavily in production without fear of losing household assets.

The BASIS/I4 research team is evaluating an index insurance contract designed to overcome some challenges inherent to the standard index insurance model. Index insurance takes a specific measure (such as rainfall or area yield), correlates the measure to predict average individual farmer yields, and pays out when index predicts average yields have fallen below a given threshold.

Researchers sought a measure that is both a strong predictor of average individual farmer yields and affordable to collect. Average area yield would clearly be highly correlated with individual farmer losses and therefore have high predictive power, but can also be prohibitively costly to collect. In Mali, however, because all cotton is purchased by a single parastatal entity, measures of area yield are affordable and easily available at the end of each growing season.



Two problems remain with regard to designing an effective contract: basis risk and moral hazard. Basis risk refers to risk that is not covered by the insurance. When using an index to predict average yield, it is inherent that yields will vary around that predicted yield - some will be higher and others lower than the predicted. Moral hazard refers to the incentive, when insured according to yields, for farmers to deliberately reduce yields to try to trigger payouts. Both of these

challenges have to be addressed for an effective and sustainable contract.

A double-trigger contract has two triggers instead of one: the first trigger is the cooperative average yield and the second trigger is the district yield. An insurance payout occurs only if both conditions are fulfilled: the coop yield is below the coop strike-point, and the district yield is below the district strike-point.

In the first year of sales, 30 percent of cooperatives agreed to purchase the contract, covering fifty percent of the total area in the pilot zone. In response, those farmers offered insurance substantially increased their investment in cotton production, dedicating some 20% more land to cotton production and investing more in each hectare of land allocated to cotton.

Only one round of data could be collected before the March 2012 coup d'état in Mali. As a result, the project was transferred to Burkina Faso, in conjunction with SOFITEX and Ecobank, where a similar contract design will be used. This will allow for comparisons of strategies and results. Preliminary results from first year sales in Burkina Faso are encouraging. In the cooperatives where the product was advertised 18.4 percent bought the insurance. This covered 446 farmers, 2,331 hectares, insured a total value of 233,100,100 CFA, and collected 26,107,200 CFA in premiums.

SUCCESS STORY: Temporary Subsidies Accelerate Learning and Have Permanent Effects on Smallholder Technology Adoption and Income

Risk and uncertainty are barriers to scaling up profitable technology amongst smallholders. Risk is a constraint when farmers understand a technology, but are reluctant to adopt it because they know that in drought years, they will lose money. Uncertainty is a barrier when farmers are unfamiliar with a technology and are reluctant to adopt it as they unsure if the technology will be profitable for them, even on average. Different financial instruments can potentially resolve these risk and uncertainty problems. The BASIS Assets and Market Access Innovation Lab has recently completed a large scale randomized controlled trial that demonstrate the effectiveness of financial instruments to relax these barriers to scaling up profitable technologies.

"Smart subsidies," such as voucher coupons, that temporarily reduce the cost of adopting new, uncertain technologies have been advocated as a way to remove the uncertainty barrier to technology adoption. Many NGOs and developing country governments have been using vouchers to subsidize the cost of learning about new technologies and it's returns for farmers. The idea is that after they've experienced the new technology and witnessed successful returns, they will no longer rely on subsidies and will have wholly adopted the change. But prior to a just completed BASIS project in Mozambique, there was scant experimental evidence on the efficacy of voucher coupon subsidy schemes.

In 2010, BASIS (in partnership with researchers at the University of Michigan) and IFDC launched a multi-year evaluation of a two-year fertilizer voucher coupon scheme in the maize-growing regions of Central Mozambique. Prior to the voucher scheme, despite efforts like the USAID/IFDC AIMS project which boosted local fertilizer availability, only 20 percent of farmers used any fertilizer (with an average use of 14 kg/hectare) and maize yields were a paltry 900 kg/hectare. The voucher coupons made fertilizer cheaper for the farmers for two years, but more importantly subsidized the period of learning. Two years after the end of the voucher program, randomly selected farmers who received the coupons had permanently changed their farming practices, using significantly more fertilizer, enjoying 15 percent higher yields, increasing consumption 9 percent, and increasing assets and savings by 20 percent more than their control group counterparts. In other words, the modest period of subsidy had stuck with farmers and shifted them to a higher productivity and income levels.

By coupling productive agricultural technologies with pioneering financial tools, scientists and economists can work together to scale up productive innovations. These lessons can be transferred to myriad other critical agricultural technologies, to drive growth and production in Feed the Future countries and beyond.

SUCCESS STORY: Coping with Drought through Index-Based Livestock Insurance in Kenya

Pastoralist households in the arid and semi-arid areas of northern Kenya are especially vulnerable to the risk posed by climate change. In the face this risk households may avoid risky, but potentially high-return activities in favor of safer strategies. This risk-reduction strategy has the effect of keeping households poorer than they need to be.

Further, when a drought occurs, as it did in 2011, households dependent on livestock must cope with large, potentially catastrophic, livestock losses. One common coping strategy households employ is to sell off remaining livestock, which could push the household into a "poverty trap." Evidence suggests there is a critical threshold level of asset ownership, and when households fall below it they may become trapped in long-term poverty. Another common strategy is meal reduction, which leads to diminished household productivity as industrious household members weaken, and could result in irreversible stunting among young children. For both reasons, these costly coping strategies contribute to the intergeneration transmission of poverty.

In January 2010, BASIS/I4 researchers launched an index-based livestock insurance (IBLI) pilot in Marsabit District of northern Kenya as an effort to improve the resilience of pastoralists in the face of frequent droughts. IBLI offers a payout based on an index rather than on verification of individual losses via a claims agent (as is done with conventional insurance), which would be prohibitively costly in this isolated and infrastructure deficient region. The index uses satellite-based measures of vegetative cover to predict associated livestock mortality. The insurance pays pastoralists for losses beyond a critical threshold, helping mitigate the impact of widespread livestock loss. The project also hopes to enable farmers to increase investment in potentially higher-return activities.

In 2011, the pilot area suffered a severe drought, and households lost upwards of 30 percent of their livestock (payouts are triggered if the predicted average livestock mortality rate reaches 15 percent). As a result, the project's first indemnity payments were made in October 2011. This step was essential to building trust in the product, both among policyholders and potential policyholders alike. Again in March 2012, two of the five contract areas triggered and those areas paid out.

A survey conducted at the time the October 2011 payout was announced asked households to predict how the insurance payments would change their coping strategies. Compared to uninsured households, insured households were 27-36 percent less likely to predict that they would reduce the number of meals eaten, 22-36 percent less likely to sell additional livestock, 42-50 percent less likely to rely on food aid, and 0-26 percent less likely to rely on other forms of assistance. If these expectations match true behavior, then this provides a good indication of the potential positive welfare impacts of IBLI.

Researchers are now working to redesign the contract in response to client feedback, including a reduced contract trigger. Also, the team anticipates improvements in information, extension and sales delivery as more partners come on board to provide support.