Yield index insurance and farmers' resilience in Ethiopia: Analysis using a farm-level integrated simulation approach

Bizimana, JC[1], Worqlul, A.W.[2], Bryant, H.L.[1], Dile, T.Y.[3], Srinivasan, R.[2,3], Lefore, N.[4] and Richardson, J.W.[1]

[1]Department of Agricultural Economics, Texas A&M University, College Station, TX
[2]Blackland Research and Extension Center, Temple, TX
[3]Spatial Sciences Laboratory, Texas A&M University, College Station, TX
[4]The Norman Borlaug Institute for International Agriculture, Texas A&M University, College Station, TX

Selected Poster prepared for presentation at the 2021 Agricultural & Applied Economics Association Annual Meeting, Austin, TX, August 1-3, 2021.

Yield index insurance and farmers' resilience in Ethiopia: Analysis using a farm-level integrated simulation approach

Bizimana J.C.[1], Worqlul, A.W.[2], Bryant, H.L. [1], Dile, T.Y.[3], Srinivasan, R.[2,3], Lefore, N.[4] and J.W. Richardson[1]

[1]Department of Agricultural Economics, Texas A&M University, College Station, TX; [2]Blackland Research and Extension Center, Temple, TX; [3]Spatial Sciences Laboratory, [4]The Norman Borlaug Institute for International Agriculture, Texas A&M University, College Station, TX

INTRODUCTION

- Main source of agriculture risks are related to weather uncertainty and variability which reduce households' assets or consumption (Elabed et al., 2013)
- Building households resilience against climate shocks is key to enhance food security.
- Crop insurance can mitigate risks and help households maintain assets and consumption levels (Carter et al., 2014)
- Area-wide (yield, weather) index insurance serves as a possible yield risk management scheme in developing countries (DC)
- Despite many index insurance pilot programs in DC, few showed positive results and sustainability due to basis risk

OBJECTIVE

Use an integrated approach of crop growth (APEX) and farm economic simulation models (Bizimana & Richardson, 2019) to develop a yield-based index insurance and estimate potential indemnities for smallholder farm families in Ethiopia Thanks.

METHOD FRAMEWORK & STUDY AREA

- Four steps are followed to develop yield index insurance:
  - Identification of climate risk areas for rainfed cropping systems in Ethiopia
  - Identification of major rainfall regimes associated with climate risk areas and rain-fed maize growing period
  - Use of observed maize yields at zonal level and weather data to calibrate and simulate 30-year maize yield history by the APEX model
  - Build yield index to trigger crop insurance indemnities:

Indemnity *= max (0, Price * (Average Yield * Insured Fraction – Realized Yield)*

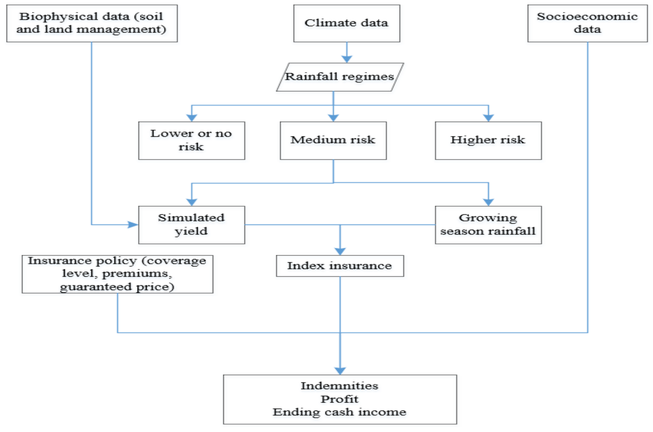

Figure 1: The methodological framework used to develop index insurance

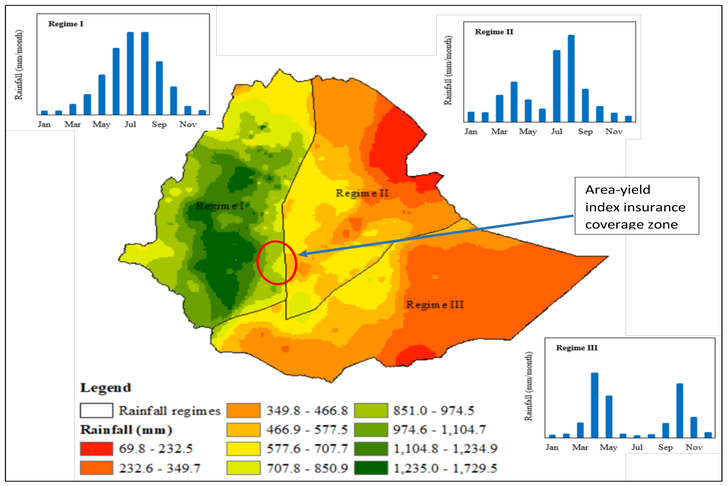

Figure 2: Boundary of rainfall regimes in Ethiopia and study area of Lemo, SNNP region

SCENARIO ANALYSIS

- Baseline scenario: Current practices, no insurance coverage and minimal ag. input (fertilizer)
- Alternative scenarios (9): Insurance coverage levels: 50%-100% + Use of ag inputs (fertilizers)

RESULTS: POTENTIAL INDEMNITIES PAYMENTS

- Insurance policy with full coverage (100%) has the highest probability (67%) of being paid indemnities while insurance policies with coverage between 75 and 85% has between 7 and 15% chance of being paid indemnities
- Insurance policies with coverage below 75% coverage have zero percent chance of being paid indemnities

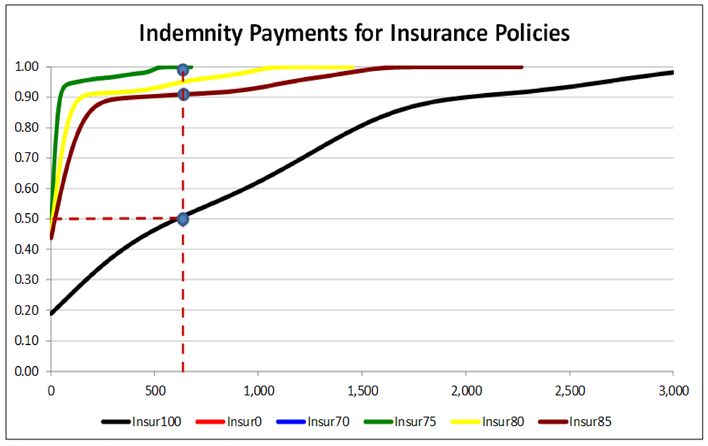

Figure 3. Cumulative distribution of indemnity payment for insurance policies

Table 1: Simulated premiums and probabilities of indemnities in Lemo, SNNP region

Scenarios	*Levels of coverage (Fraction)*	*Per Hectare Premium (ETB)*	*Probability of Indemnity*	*Range Indemnity pay (ETB)*
Full Insur. Policy	1	795	67%	0 - 3,014
No Ins 0.0	0	0.0	0%	0
Insur 0.5	0.5	0.0	0%	0
Insur 0.55	0.55	0.0	0%	0
Insur 0.6	0.6	0.0	0%	0
Insur 0.65	0.65	0.0	0%	0
Insur 0.7	0.7	0.0	0%	0
Insur 0.75	0.75	19	7%	0 - 494
Insur 0.8	0.8	62	10%	0 - 998
Insur 0.85	0.85	118	15%	0 - 1,502

CONCLUSIONS

- Crop index insurance can help households maintain assets and consumption levels in face of severe shocks due to climate variability such as drought
- This study uses an integrated approach combining an economic and biophysical models to reduce basis risk and estimate indemnity payments.
- Higher levels of insurance coverage 75% to full coverage offer higher probability of indemnity payment

REFERENCES

- Elabed, G., Bellemare, M.F., Carter, M.R., C. Guirkinger. 2013. Managing basis risk with multiscale index insurance. Agricultural Economics 44 (2013) 419–431.
- Carter, M., de Janvry, A., Sadoulet, E. and A. Sarris (2014). Index-based weather insurance for developing countries: A review of evidence and a set of propositions for up-scaling. Paris, June 25. 2014.
- Bizimana, J.C. and J.W. Richardson. Agricultural Technology Assessment for Smallholder Farms: An Analysis Using a Farm Simulation Model (FARMSIM). Computers and Electronics in Agriculture, 2018.

ACKNOWLEDGEMENT

This poster is made possible by the support of the American People provided to the Feed the Future Innovation Lab for Small-scale Irrigation (ILSSI) through the United States Agency for International Development (USAID). The contents are the sole responsibility of the authors and do not necessarily reflect the views of USAID or the United States Government. Program activities are funded by USAID under Cooperative Agreement No. AID-OAA-A-13-0005.