Imperfect Information in Insurance

University of Alabama

September 22, 2016

Reminders

- Midterm 1, Thursday September 29
- Midterm 1 Study Guide is on Blackboard
- Please fill out survey for extra credit on exam (survey should be on blackboard by tomorrow).
- In-class review session on Tuesday September 27
- Office Hours:
  - Today from 3:00pm-4:30pm
  - Tuesday 1pm-3pm
  - Wednesday 1pm-5pm

Midterm 1

Exam will cover:

- Health Care Spending
- Welfare Economics and the Market for Medical Care
- Health Production
- Demand for Health
- Empirical Microeconomics
- Health Insurance Theory
- Demand for and Supply of Health Insurance
- Asymmetric/Imperfect Information

How to study?

- Work through Quizzes 1-3
- Lecture slides on blackboard (study intuition and work through examples within lectures)
- Read the study guide

Last Class

- We more formally introduced the demand for and supply of health insurance.
- We discussed a consumer's demand for insurance by using the concepts of marginal benefits and marginal costs.
- We talked about the supply of health insurance under the assumption that the insurance industry is perfectly competitive.
- We showed that under an equilibrium within perfect competition, consumers will fully insure.
- Finally, we talked about issues of information such as moral hazard and adverse selection.

Information Asymmetry in Health Insurance

Rothschild & Stiglitz (1976) are given credit to be the first analysis of information asymmetry within health insurance markets. In their paper:

- There are two groups of consumers: those with a low probability of getting sick and those with a high probability of getting sick.
- Consumers derive utility from their income denoted by W, or wealth level.
- If consumers get sick, they lose a certain amount of wealth.
- With no Adverse Selection, both groups of consumers purchase full insurance.
- With Adverse Selection, sick individuals purchase full insurance, while healthy individuals purchase partial insurance. In this example, sick individuals impose a negative externality onto healthy individuals.

Rothschild & Stiglitz (1976)

- Two states for consumers: sick and healthy.
- Probability of getting sick is given by p.
- Wealth if healthy: W_1, wealth if sick: W_2
- Consumers can purchase an insurance contract $a = \{a_1, a_2\}$, where a_1 is the payment made to the insurance company if the individual is healthy, and a_2 is the payment made to the insurance company if the individual is sick.

Rothschild & Stiglitz (1976)

As usual, the consumer seeks to maximize expected utility:

$$(1-p)U(W_1) + pU(W_2)$$

Suppose we considered an example in which the consumer has an indifference curve capturing a tradeoff between wealth in the healthy state and wealth in the good state. We could calculate the marginal rate of substitution, or the rate at which a consumer is willing to tradeoff units of wealth in the good state for additional units of wealth in the bad state.

Recall from intermediate micro,

$$MRS_{xy} = \frac{MU_x}{MU_y}$$

Let's consider W_1 to be the "good" in x-space and W_2 to be the "good" in y-space

Rothschild & Stiglitz (1976)

$$(1-p)U(W_1) + pU(W_2)$$

Once again, treating wealth in the healthy state as the x good and wealth in the sick state as the y good, we can compute the MRS:

$$MRS_{W_1 W_2} = \frac{MU_{W_1}}{MU_{W_2}} = \frac{1-p}{p}\frac{U'(W_1)}{U'(W_2)}$$

Recall that the MRS is the negative slope of the indifference curve

Rothschild & Stiglitz (1976)

- General setup for only one type of individual

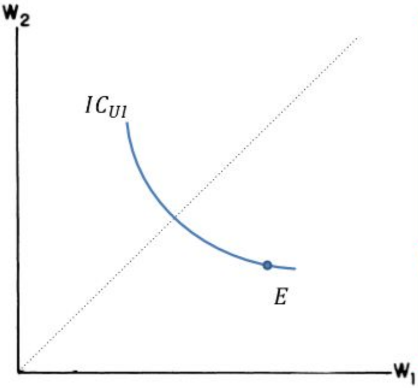

FIGURE I

- Y-Axis: Wealth when sick
- X-Axis: Wealth when well
- E: consumer's uninsured state
- IC_{UI}: Consumer's uninsured indifference curve
- Slope of indifference curve:

$$-MRS = \left(\frac{1-p}{p}\right)\left(\frac{MU(W_1)}{MU(W_2)}\right)$$

- 45° line represents no risk
- Wealth when healthy=wealth when sick

Rothschild & Stiglitz (1976)

- General setup for only one type of individual

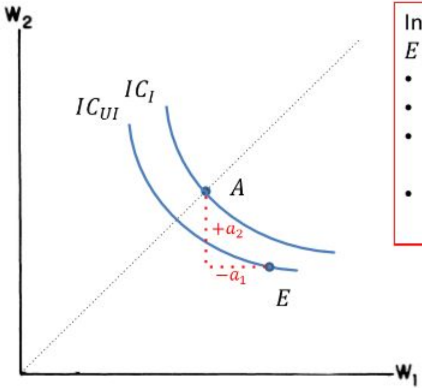

FIGURE I

Insurance Contract shifts consumer from E to A

- Decreases wealth when healthy by a_1
- Increases wealth when sick by a_2
- IC_{UI}: Consumer's uninsured indifference curve
- IC_I: Consumer's insured indifference curve

Rothschild & Stiglitz (1976)

- Insurance companies operate in perfect competition and administrative/loading fees are assumed to be zero.
- Profits: $\pi = (1-p)a_1 - pa_2$
- In PC, in the long run we observe zero economic profits

$$\Longrightarrow (1-p)a_1 = pa_2.$$

- So

$$\frac{a_2}{a_1} = \frac{1-p}{p}$$

Rothschild & Stiglitz (1976)

- Equilibrium for single type of individual

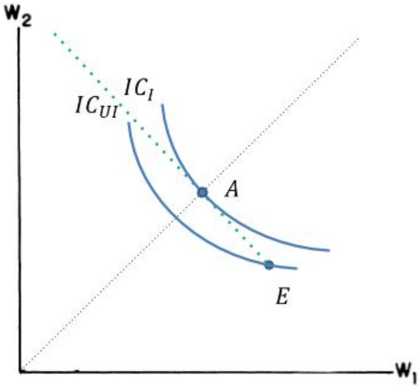

FIGURE I

- Insurance contracts have set slope of $-\frac{1-p}{p}$
- Thus consumers can purchase any contract extending from E on green line

Best-possible contract is where slope of contract line equals slope of indifference curve.

Thus $\left(\frac{1-p}{p}\right)\left(\frac{MU(W_1)}{MU(W_2)}\right) = \frac{1-p}{p}$

Rothschild & Stiglitz (1976)

The equilibrium for single type individual:

- $$\frac{1-p}{p}\left(\frac{U'(W_1)}{U'(W_2)}\right) = \frac{1-p}{p}$$
- This implies that $U'(W_1) = U'(W_2)$, which implies that $W_1 = W_2$
- So in equilibrium, a consumer purchases full insurance which lies on the 45° line.

Rothschild & Stiglitz (1976)

Now, suppose there are two different groups of consumers that differ only in their risk of getting sick.

- High-risk individuals face the probability p_h of getting sick.
- Low-risk individuals face the probability p_l of getting sick.

First, what happens if insurance companies can perfectly and costlessly determine in which group a consumer falls?

Rothschild & Stiglitz (1976)

- Full information equilibrium for two types

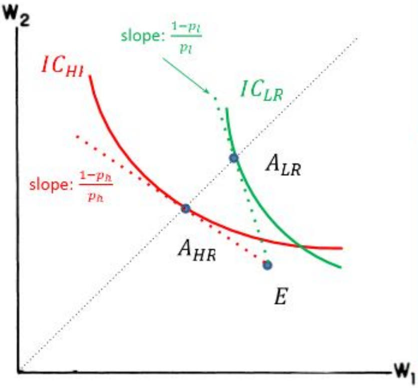

FIGURE I

- Insurance company offers two contracts
  - High risk: slope $-\frac{1-p_h}{p_h}$
  - Low risk: slope $-\frac{1-p_l}{p_l}$

Best-possible contracts are where slopes of contract line equal slope of indifference curves.

$$\left(\frac{1-p_l}{p_l}\right)\left(\frac{MU(W_1)}{MU(W_2)}\right) = \frac{1-p_l}{p_l}$$

and

$$\left(\frac{1-p_h}{p_h}\right)\left(\frac{MU(W_1)}{MU(W_2)}\right) = \frac{1-p_h}{p_h}$$

Rothschild & Stiglitz (1976)

Equilibrium with two types of consumers under full information:

- Insurance companies offer two contracts
- High-risk individuals purchase where

$$\frac{1-p_h}{p_h}\left(\frac{U'(W_1)}{U'(W_2)}\right) = \frac{1-p_h}{p_h}$$

- Low-risk individuals purchase where

$$\frac{1-p_l}{p_l}\left(\frac{U'(W_1)}{U'(W_2)}\right) = \frac{1-p_l}{p_l}$$

- Both cases where, again, $W_1 = W_2$
- So both types of consumers purchase full insurance which lies on the 45° line.

Rothschild & Stiglitz (1976)

So what will happen if insurance companies cannot successfully distinguish between the high- and low-risk consumers?

- Under incomplete information, the previous equilibrium won't work.
- The high-risk consumers will all purchase the cheaper, low-risk contract

Rothschild & Stiglitz (1976)

- Adverse selection

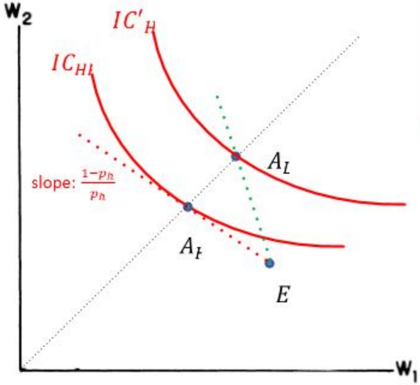

FIGURE I

- Previous equilibrium breaks down
- High-risk individuals prefer low-risk contract
- Unsurprising – everyone wants cheaper insurance!

Rothschild & Stiglitz (1976)

In order to deal with adverse selection, the Insurance Company offers two contracts:

1. Offers the same contract to high-risk individuals, so high-risk individuals still fully insure.
2. Offers different insurance contract to low-risk individuals.

Contracts are structured such that:

1. Each type purchases some insurance
2. Each type prefers their contract and not the contract of the other type.

Rothschild & Stiglitz (1976)

- Adverse selection equilibrium for two types

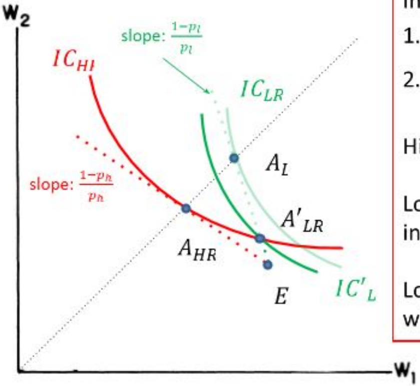

FIGURE I

Insurance company offers two contracts

1. High risk: slope $\frac{1-p_h}{p_h}$ on 45° line
2. Low risk: slope $\frac{1-p_l}{p_l}$ just on IC_{HR}

High-risk individuals stay the same.

Low-risk individuals purchase some insurance. But not full insurance

Low-risk individuals are less happy than with full information.

Rothschild & Stiglitz (1976)

Equilibrium Results under Adverse Selection:

1. Zero-profits condition means that insurance contracts fall on line determined by probability of illness $\frac{1-p}{p}$
2. With full information, both types purchase full insurance
3. Without full information:
   - High-risk individuals purchase full insurance
   - Low-risk individuals purchase partial insurance

Next Class

Midterm 1 Review Session