Public Economics

José Mesquita Gabriel

Mail: jose.gabriel@novasbe.pt

Office Hours: Tuesday afternoon (15h30 – 16h50) – or simply e-mail me

4- Social Insurance

4.1) Benefits and Costs of Insurance (Chapter 12 Gruber)

Social Insurance – Expected Utility Theorem

- $E(X) = \sum_{i=1}^{N} p_i \, x_i$: **Expected income** of a lottery is an average of the income levels of each possible state of nature, weighted according to the respective probabilities

- $E(u(X)) = \sum_{i=1}^{N} p_i \, u(x_i)$: **Expected utility** of facing a lottery is an average of the utilities of each possible state of nature, weighted according to the respective probabilities.

- $E(u(X)) = u(CE)$: For any agent, there is an amount of money, such that she would be indifferent between facing the lottery or receiving that amount for sure. That amount is the **Certainty Equivalent.**

Social Insurance – Expected Utility Theorem

- $RP = E(X) - CE$: The **Risk Premium (RP)** will be the difference between the expected income of a lottery and the Certainty Equivalent. This is the amount of income an agent is willing to give up in order to avoid the risk and receive a certain payment instead of facing the lottery. If agents are risk-averse, this will be positive; if risk-lovers, RP is negative.

- AFP $= E(Loss)$: The **Actuarially Fair Premium (AFP)** is the expected loss of a lottery, which corresponds to the amount a risk-neutral insurance company would require from an agent to provide insurance in a competitive market.

- $WTP = AFP + RP$: The **Maximum Willingness to Pay (WTP)** for full for full insurance is equal to the "face value" of the insurance itself (AFP) plus the additional amount the agent is willing to pay to avoid the risk (RP).

PS 8: Social Insurance

Ex.1) What is consumption smoothing? How does insurance help people smooth consumption?

- Consumption smoothing refers to people's efforts to have approximately the same amount of consumption in all time periods, rather than having periods of high consumption and periods of low consumption.

- This comes from the principle of *diminishing marginal utility* – prefer to eat one slice of pizza in two consecutive years, rather than eat 2 slices in the first period and starve in the second.

- Insurance helps people smooth consumption by taking away a relatively small amount of money in each period in the form of insurance premiums and paying a substantial amount of money in the event of a loss.

PS 8: Social Insurance

Ex.2) Suppose that you have a job paying €50.000 per year. With a 5% probability, next year your wage will be reduced to €20.000 for the year.

a) What is your expected income next year?

b) Suppose that you could insure yourself against the risk of reduced consumption next year. What would the actuarially fair insurance premium be?

PS 8: Social Insurance

Ex.3) There are two types of drivers on the road today. Speed Racers have a 5% chance of causing an accident per year, while Low Riders have a 1% chance of causing an accident per year. There are the same number of Speed Racers as there are Low Riders. The cost of an accident is €12.000.

a) Suppose an insurance company knows with certainty each driver's type. What premium would the insurance company charge each type of driver?

b) Now suppose that there is asymmetric information so that the insurance company does not know with certainty the driver's type. Would insurance be sold if:

    i) Drivers self-reported their types to the insurance company?

    ii) No information at all is known about individual driver's types?

PS 8: Social Insurance

Ex.4) Your utility function is U=ln(2C), where C is the amount of consumption you have in any given period. Your income is €40.000/year and there is a 2% chance that you will be involved in a catastrophic accident that will cost you €30.000 next year

a) What is your expected utility?

b) Calculate an actuarially fair insurance premium. What would your expected utility be were you to purchase the actuarially fair insurance premium?

c) What is the most that you would be willing to pay for insurance, given your utility functions?

PS 8: Social Insurance

Ex.5) Changnesia has two equally sized groups of people: smokers and nonsmokers. Both types of people have utility U = ln(C), where C is the amount of consumption that people have in any period. So long as they are healthy, individuals will consume their entire income of €15.000. If they need medical attention (and have no insurance), they will have to spend €10.000 to get healthy again, leaving them with only €5.000 to consume. Smokers have a 12% chance of requiring major medical attention, while nonsmokers have a 2% chance. Insurance companies in Changnesia can sell two types of policy. The "low deductible" (L-) policy covers all medical costs above €3.000, while the "high deductible" (H-) policy only covers medical costs above €8.000.

a) What is the actuarially fair premium for each type of policy and for each group?

b) If insurance companies can tell who is a smoker and who is a nonsmoker and charges the actuarially fair premiums for each policy and group, show that both groups will purchase the L-policy.

PS 8: Social Insurance

Ex.5) … Smokers have a 12% chance of requiring major medical attention, while nonsmokers have a 2% chance. Insurance companies in Changnesia can sell two types of policy. The "low deductible" (L-) policy covers all medical costs above €3.000, while the "high deductible" (H-) policy only covers medical costs above €8.000.

- Suppose that smoking status represents asymmetric information: each individual knows whether or not they are a smoker, but the insurance company doesn't.

c) Explain why it is impossible, at any prices, for both groups to purchase L-policies in this setting. Which groups, if any, do you expect to buy L-policies, and at what price?

d) Show that it is possible for both groups to purchase insurance, with one group buying Lpolicies and one group buying H-policies.

PS 8: Social Insurance

Ex.6) The problem of adverse selection in insurance markets means that it is generally a bad deal for companies to offer insurance at the same price for all potential customers. Why then do we observe some insurance companies (such as those selling trip insurance that refunds money to people who purchase trips that they are unable to take) do exactly this? How does insurance help people smooth consumption?

- In some markets, people have no better information about their risk exposure than the firm. In this case, adverse selection will not operate.

- Sometimes it is too costly for firms to collect information necessary to distinguish different risk groups.

- In the case of trip insurance, which covers a very short period of time with a low risk of a claim being made, insurance companies set the premium high enough to cover the traveller who knows he is at a high risk for cancellation.

PS 8: Social Insurance

Ex.7) Professors in the U.S. are only paid nine months out of the year. Suppose that they were fired each summer and rehired each fall and thereby eligible for unemployment insurance benefits. Do you think that would affect her consumption smoothing over the year, relative to what they do right now, when they are not fired annually? Explain your answer.

- Unemployment insurance is less likely to have a *crowding out* effect (more likely to be effective) when the event is unpredictable, and the agent has difficulties to self-insure.

- Since this is a very predictable event, and Professors likely do not have liquidity concerns, they will simply save on their own (self-insurance).

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