

## Chapter 2

# A model of insurance

One's destiny, of course, depends on one's self-struggle, but one must also take into account the course of history.

—President. Jiang

### 2.1 An interesting economic story

You know, a world isn't always so perfect that your good is always same even more. You always encounters some risks and uncertainty. Let's make the story more theoretical.

#### 2.1.1 Assumptions

The agent lives in a period which is divided into two parts. Call them **ex post** state and **ex ante** state.

Ex post period is after the event X, ex ante period is before the event X.

How will the event impact you? After the event happens, you will get different incomes as  $M_1$  and  $M_2$ .

And different incomes happen at different probabilities as  $\pi_i = \text{Prob}\{\theta = \theta_i\}$ ,  $i = 1, 2$ , where  $\pi_i > 0$  and  $\pi_1 + \pi_2 = 1$ .

Assume in each of your ex post income states, the utility function that the agent uses to measure utility is  $u(c)$ , which is monotonically increasing and weakly concave, that is:  $u'(c) > 0$ ,  $u''(c) \leq 0$ .

So what does the agent know at present (ex ante) state?

The probability of each ex post income state; The possible incomes  $(c_1, c_2)$ ;

The utility function.

So what does the agent not know?

Which state he will be plunged in—Risk!

So his utility in ex post life is:

$$u(c_1, c_2) = \pi_1 u(c_1) + \pi_2 u(c_2)$$

Call this function "expected utility", which is the expected value of his utility across the two different ex post states of the world.

And  $c$  represents consumption but not wage in each state.

### 2.1.2 Expansion to multiple states

Obviously if  $\theta = \{\theta_1, \theta_2, \dots, \theta_N\}$ ,  $\pi_i = \text{Prob}\{\theta = \theta_i\}$ ,  $i = 1, 2, \dots, N$ .

Then  $u(c_1, c_2, \dots, c_N) = \sum_{i=1}^N \pi_i u(c_i)$

### 2.1.3 Insurance

You know, we afraid about risks. And from the last model, we should reach the conclusion that an relatively controllable and even allocation is always better than a casual allocation.

However, unlike the last model—we are a superstar that we master a technology to reallocate food between young self and old self. This days we have to face risks.

But you know the risks might make you rich, might make you poor. It not depends on you, but you have a desire to move some good from the rich self (one day you may pick up a check) to your poor self (one day you may be rubbed).

So desire exists, but you can't reallocate food this time.

How can you implement a plan to take consumptions from your rich self to poor self?

That's insurance!

- **Points 1.** *My view Insurance is about getting consumption when I'm poor, and pay you when I'm rich.*

*By the contract with you, I reach a balance with myself.*

- **Points 2.** *Market view Insurance is traded right now. The underlying logic is that the market has a somehow different utility function(linear).*