Adverse selection

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Outline

Introduction

- markets can efficiently aggregate (private) information on willingness to pay and costs
- today:
  - private information on product feature
  - buyers cannot distinguish products with different features at the time of purchase
  - market incompleteness: goods with distinct features are traded on same market
  - first fundamental theorem of welfare economics does not apply

Adverse selection: basic idea I

- sellers of used cars know something about the quality of their car that buyers do not know
- sellers' reservation price for a high quality car is higher than for a low quality car
- at every market price p only $S(p)$ *worst* cars will be offered ("adverse selection")
- buyers' anticipate adverse selection
    - willing to pay is low as anticipated quality is low
    - market breakdown as sellers are not willing to sell at these low prices

Adverse selection: basic idea II

- details of market breakdown logic:
    - say S worst cars are offered
    - expected quality is average quality of offered cars
    - willingness to pay is average willingness to pay for cars of offered qualities
    - marginal seller (i.e. highest offered quality) may rather keep his car at such low price
        - $\Rightarrow S - 1$ cars offered
        - $\Rightarrow$ average quality even lower
        - $\Rightarrow$ willingness to pay even lower
        - $\Rightarrow$ another seller may decide not to sell
        - $\cdots$

Simple model

- continuum of sellers
  - uniform distribution on $[0, 1]$
  - each seller $i \in [0, 1]$ owns 1 car of quality i
  - reservation utility of seller i equals i
- continuum of buyers
  - mass 1 of risk neutral buyers
  - each buyer j wants to buy 1 car
  - willingness to pay for a car of quality i equals αi with $\alpha > 1$
- seller i knows the quality of his car
- buyers cannot distinguish qualities at the time of purchase
- equilibrium: a price p such that supply equals demand at this price

Analysis: supply and demand

Supply:

- at price p, all sellers $i \leq p$ offer their car

$$S(p) = \begin{cases} p & \text{if } p \in [0, 1] \\ 1 & \text{if } p > 1 \end{cases}$$

- average offered quality at price p equals $Q(p) = p/2$

Demand:

- at price $p \in [0, 1]$ quality offered equals $Q(p) = p/2$
    - willingness to pay is above price if $\alpha p/2 \geq p$
    - at price $p > 1$ average quality equals $Q(p) = 1/2$

$$D(p) = \begin{cases} 1 & \text{if } \alpha \geq 2 \text{ and } p \leq \alpha/2 \\ 0 & \text{else.} \end{cases}$$

Analysis: equilibrium

- If $\alpha \geq 2$, any $p \in [1, \alpha/2]$ is an equilibrium price at which all cars are sold.
- If $\alpha < 2$, no car is sold in equilibrium as demand is zero at any price.
  $\Rightarrow p = 0$ is the equilibrium price at which demand and supply equal 0

Results and discussion

- asymmetric information on product features can lead to market failure (if gains from trade are not too large)
- it is not clear how a government could beneficially intervene in such a failed market unless the government knows the qualities of the cars
- key assumption: sellers are most reluctant to sell those cars that buyers value most
- what practical measures are or could be taken in used car/goods markets to avoid market failure due to asymmetric information?

Insurance market: basic idea

- who has the higher willingness to pay for comprehensive health insurance: a chronically ill person (diabetes, HIV...) or a healthy person?

Insurance market: basic idea

- who has the higher willingness to pay for comprehensive health insurance: a chronically ill person (diabetes, HIV. . .) or a healthy person?
- at any premium p, the $D(p)$ least healthy people will buy insurance
- the least healthy cause the highest costs to insurance companies
- "death spiral of health insurance":
    - healthiest do not buy insurance
    - average cost for insurance go up
    - premium increase
    - healthiest of the still insured cancel their insurance
    - repeat

Insurance market: model I

- market for full insurance (all health care expenditures are covered 100%)
- continuum of consumers
  - mass 1
  - consumer i has expected health care expenditures (when insured) of i
  - consumer values insurance αi with $\alpha > 1$ (due to risk aversion)
  - consumers are distributed on $[i_l, i_h]$ with distribution F (and density f)
- perfectly competitive insurance market
  - insurances have no administrative or other fixed costs
  - insurances maximize profit
  - $\Rightarrow$ an insurance's profit from insuring consumer i at premium p equals $p - i$

Insurance market: model II

- *information:*
  - consumers observe their risk i
  - insurances do not observe i
- *equilibrium:*
  - premium p equals average cost of insured (due to perfect competition among insurance companies)
  - insured are those consumers whose value is above premium

Insurance market: analysis

Demand:

- at premium p all consumers i for which $\alpha i \geq p$ buy insurance

$$D(p) = 1 - F(p/\alpha)$$

- expected costs of insured are $\mathbb{E}[i|i \geq p/\alpha]$
    - note: $\mathbb{E}[i|i \geq p/\alpha]$ is increasing in p ("adverse selection")

Equilibrium:

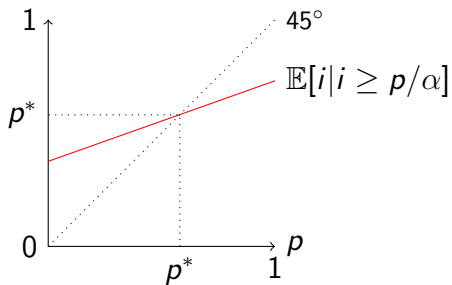- in equilibrium

$$p = \mathbb{E}[i|i \geq p/\alpha]$$

solving this equation for p yields the equilibrium price p^*

- let $\hat{i} = p^*/\alpha$ be the marginal consumer
    - if $\alpha i_l < \mathbb{E}[i]$, then some consumers will not buy insurance

Welfare:

- welfare maximizing to have everyone insured
- adverse selection leads to underinsurance if $\alpha i_l < \mathbb{E}[i]$
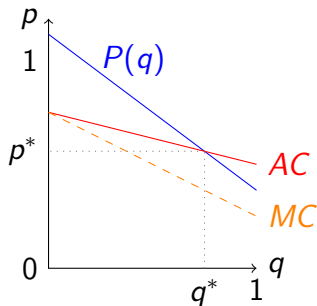
Insurance market: graph I

Insurance market: graph II

similar to regular supply and demand diagram:

- marginal cost when quantity q is traded:
  $MC(q) = F^{-1}(1 - q)$
- average cost: $AC(q) = \mathbb{E}[i | i \geq F^{-1}(1 - q)]$
- inverse demand (i.e willingness to pay of marginal consumer): $P(q) = \alpha F^{-1}(1 - q)$
- equilibrium is intersection of P and AC
- where is the welfare loss due to underinsurance depicted?

Insurance market: policy

- Who will benefit/lose from *mandatory insurance* at premium $\mathbb{E}[i]$?
  - Does this fit the lines of support for mandatory health insurance in the US?
- Governments often *subsidize* health insurance (using tax revenue).
  - How does a subsidy affect welfare?
  - Does this per se justify such subsidies?
- The Affordable Care Act in the US originally included *financial penalties* for those not buying health insurance.
  - What are the effects of this policy in our model?