Disaster Management - The Agricultural Dimension

Global Facility for Disaster Recovery and Reduction
Seminar Series
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COMMODITY RISK MANAGEMENT GROUP
The World Bank

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Overview

- Risk Management in the Rural Sector
  - Commodity Risk approach to Rural Risk Management
  - Price and Weather Risks (Covariate)
  - Agricultural Supply Chain Risk Management

- 3 Examples
  - Ethiopia: Drought Relief as Insurance
  - Malawi: Integrated Drought Risk Management Strategy
  - Madagascar: National Risk Assessment

Risk In Rural Areas

- Production Risk
  - Inputs
  - Credit
  - Weather
  - Harvest
  - Quality
- Infrastructure
- Access
- Communication

Impact of Natural Disasters

- Natural Disasters
  - Direct Losses
  - Indirect Losses

- People
- Public/Private Assets
- Inventories

- Loss of Tax Base
- Business Interruption
- Reallocation of Investments

- Short Term: Humanitarian
- Long Term Impact
Motivation

- Traditional crop insurance in developing countries
  - Multi-Peril Crop Insurance (MPCI)
    - Yield-based insurance is not sustainable
  - Main constraints for traditional products
    - Poor rural insurance infrastructure and capacity
    - Operationally difficult for small farmer agriculture
    - Loss adjustment; availability of farm level data
    - Moral hazard
    - Adverse selection due to asymmetric information
    - High monitoring and administrative costs

- Management of Aggregate (Macro) Risk
  - Transfer Covariate Risk - Reinsurance

Estimated global agricultural insurance premiums

- Estimated total premium 2003: $7 billion


Index (Parametric) Insurance

- Challenge
  - Micro: Design an alternative, efficient and cost-effective crop failure insurance program that facilitates risk transfer and is feasible for small farmers in low-income countries
  - Macro: Design alternative risk transfer schemes for aggregate risk in rural areas or at the national level

- Index Insurance
  - An index insurance contract pays out on the value of an “index”
    - An index is a variable that is highly correlated with losses
    - Index cannot be influenced by the insured
    - Example indices: high or low rainfall, temperature; regional yield; river levels
    - One key advantage is rapid payment following a triggered event
    - Main shortcoming is basis risk
Applications and experience

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
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<tbody>
<tr>
<td>Micro</td>
<td>Weather-indexed insurance for smallholder farmers, intermediated through institutions with rural outreach</td>
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<tr>
<td>Meso</td>
<td>Weather-indexed portfolio hedge for rural financial institutions that lend to poor farmers</td>
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<td>Macro</td>
<td>Weather insurance or weather-indexed contingent credit line for governments or international organizations that provide safety nets for the poor</td>
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Index insurance experience to date
- Main application has been for drought risk at Micro level
- Pilot scale implementation in several countries
- Private sector scale-up only in India
- Research to expand to other risks: flood, ENSO, cyclone

Pre-Conditions for Index-based Risk Transfer

- **Micro level:**
  - Willing insurance market
  - Distribution linkages (e.g., MFIs)
  - Client base in emergent or commercialised agri sectors
  - Ability and willingness of farmers to pay premium (subsidy?)
  - Minimisation of basis risk

- **Meso and macro levels:**
  - Tolerance of basis risk may be higher
  - Ex-ante plan targeting beneficiaries of payouts
  - Offers possibility to extend to safety net for most vulnerable

- **All levels:**
  - Adequate meteorological data history and station density
  - Due diligence of insurer and programme by reinsurers
  - Risk layering: structuring of reinsurance market and govt intervention

Distribution and Risk Transfer

- Weather risk market maker
- Reinsurance treaty
- Insurance Company
- MFIs, Farmer Associations etc.
- Farmer
- Weather insurance contract
- Bulk weather insurance contract
- Reinsurance treaty

International

- Weather risk market maker
- Reinsurance treaty
- Insurance Company
- MFIs, Farmer Associations etc.
- Farmer
- Weather insurance contract
- Bulk weather insurance contract
- Reinsurance treaty
Layering facilitates clear delineation of public-private roles and the transfer of low-probability, high impact indexed risks from developing countries to the international markets.

**Issues for Reinsurer Support**
- Reinsurers need control of their aggregate exposures
- Local and regional climate information is needed to underwrite weather risks
- Reinsurance markets are more willing to support index than traditional products in developing countries
- Underwriting due diligence is generally easier for index products
- Index product is suitable for catastrophe risks such as drought
- Diversification of risk attractive to reinsurers
- Involve reinsurers during the design phase

**Other considerations...**
- Emergency liquidity
  - Rapid release of non-insurance funds using indexes
- Risk assessment in supply chain:
  - Hazard analysis
  - Vulnerability analysis
  - Risk Management Framework
- Insurance is only one of many Climate Risk Management measures, e.g.
  - Drought resistant varieties
  - Water management
  - Climate information for crop and livestock decision support
  - ex ante DRR planning at govt, regional and local level
  -> Mainstream insurance into CRM mechanisms
CRMG agenda

- Assess risk in relation to agriculture and commodity supply chains
- Identify alternative and feasible risk management approaches
- Facilitate adoption of innovative instruments to manage/transfer risk, including to the international market
- Partner with private sector financial institutions, agribusiness, and the public sector
- Mainstream technical assistance and product development into development projects and lending

ETHIOPIA

Effective insurance function of humanitarian assistance requires financing

WFP MOTIVATION: AID AS INSURANCE

- Uninsured asset and income losses trap vulnerable populations in poverty
- Emergency aid is insurance for vulnerable populations in developing countries
- Difference: insurance provides contingency funding in event of shock; humanitarian aid seeks funding for assistance after shock
- Insurance is risk management instead of emergency response
- Contingency funding is of far greater value to beneficiaries; transfers risks from vulnerable populations to financial markets

Reference: WFP 2005
**PILOT OBJECTIVES**

The objectives of this small pilot were:

- Quantification of Ethiopia's drought risk and development of appropriate rainfall index;
- Demonstrate the possibility of transferring LDC weather risk to the international market and put in place a small derivative contract to hedge against the effects of severe drought for Ethiopia's 2006 agricultural season;
- Enable price discovery for Ethiopian weather risk in international financial markets;
- Set in motion a process for ex-ante risk management in Ethiopia and other developing countries.

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**ETHIOPIA PILOT FOR WFP**

Drought derivative to demonstrate feasibility of establishing contingency funding for an effective aid response

- Ethiopia Drought Index:
  - Crop water balance model, FAO’s WRSI
  - Variable input is daily rainfall data
  - 26 primary weather stations tracking staple crop yields
  - Stations cover “At-Risk” farmers in 276 woredas
  - Indexed yield calibrated to the income losses of “At-Risk” farmers

**Extreme Drought Coverage**

- Location: 26 Weather Stations (Agricultural Areas Only)
- Start Date: 11th March 2006
- End Date: 31st October 2006
- Tender Winner: AXA Re
- Premium: $930,000
- Max Payout: $7,100,000

PILOT RESULTS

- Contingency funding established through transaction with AXA Re, premium paid by USAID
- Rainfall data flow secured through National Meteorological Agency (NMA) capacity building
- No payout in 2006, but drought index accurately tracks agricultural season
- Implementation Rulebook was designed by Government of Ethiopia with WFP assistance to channel payout as cash-transfers to 65,000 households if a maximum payout occurred
LESSONS LEARNED SO FAR

Pilot Drought Insurance Project focused on testing an innovative financial tool and demonstrated (WFP 2007):

- It is feasible to use market mechanisms to finance drought risk in Ethiopia;
- It is possible to develop objective, timely and accurate indices for triggering drought response;
- Contingency plans can better be designed with predictable resources;
- Ethiopian weather data from National Meteorological Agency satisfies international weather risk market standards; and
- If insurance is to become an effective risk-management tool, it must be coordinated with other financial instruments to provide more comprehensive coverage of Ethiopia’s drought risks.


MALAWI

CHALLENGE

To secure timely and reliable funds to finance GoM response to drought in severe years.

Timely response requires contingency funds, which weather risk management instruments can provide.

Cost effective response requires Commodity price risk management.
Malawi Maize Production Index (MMPI) is the output of rainfall-based index model for maize production. Details:

- Malawi Meteorological Office developed, CRMG adapted
- Crop water balance model, FAO’S WRSI
- Variable input is daily rainfall data only
- 21 primary weather stations throughout the country tracking local and hybrid maize yields

Hypothetical Protection Structure:

- Trigger to protect against maize output below 1,500,000 MT
- Strike: 1,500,000 MT
- Limit: 1,000,000 MT
- Payout Rate: $30 per MT
- Location: 21 Weather Stations
- Start Date: 1st October 2006
- End Date: 30th April 2007
- Payout Date: 7th May 2007
- Maximum Payout: $15,000,000

Coverage to protect against the impact of deficit/erratic rainfall on national maize production. Structure designed to reflect conditions which would impact national maize production and food security, resulting in Gilh maize imports.

Drought Protection Component:

--national maize production

MMPI VERSUS NATIONAL PRODUCTION

Prototype Index: Correlation 75%

PAYOUT STRUCTURE

- Maximum Payout $15 million
- $30 per MT
- 1.6 million MT – Long-Term Average
- Trigger Level – 1.5 million MT
HISTORICAL PAYOUTS

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<tr>
<th>Year</th>
<th>Payout ($US)</th>
<th>Index Predicted Production (MT)</th>
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<tbody>
<tr>
<td>1962</td>
<td>$2,000,000</td>
<td></td>
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<tr>
<td>1964</td>
<td>$4,000,000</td>
<td></td>
</tr>
<tr>
<td>1966</td>
<td>$6,000,000</td>
<td></td>
</tr>
<tr>
<td>1968</td>
<td>$8,000,000</td>
<td></td>
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<tr>
<td>1970</td>
<td>$10,000,000</td>
<td></td>
</tr>
<tr>
<td>1972</td>
<td>$12,000,000</td>
<td></td>
</tr>
<tr>
<td>1974</td>
<td>$14,000,000</td>
<td></td>
</tr>
<tr>
<td>1976</td>
<td>$16,000,000</td>
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Basis Risk or “How good is this protection?”
- Mismatch between coverage and actual result
- How can it be minimized?
- Index must reflect the critical dependence of maize yields on rainfall from sowing to maturity
- Good station weighting
- Protection against extreme drought events

Data or “Can we transfer the risk?”
- Length of historical records, 30 years or more?
- Quality controlled, many gaps?
- Reliable real-time collection and reporting procedures?
- Independent third-party for data settlement

Malawi Met Office data excellent: over 30 years, few gaps. Can potentially provide real-time data required by market.

KEY WEATHER STRUCTURAL HURDLES

Price Risk Management Component
- Pilot during 2005/6 Food Shortage
- Government of Malawi purchased SAFEX-based call option to cap the cost of maize imports
  - for 60,000 mt of maize
  - During Dec/Jan maize prices rose $50-90/mt higher than level at which Govt was importing
  - Contract was customized to give flexibility and delivery performance was higher than through other tenders
- Weather Insurance + Price Risk Mgmt = Integrated Ex Ante Drought Risk Mgmt Strategy
National Risk Assessment

- Multi-Peril Risk Assessment for Productive Sectors and Key Infrastructure
  - Cyclones, Droughts, Floods
  - Hazard Mapping + Vulnerability Mapping = Risk
- Agricultural Risk Assessment
  - Exposure of Key Commodities and Staple Crops (Rice)
  - Agricultural Infrastructure (Irrigation)
  - Madagascar Action Plan (PRSP): likely increase in risk exposure
- Contingent Funding and Risk Transfer for Cyclones
  - Rapid Funds for Post-Disaster Response & Rehabilitation

Cyclone Risk Mapping

- Probabilistic Analysis for Loss Estimation
  - Stochastic Cyclone Modeling
  - Hazard Mapping
  - Vulnerability Analysis
  - Financial Impact Analysis

Date: 03-11 MAR 2004
Cyclone GAFILO Madagascar
Cyclone Vulnerability Analysis

Construct Composite Vulnerability Functions from:
- Agricultural Census
- Census
- Infrastructure Inventory (Irrigation)
- Crop losses
- Engineering Review
- Remote Sensing
- International Benchmarks

Cyclone Impacts

- Irrigation Infrastructure
- Agriculture/Aquaculture Exports
  - Vanilla, Shrimp, Spices
- Rural Livelihoods
- Public Infrastructure
- Diversion of Government Resources
- No financially sustainable mechanism to cope with cyclone risk
- Poor donor coordination
- Cyclone Risk Analysis in support of:
  - Irrigation Infrastructure Rehabilitation Fund
  - Value Chain Risk Analysis (key commodities)
  - National Response Funding (disaster pool)
  - Macro Risk Transfer Mechanism

Commodity Risk Mgmt work (within ARD) facilitates:

- Market-based Risk Transfer Products
  - Weather index-based insurance
  - Price risk management contracts
- Knowledge Transfer and Education
  - Technical assistance in projects
  - Publications and training workshops
- New Applications
  - Disaster risk financing
  - Extension to new hazards
- Access to risk capital
  - Access to global reinsurance and commodity derivative markets