The Actuarial Profession
making financial sense of the future

GIRO conference and exhibition 2010
Agrotosh Mookerjee and Daniel Clarke

Tackling poverty

One insurance policy at a time

12-15 October 2010

Workshop overview

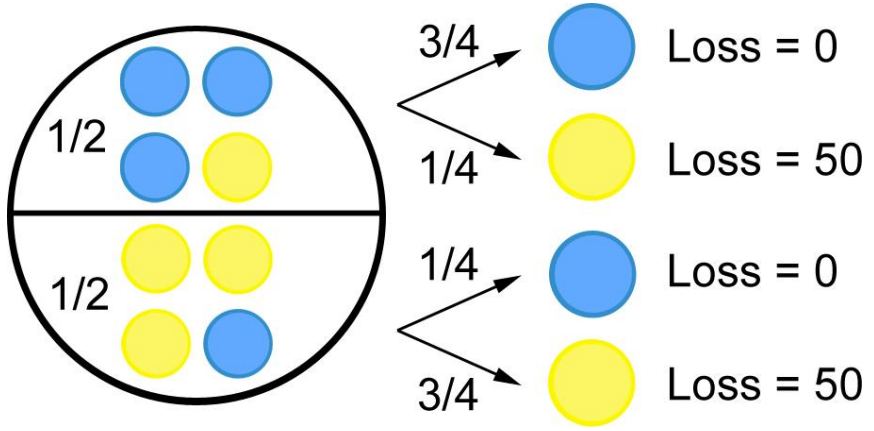
1. Background to crop micro-insurance
2. Two economic experiments (interactive)
3. Loading versus basis risk
4. Four crop micro-insurance products
5. What can actuaries do?

Crop micro-insurance: Background

- What is micro-insurance?
  - Insurance for 80% of humanity?
  - Low income customers, often linked to microfinance loans
  - Affordable, often community based, aim to reduce poverty
- Importance of agriculture…weather risks (e.g. rainfall)
  - Informal risk management strategies – “Poverty Trap”
- Crop micro-insurance- insuring poor farmers
  - Individual vs Group, Indemnity vs Indexed.

Learning by playing:
Two economic decision problems

- **Suppose you have been hired to offer independent financial advice to an Ethiopian farmer**
- The farmer starts with £65 but will incur a loss of £50 with probability ½
  - £50 ≅ 35 days of casual farm labour wage
- Compound lottery:
  - $\mathbb{P}$(Good weather)=½
  - $\mathbb{P}$(Bad weather)=½
  - $\mathbb{P}$(Loss=50|Good weather)=¼
  - $\mathbb{P}$(Loss=50|Bad weather)=¾



Decision problem 1: Indemnity insurance with loading of 60%

Insurance premium	Claim income if incur loss of £50 $\mathbb{P}=1/2$	Claim income if incur no loss $\mathbb{P}=1/2$
0	0	0
8	10	0
16	20	0
24	30	0
32	40	0
40	50	0

- What other information would you need as financial advisor?
- What levels of cover would you consider advising?

Decision problem 2:
Weather derivative with loading of 20%

Insurance premium	Claim income if weather is bad $\mathbb{P}=1/2$	Claim income if weather is good $\mathbb{P}=1/2$
0	0	0
3	5	0
6	10	0
9	15	0
12	20	0
15	25	0

- What other information would you need as financial advisor?
- What levels of cover would you consider advising?

Decision problems 1 and 2 were played in Ethiopia

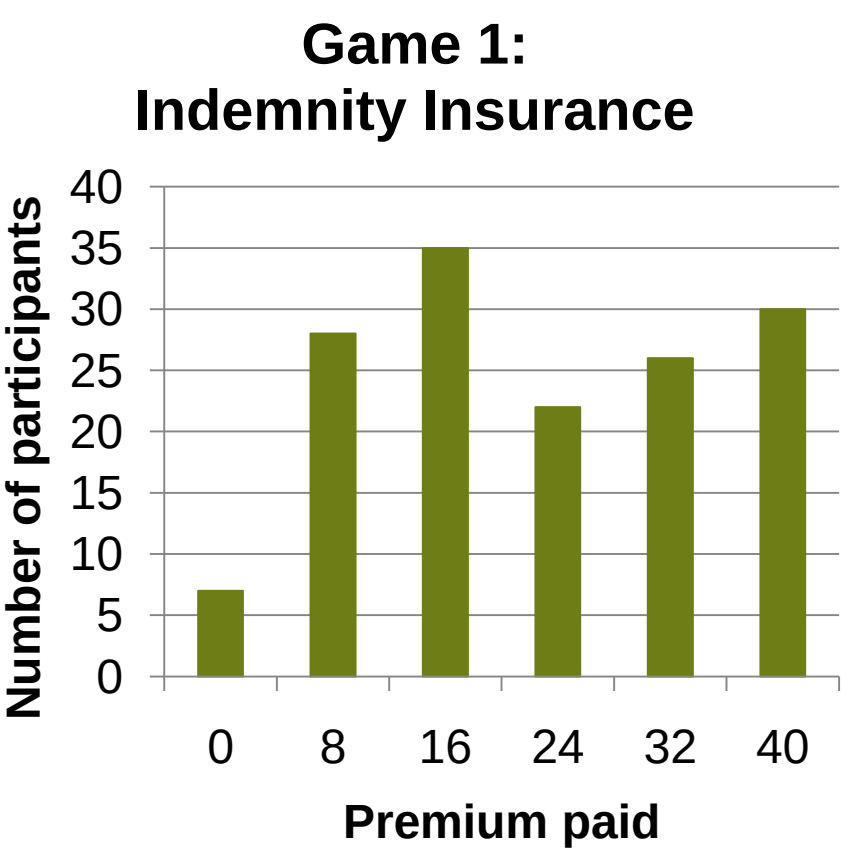
- 378 participants over 39 sessions
- From seven rural sites around Ethiopia
- Played 3 out of 5 games per session, 40 minutes per game
- Paid real money, with potential loss of 50 Birr
  - ≅ 3 days of casual farm labour wage
- Experiments funded by Microinsurance Innovation Facility

Participant was:	
Male	67%
Household Head	70%
Spouse of HH Head	10%
Literate	77%

Maths question answered correctly:	
5+3	86%
3×7	54%
1/10th of 300	30%
5% of 200	1%

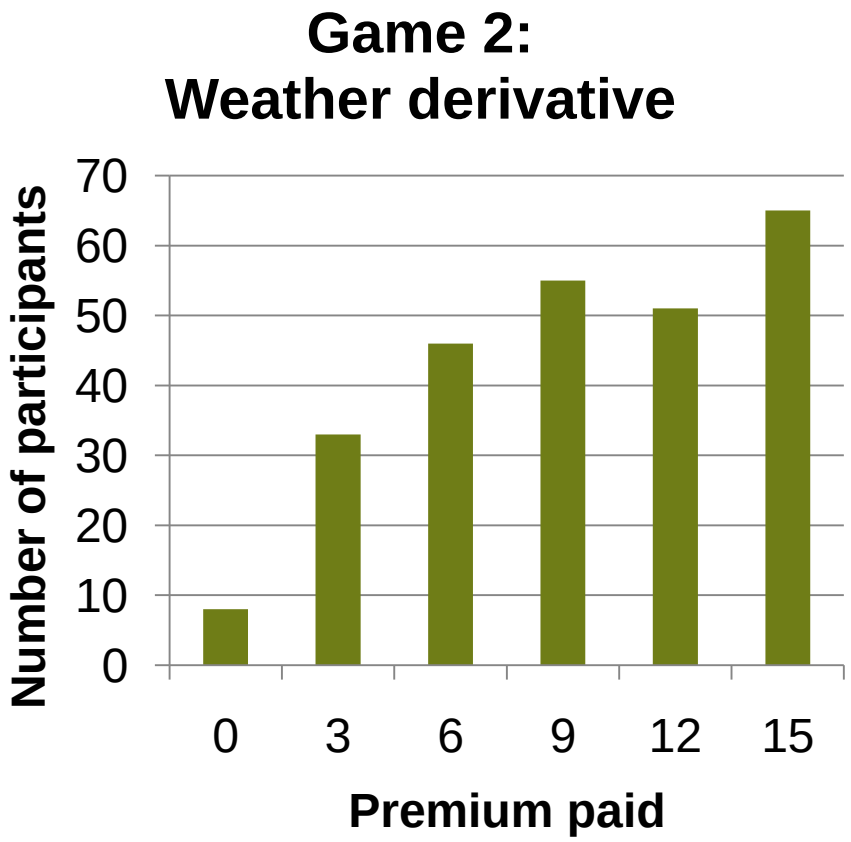
Decision problem 1: Indemnity insurance Participant choices and economic theory

- Classical economic theory doesn't restrict rational choice for Game 1:
  - A very risk averse participant might reasonably purchase full insurance
  - A risk neutral participant might reasonably purchase zero insurance



Decision problem 2: Weather derivative Participant choices and economic theory

- Classical economic theory does restrict rational choice for Game 2:
  - If care enough about risk to purchase derivative...
    - ... (and risk averse expected utility maximiser with decreasing absolute risk aversion) ...
  - ... then must care about downside basis risk enough to limit cover
- Premiums above 6 Birr are irrational



Decision problem 2: Weather derivative with loading of 20%

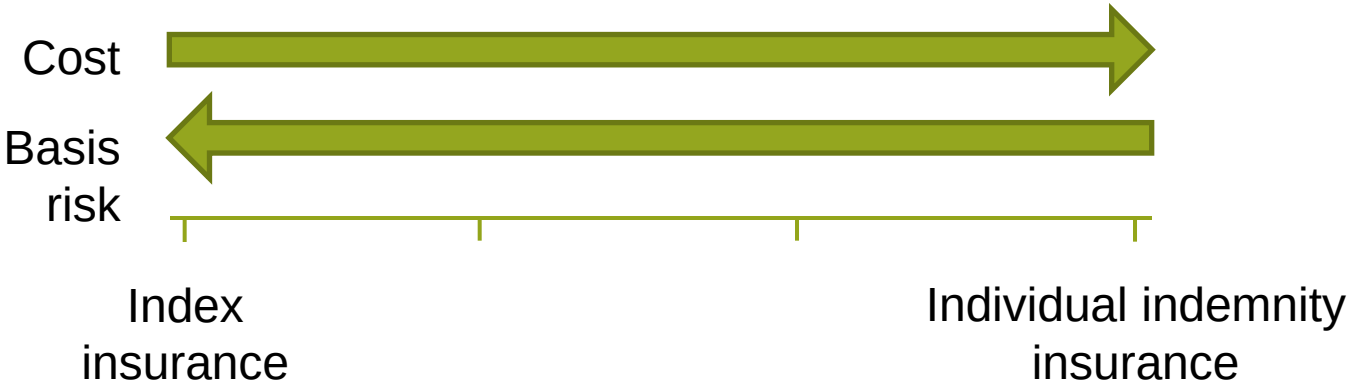
Full table of net wealth for decision problem 2:

Insurance premium	Net wealth			
	£50 loss		No loss	
	Good W.	Bad Weather	Good Weather	Bad W.
	$\mathbb{P}=1/8$	$\mathbb{P}=3/8$	$\mathbb{P}=3/8$	$\mathbb{P}=1/8$
0	15	15	65	65
3	12	17	62	67
6	9	19	59	69
9	6	21	56	71
12	3	23	53	73
15	0	25	50	75

Cost and basis risk: where is the sweet spot?

Product designer faces tradeoff between cost and basis risk

- High cost ⇒ zero purchase rational for all but the most risk averse
- High basis risk ⇒ zero purchase rational for all



Four crop insurance products: Description

- **Indemnity Basis**:= payment conditional on incurred loss
  - Individual Multiple Peril Crop Insurance (MPCI)
  - Group stop loss MPCI
- **Indexed Basis**:= payment conditional on index
  - Weather derivative
  - Area yield index insurance

Four crop insurance products: Comparison

Product	Basis risk	Deadweight cost
Individual MPCI	☺☺☺☺☺	$$$$$
Group stop loss MPCI	☺☺☺☺☺ (so long as group can pool risk)	$$$ (no loss adjustment for idiosyncratic losses)
Weather derivative	☺	$$
Area yield index insurance	☺☺ to ☺☺☺☺ (depending on size of insurance unit and ability of group to pool risk)	$$$

A proposal for next year's microinsurance working party

1. What could actuaries realistically contribute

- What is the demand? Need to liaise with:
  - Microinsurance practitioners
  - Supranational organisations involved with microinsurance
- What is the potential supply?
  - Work from home country in spare time
    - Ask an actuary by email
  - Short training courses offered in developing country
  - Fixed term sabbatical placement with a pro-poor developing country institution?
- Should actuaries just work hard and donate cash?

A proposal for next year's microinsurance working party

2. Perhaps start trying to provide some public goods

- Basic models for design and ratemaking:
  - Generic
  - Free to download
  - Written in MS Excel?
  - Fully documented

Questions or comments?

Expressions of individual views by members of The Actuarial Profession and its staff are encouraged.

The views expressed in this presentation are those of the presenter.