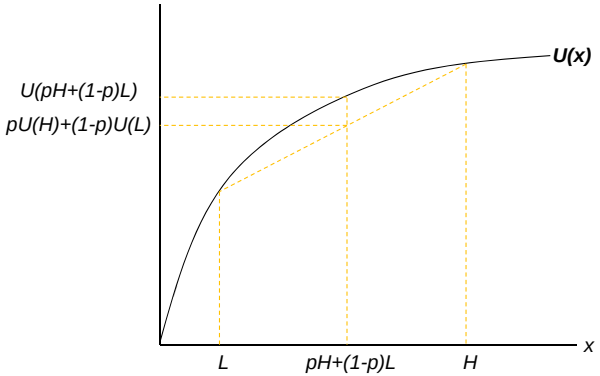
EE461
Lecture 9: Risk and Insurance

April 21th, 2012

MOTIVES OF INSURANCE

Risk Aversion

- Most people are *risk-averse*: they don't like uncertainty.
- Formally, it means utility function is concave.



- What do you think *risk-neutral* and *risk-loving* preference look like?

Smoothing Consumption

- With a risk-averse individual, swing in consumption is undesired.

$$U(pH+(1-p)L) > pU(H)+(1-p)U(L)$$

- Having an expected consumption with certainty is preferable than waiting anxiously for the uncertain consumption.
- Overtime, people face many risks and uncertainty of income
  - Risk-averse individuals will try to smooth their consumption.
  - How?

Outputs with Swings

- Suppose Anan and Seri are two risk-averse farmers.
  - Produce the same crop with the same inputs and lands
- Suppose the harvest can take one of the two values
  - $2000 in good year or $1000 in bad year.
  - Probability of each happening is ½
- Anan & Seri don't know each other and each will try to deal with their uncertainty on their own.
- What are the options?

Three Ways to Deal with Risks

1. ***Self-insurance:*** Anan and Seri can to absorb losses or store the excess (saving) in bad times.
2. ***Credit:*** Anan and Seri could from different sources
3. ***Insurance:*** Anan and Seri could by paying fees in good times and receiving payment in bad times.

→ Does it work? Can they help each other out?

UNNECESSARY RISKS

What Can Be Insured?

- Four possible cases that could happen to Anan and Seri's harvest.
  I. Both produce good outputs
  II. Both produce bad outputs
  III. (&IV.) One produces good outputs and one produces bad outputs.
- First two cases, there's little sharing they can do.
- What about the third and fourth case?
  - What if they agree to share outputs equally?
  - Each can have outputs of $1500 by

Improvement with Insurance

- If probability were independent (i.e. no correlation), probability for each case would be ¼.
- That means, possible outputs for each of them is

  Anan gets (2000, 1000, 2000, 1000)

  Seri gets (2000, 1000, 1000, 2000)
- With the scheme of sharing, outputs for each are

  (2000, 1000, 1500, 1500)
- Remember, the first two cases, nothing can be done, so sharing happens only in the latter cases.
- Better off? Risk-aversion?

Correlation

- Key factor is whether Anan and Seri share the same risk.
- Corr = 1
- Corr = -1
- -1 < Corr < 1, then there are some gains to insurance.
  - Is perfect insurance possible?

Complicating Common Sense

- We can write income of Anan and Seri as follows:

$$y_A = \bar{y} + \varepsilon_A = 1500 + \varepsilon_A$$

$$y_S = \bar{y} + \varepsilon_S = 1500 + \varepsilon_S$$

  where $\bar{y}$ is the expected income of each farmer which equals 1500 and ε_i is the uncertainty (either 500 or -500, each with probability ½).
- Note that income of 1500 is never realized, as each either receive 2000 in good times or 1000 in bad times.
  - Unless they agree to share as we have previously discussed
- How much they could gain from insurance depends on how often $\varepsilon_A \neq \varepsilon_S$ so they can exchange payment.

The More the Merrier I

- Insurance usually involve *more than* two people, how does it work?
- Imagine a large pool of people (Just “Ctrl + C” on Anan and Seri and paste) with *independent* income.
  - With probability ½ income is $2000 per year
  - With probability ½ income is $1000 per year
- Now, how much is the average income per person at the end of the year?
- This is like a coin flip, head gives you $2000, tail gives you $1000.

The More the Merrier II

- The necessary arrangement would be
  - Lucky farmers (i.e. $2000 income) pay $500 to the pot
  - Unlucky farmers (i.e. $1000 income) collects $500 from the pot
- Can this work?
  - Surplus and deficit should be small over time.
- Note that, each farmer can smooth consumption completely at the insured-level of income.
  - Two farmers →
  - Many farmers →

What Can Be Insured?

- Suppose there are a large pool of farmers in the village whose income for farmer *i* is given by

$$y_i = \bar{y} + \varepsilon_i + \omega$$

- There are three components: average income, random element for each farmer, and ω is the risk shared by all farmers.
  - Assume random shock ε_i to be independent across farmers, e.g. illness, rampant animal, inappropriate use of fertilizers
  - ω is aggregate risk, affecting all farmers equally, e.g. weather, natural disasters
  - Both have *zero* mean

What Can Be Insured?

- Large number of farmers => random shock ε_i can be insured away by the process we already have discussed, leaving income as $y_i = \bar{y} + \omega$
  - Some will receive positive shocks → contribute to the pot
  - Some will receive negative shocks → collect payment
- What about *aggregate risk*? Can farmers insure against the aggregate risk among themselves?
  - *Self insurance:* require savings
  - *Credit:* require lenders willing to face aggregate risk.
  - Insurance among themselves is not possible.

What have been insured?

- Townsend (1993, 1995) have found significant consumption smoothing among poor villagers in India and Thailand
  - $1 increase in income only move consumption by $0.14!
  - Sickness and loss of work do not affect household consumption.
  - Paxson (1992) finds Thai farmers save up to 82% of transitory income!

LIMITS OF INSURANCE

Asymmetric Information

- **Ex-post Outcome:** Those coming to claim insurance may lie about the value their final outcome.
- **Ex-ante Outcome (Moral Hazard):** Those coming to claim insurance may lie about the reason of their adverse outcome (reckless behaviors and careless management.)
- **Remedy:** *Social Capital*, i.e. informal information network within the community as monitoring device, which means activity must be at the village level, *not in headquarter.*

Practical Issues

- **Lack of reinsurers:** Insurer needs reinsurers to pass on risks beyond their appetite.
- **Lack of appropriate data:** Require intensive data both for calculating insurance premiums and to overcome asymmetric information problems (e.g. health, life-expectancy, weather data)
- **Lack of Innovation to reduce transaction cost:** Unlike *Microfinance*, there hasn't been any innovation to reduce the cost of dealing for many small transactions.
  - It means Insurer incurs the same cost insuring the rich and the poor.

CONCLUSION

A long way to go

- Insurance exists for the need to smooth consumption of the risk-averse people
- Some (and not all) risks can be diversified
- With the lack of many factors, micro-insurance is still much less underdeveloped: still a long way to go