

Index Insurance and Climate Risk Management In Malawi:

Theory and Practice (mostly practice)

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Support: World Bank CRMG, IRI, CU-CRED

Index insurance

- Insurance is an important link to allow use of climate information in decisionmaking
- **Private Information** problems with traditional crop insurance
 - Moral hazard (incentives to let crops die)
 - Adverse selection (farmers with secret weaknesses more likely to join)
- The index innovation
 - Closely related to weather derivatives
 - Insure weather index (such as seasonal rainfall), not crop
 - Only partial protection (basis risk), should not oversell
 - Cheap, easy to implement, good incentives
- Design complex: **only a naive partner would reveal all their cards**
 - All partners must play active role in a cooperative design process
- Price: Money in = average(Money out) + cost of holding risk
 - **EG: Ave(Payout) + 0.065 * 0.06 (99th % payout – Ave(Payout))**
 - This price must < value to client for market to exist
 - Only clients really know personal value (their info may be used against them)

Index issues, risk layering, basis risk

- Not only to farmers for crop loss using rainfall
- Broad applications, in principal
 - Temp, rainfall, degree days, wind, SST, reservoir level, model output, remote sensing
 - Not limited to target group
- Not comprehensive--target cost effective parts of risk
- Index protects some people from some risks
 - Risk management needs other solutions for other risks, players
 - Build risk layering system
 - Eg: farmer, group, cooperative, micro-lender, government, re-insurer
- Only partial coverage--must not oversell
- **But an important link in climate risk management**
- **This application is development oriented NOT famine relief**

Some projects

- India
 - BASIX, hundreds of thousands of farmer transactions completed in only about 4 years
- Ethiopia
 - Drought famine relief (client: national government, first transacted 2006)
 - Example of early action system/trigger policies
 - Crop loss micro-insurance (client: <100 farmers, piloted 2006)
- **Malawi**
 - **Drought relief (insurance/price options, client: national government)**
 - **Farm level crop loss, bundled contracts**
 - initially ~900 farmers, 2005
 - We designed 2006 contracts in operation now, several thousand contracts
- Working on projects for 2007 in Kenya, Tanzania, MVP, Central America
- Experimental 2007 pilot precip/NDVI for selected counties' rangelands in US (subsidized)
 - <http://www.rma.usda.gov/policies/pasturerangeforage/> , NOAA CPC, EROS data

World Bank CRMG, Re-insurance companies, WFP highly involved

Micro loans

- Insurance, credit, savings complement each other
 - Insurance for uncertainty (useless without uncertainty)
 - Uncertainty hurts credit markets
- Work better together
 - Insurance can make loans to riskier clients possible
 - “Traditional” microfinance strategy of relying on group liability is vulnerable to widespread drought
- Package of microfinance insurance, credit, savings
- Bundle contracts
 - Lender packages insurance in loan, so farmer can use insurance if dry
 - Seed provider packages insurance in seed sale, so farmer gets payment if seed fails due to drought



Groundnuts from farmer in Malawi program



Maize of farmer in groundnut program (not yet program Maize)

Malawi Groundnut contract bundle

- Farmer gets loan (~4500 Malawi Kwacha or ~\$35) that covers:
 - Groundnut seed cost (~\$25, ICRSAT bred, delivered by farm association)
 - Interest (~\$7), Insurance premium (~\$2), Tax (~\$0.50)
 - Prices vary by site
- Farmer holds insurance contract, max payout is loansize
 - Insurance payouts on rainfall index formula
 - Joint liability to farm “Clubs” of ~10 farmers
 - Farmers in 20km radius around met station
- At end of season
 - Farmer provides yields to farm association
 - Proceeds (and insurance) pay off loan
 - Remainder retained by farmer
- **Farmers pay full financial cost of program**
- Only subsidy is data and contract design assistance
- Partners: Farmers, NASFAM, OIBM MRFC, ICRSAT, Malawi Insurance Association, the World Bank CRMG, Malawi Met Service, IRI, CUCRED



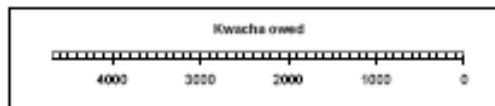
Some Stakeholders

Graphical representation of Insurance Contract developed with Farmers

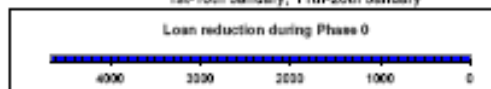
2006-2007 Potential Groundnut Contract -- CHITEDZE
 Loan approximation worksheet Rainfall is measured at Chitedze Research Station. Rainfall amounts may differ from those received at individual fields.

TOTAL LOAN 4667.35

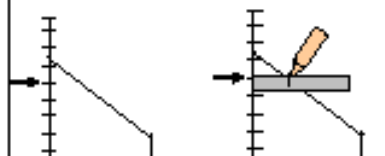
	Upper trigger	Lower trigger
Phase 1	35 mm	30 mm
Phase 2	35 mm	30 mm
Phase 3	220 mm	20 mm



Phase 0:
 If there is less than 25mm of rain in each and every one of the following 10-day periods, the loan is reduced to zero: 11th-20th November, 21st-30th November, 1st-10th December, 11th-20th December, 21st-31st December, 1st-10th January, 11th-20th January

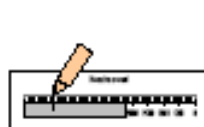


To use this sheet:



1. For Phase 1, read the amount of rainfall received and find where it hits the line.

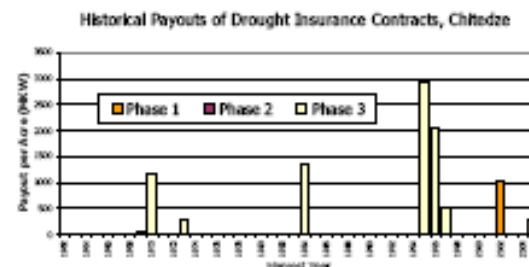
2. Using a piece of paper, measure the distance from the left side of the graph to the line.



3. Mark that distance against the small graph at the top, starting at the left side.

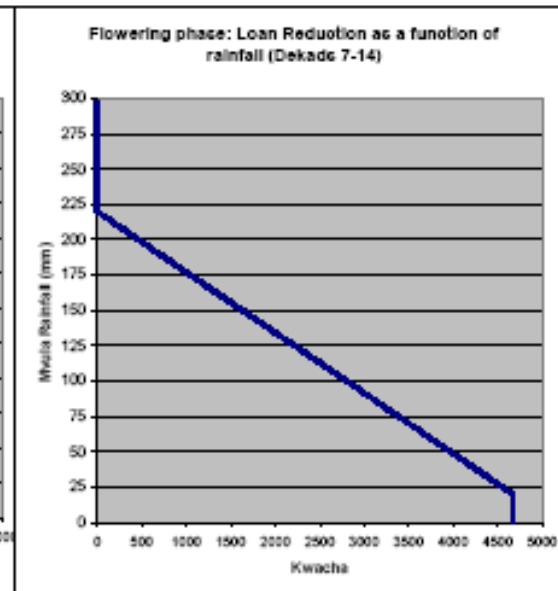
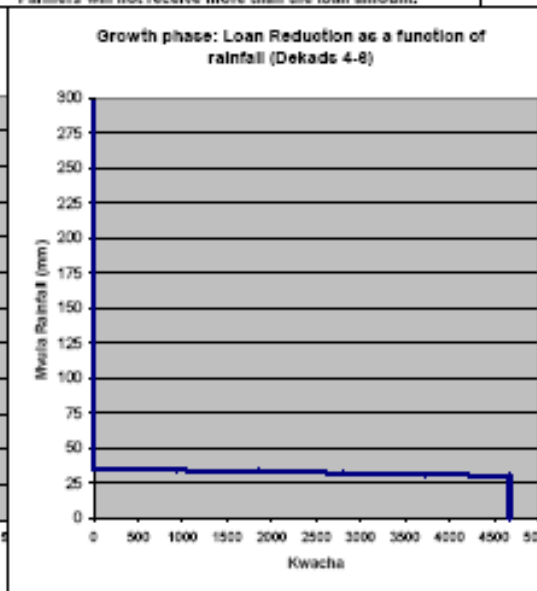
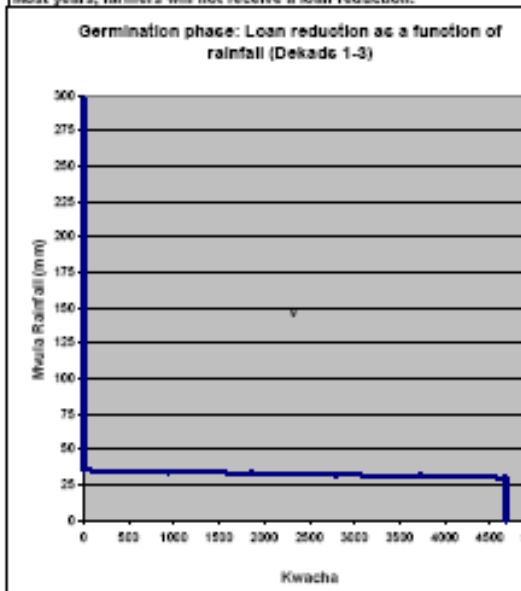


4. Repeat for the other phases, but in Step 3, start at the previous mark.



5. Note that rainfall is measured in 10 day periods, and capped at 60mm per period. Most years, farmers will not receive a loan reduction.

Farmers will not receive more than the loan amount.



Nicole Peterson, CRED

Contract design?

- Different simulation strategies provide different results
- Historical yield data scarce and unreliable, for different varieties, different inputs
- Private information inherent to design problem:
 - Only naïve players show all of their cards
 - We do not know risk preferences, productivity, self-insurance, production details, consumption needs, hedging strategies, other sources of income, if having new child year...
- So we cannot run ‘ideal’ optimization
- But we must design contracts

Cooperative Design Strategy



Cooperative design steps

- Stakeholders choose maximum insurance price
- Use qualitative knowledge of vulnerability to set initial guess for optimizer
- Computer optimization (really just “tuning”):
 - WRSI based simulation of losses (using historical precip)
 - Optimize upper triggers to:
 - **Minimize variance of (losses - insurance payments)**
 - **Subject to specified maximum insurance price** (can get great correlation at high price)
- Compare contracts performance against array of simulations and historical data, looking for contract vulnerabilities.
- Would most payouts have occurred in most of the worst years of history, for right reasons?
- Communicate results with stakeholders, iterate, and manually adjust contracts to address requests, reporting price, payout, and correlation impacts of changes.

Stakeholder input drives contracts

- Look for:
 - Do stakeholders understand contracts?
 - Do stakeholders show evidence of negotiating in their own interests?
 - Do stakeholders understand basis risk and what is not covered?
 - **Look for insightful complaints**
- Malawi stakeholders have been very active, driven design
 - Original CRMG project proposal was for stand alone Maize Insurance
 - **Malawi stakeholders proposed groundnut bundle**



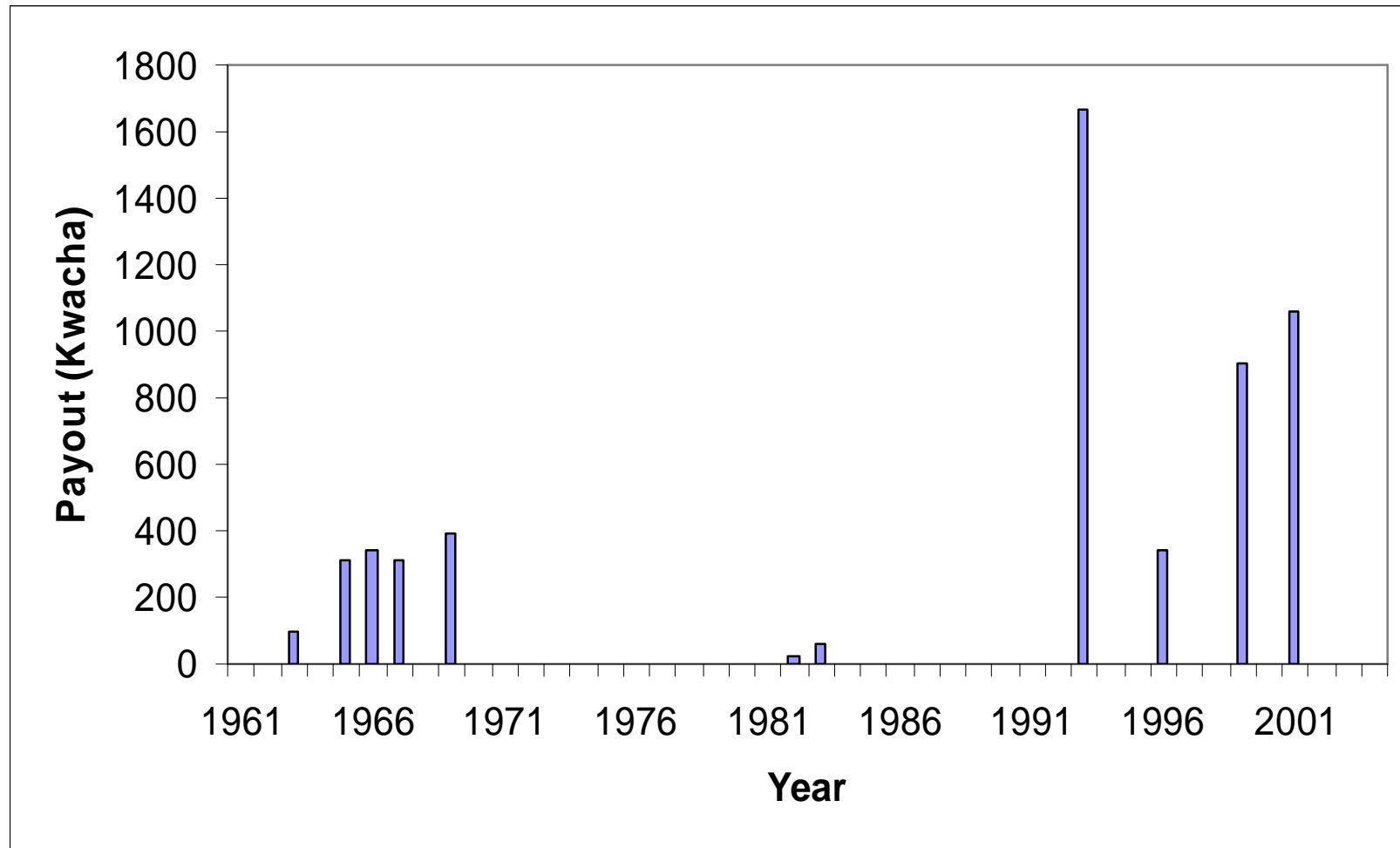
Some Malawi Project Challenges

- Basis risk
 - Seed quality
 - Aflatoxin
 - Rainfall spatial variability
- Seed and Yield prices
- Repayment
- Scaling challenges
 - Station availability, history
 - How do you responsibly include thousands of new farmers?
- Financial recordkeeping quality
- Compatibility with government subsidy programs

Seasonal forecasts, long term trends, and climate change

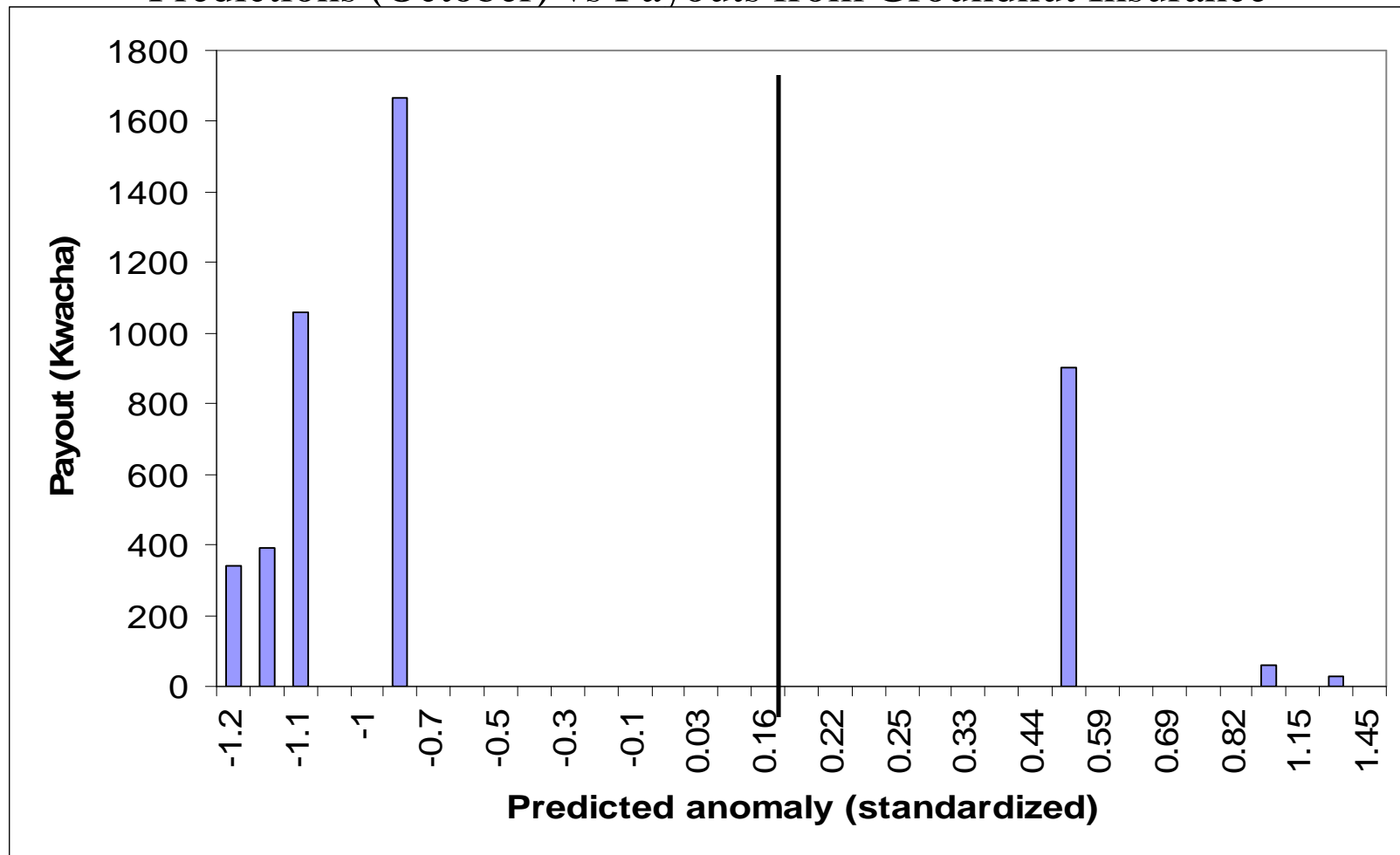
- Seasonal forecast and index insurance interact
 - Difficult to take chance using forecast if livelihood at stake
 - Well designed insurance can take risk out of forecast
 - Maps probabilistic forecast to deterministic outcome
 - Farmers (banks) can take intensification chances for higher productivity
 - Insurance can communicate forecasts and risk costs as price signal
 - Seasonal forecast makes badly designed insurance insolvent
 - Well designed insurance robust to forecast
- “Low skill” forecasts/indices can have high skill for insurance specific decisions
- Can climate science “guarantee” no skill?

Exploratory analysis: Hypothetical Historical Payouts of Drought Insurance 2005 Contracts for Groundnuts in Lilongwe, Malawi



Miguel Carriquiry. Draft Results—Do not cite

Exploratory Analysis: Standardized Seasonal Rainfall Anomaly Predictions (October) vs Payouts from Groundnut Insurance



Miguel Carriquiry. Draft Results—Do not cite

Visions for climate risk management

- Malawi farmers
 - Knew about Enso impacts on precipitation
 - Would like to adjust practices to take advantage of seasonal forecasts but are unable to obtain appropriate fertilizer and seed
 - We are researching and cooperatively developing packages that provide price incentives, risk protection, and strategic input availability so farmers can take advantage of forecasts
 - No ‘historical’ payouts for La Nina years for many stations
 - ICRSAT would like to develop seeds to compliment these packages
 - Fundamental research on insurance, production, and forecast necessary (Xiaoyu Liu. . .)
- **When asked how they adapt to climate variability and change farmers reported that they signed up for the index insurance program.**

Climatology important

- Northern and Southern Malawi
 - “**opposite**” **Enso phase response**
 - Location of north-south dividing line challenging to forecast
- But climate info still very valuable for insurance
- Potential for natural hedge
 - By **strategic pooling of contracts** from the north and south, total risk can be reduced, reducing costs of insurance
 - Research underway (Megan McLaurin . . .)
 - Pool Kenya with Malawi?
 - Negative correlations, forecast critical in Central America
- We are building integrated data/contract design web tools



I'm Mrs Timange Mateyo Kalitsiro from the Chiponde GAC, Chiwamba Association and one of the Volunteers of Gender and HIV.

I would like to talk about the Chalimbana 2000 Groundnut variety. This type of ground nut is high yielding. But, we had a seed problem. Not all the seed that we planted germinated. This is what caused us not to achieve the normal high yield expected from Chalimbana 2000.

We hope that if we can be given a good seed this coming season, we will be able to harvest high yields. Chalimbana 2000 is different from the ordinary Chalimbana . If we can be given good seed and take a good care of our gardens we can benefit a lot from this crop.

We wanted to know more about insurance. What is the meaning of insurance? We did not know much about this insurance, but now through the explanation that has been given to us by the agricultural advisors and visitors who came here at Chiwamba, now we have understood how this insurance works. We will be able to explain to our friends how the insurance works and how we can benefit from it in the time of disaster.

Our request is that the insurance should not only cover rain disaster but also other agricultural problems. We the farmers, we are ready to work with you for the success of the project, and the insurance coverage will help us when we have a disaster.

We farmers from Chiwamba, we promise to work hard if we are given the farm inputs in good time and plant with the first planting rain, we will have enough time to take care of the crops at the end we will have enough yields.

Thank you (Zikomo)