Advanced Microeconomics III

Francisco Poggi

Information about the course

- **Lectures**: Mondays and Tuesdays, 10:15 AM.
- **Exercise session:** with Chang Liu on Tuesdays, 12:00 PM.
- **Office hours**:
  - Mondays 1:30 PM in my office (310).
  - Send me an email in advance.
- **Problem Sets**:
  - Due on Mondays.
  - Hand in via email to Chang.
  - You can work in groups of up to 3 students. Only one submission is required per group (clearly indicating group members).
- **Final exam**: June 5th.

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Course material

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franciscopoggi.com/courses/microIII

- **Main Textbook**: "Microeconomic Theory" by Mas-Colell, Whinston, and Green, Oxford University Press, 1995 (**MWG**).
  - The course covers Ch. 13, Ch. 14, and Ch. 23 D-F.
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Course plan

Week 1 (April 17) Adverse Selection (Akerlof)
Week 2 (April 24) Signaling (Spence)
Week 3 (May 1) Competitive Screening (Rothchild-Stiglitz)
Week 4 (May 8) Moral Hazard
Week 5 (May 15) Bayesian Implementation/Envelope Theorem
Week 6 (May 22) Auctions and efficient Mechanisms (3 lectures)
Week 7 (May 30) Revision week

Overview

1. Introduction to Information Economics

2. Akerlof's Market for Lemons
   - Setup
   - Competitive Equilibria
   - Equilibrium Multiplicity
   - A game-theoretic approach
   - Experimental Evidence
   - Information and Trade

Information economics

- What is "information"?
  - Informally: the ability to exclude some states of the world.
- What is "asymmetric information"?
- **Asymmetric information is present in many economic relationships**
  - Trade of used goods or novel goods
  - Labour markets
  - Financial markets
  - Provision of public goods
  - Insurance
  - Expert advise
- What is "economics of information"?
  - economics of markets with asymmetric information, i.e., welfare and distributional aspects of equilibria

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Overview

Akerlof's market for lemons

- QJE (1970).
- Around 40k citations.
- Nobel Prize (2001) with Spence and Stiglitz.

- Before QJE, the paper was rejected by 3 top journals.
  - AER: trivial.
  - JPE: wrong.
  - REStud: trivial.

Overview

Akerlof's market for lemons

- There is a continuum of sellers (measure N) and a continuum of buyers (measure larger than N).
- Each seller owns a "car" of quality $\theta \in [\underline{\theta}, \bar{\theta}]$, where $F(\theta)$ represents the proportion of sellers with quality below θ.
- Buyers and sellers have quasiliner preferences:
  - The payoff of a buyer who acquires a car of quality θ at price p:
  $$\theta - p$$
  - The payoff of a seller parting with a car of quality θ at price p is:
  $$p - r(\theta)$$
    - $r(\theta)$ can be thought of as an opportunity cost.

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Efficient allocation

Let $\Theta \subset [\underline{\theta}, \bar{\theta}]$ be the set of car qualities that are traded.

$$\text{Gains from trade} = \int_{\underline{\theta}}^{\bar{\theta}} 1_{\{\theta \in \Theta\}} \cdot [\theta - r(\theta)] \cdot N \; dF(\theta)$$

- The efficient allocation Θ^* maximizes the gains from trade.
- **Solution:**

$$\theta \in \Theta^* \qquad \Leftrightarrow \qquad \theta \geq r(\theta)$$

$$\Theta^* = \left\{ \theta \in [\underline{\theta}, \bar{\theta}] \; : \; \theta \geq r(\theta) \right\}$$

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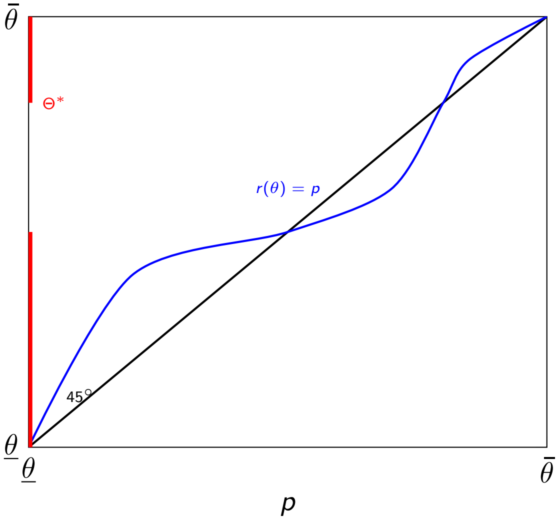
Efficient allocation



Benchmark: symmetric information

- Suppose car quality is observable. There can be different prices for different qualities of cars.
- We denote $\hat{p}(\theta)$ the price function.
- In a **Competitive equilibrium**, $\hat{p}(\theta)$ is such that quantity demanded and supplied are equal for all car qualities.

$$\text{Demand for car of quality } \theta = \begin{cases} 0 & \text{if} \quad p > \theta \\ [0, N'] & \text{if} \quad p = \theta \\ N' & \text{if} \quad p < \theta \end{cases}$$

$$\text{Supply for car of quality } \theta = \begin{cases} N & \text{if} \quad p > r(\theta) \\ [0, N] & \text{if} \quad p = r(\theta) \\ 0 & \text{if} \quad p < r(\theta) \end{cases}$$

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Benchmark: symmetric information

- For qualities $\theta \in \Theta^*$:

$$\theta > r(\theta) \qquad \Rightarrow \qquad \hat{p}(\theta) = \theta \text{ and } \hat{Q}(\theta) = N$$

- For qualities $\theta \notin \Theta^*$:

$$\theta < r(\theta) \qquad \Rightarrow \qquad \hat{p}(\theta) \in (\theta, r(\theta)) \text{ and } \hat{Q}(\theta) = 0$$

Observation

With symmetric information the competitive equilibrium is efficient.

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Observation

With symmetric information the competitive equilibrium is efficient.

Overview

Asymmetric information: competitive equilibrium

- Since car quality is **not observable** by the buyers, all car qualities should have the same price.

- A *competitive equilibrium* is a price $\hat{p}$ and a set $\hat{\Theta} \subseteq [\underline{\theta}, \bar{\theta}]$ such that

$$\hat{p} = E[\theta | \theta \in \hat{\Theta}]$$
$$\hat{\Theta} = \{\theta : r(\theta) \leq \hat{p}\}$$

- (or $\hat{\Theta} = \emptyset$ and $\hat{p} = E[\theta]$.)

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Example

Assume $r(\theta) = \bar{r}$ and $F(\bar{r}) \in (0, 1)$.

- Note that $\Theta^* = \{\theta \in [\underline{\theta}, \bar{\theta}] : \theta \geq \bar{r}\}$.
- Constructing equilibria with $\hat{p} \geq \bar{r}$:
  - Then, by equilibrium condition 2,

$$\hat{\Theta} = \{\theta \in [\underline{\theta}, \bar{\theta}] : r(\theta) \leq \hat{p}\} = [\underline{\theta}, \bar{\theta}]$$

  - By condition 1,

$$\hat{p} = E[\theta|\theta \in \hat{\Theta}] = E[\theta]$$

  - Equilibrium candidate: $\hat{p} = E[\theta]$ and $\hat{\Theta} = [\underline{\theta}, \bar{\theta}]$.
  - Equilibrium when $E[\theta] > \bar{r}$.
  - This is inefficient.

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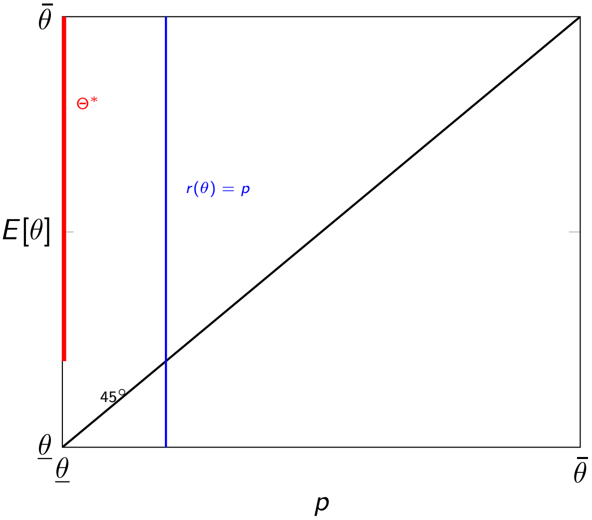

$\bar{\theta}$
Θ^*
$r(\theta) = p$
$E[\theta]$
45°
$\underline{\theta}$
$\underline{\theta}$
$\bar{\theta}$
p

Adverse selection

- In the previous example:
  - Willingness to sell r is independent of the quality.
  - Either every or no seller wants to sell.
  - But the efficient allocation depends on the quality.
- *Adverse selection* occurs when $r(\theta)$ is increasing in θ.
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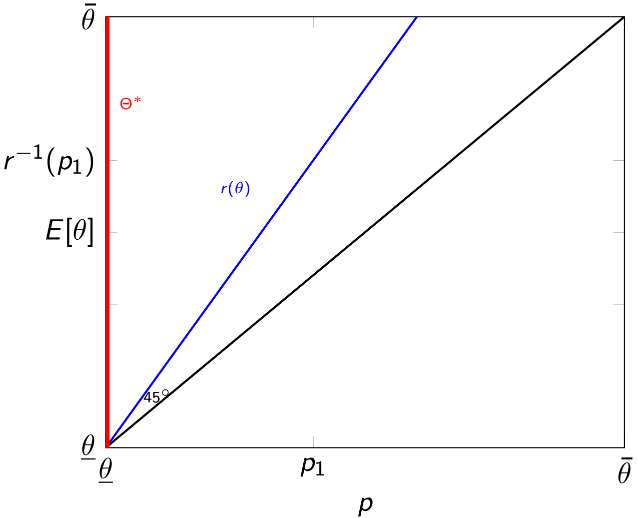

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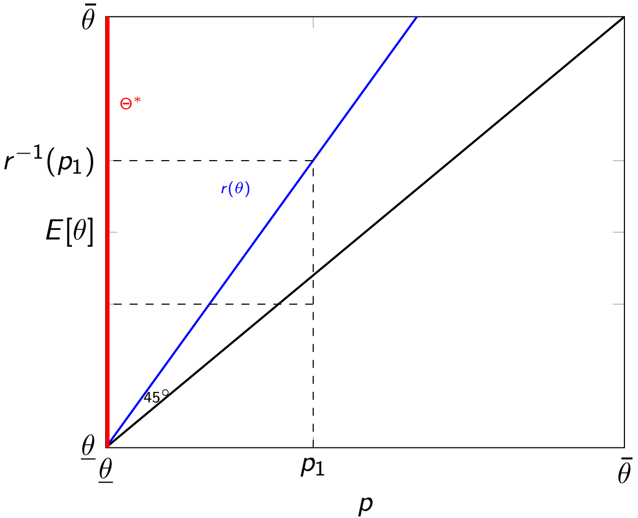

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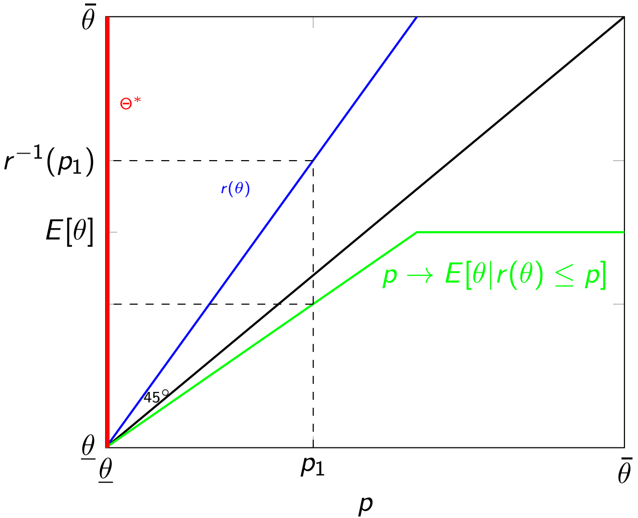

Existence of CE with no market breakdown

Assumptions:

1. *Negative Selection*: r is strictly increasing.
2. *No atoms*: F is continuous.
3. *No market breakdown*: There exists a price such that $E[\theta|r(\theta) \leq p] > p$.

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Assume 1-3. Then a competitive equilibrium with some trade exists.

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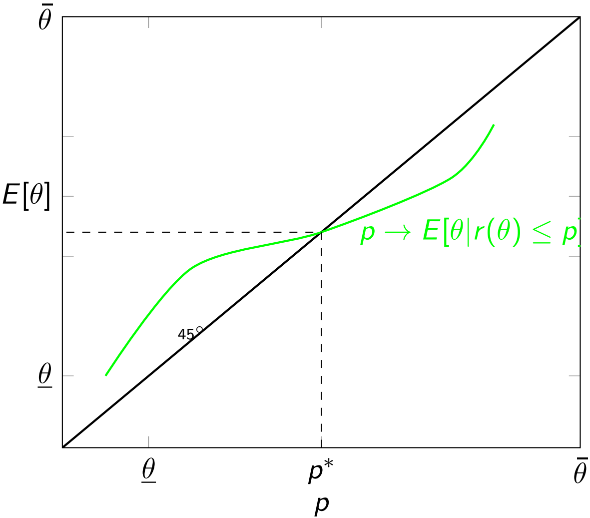

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Assume 1, 2 and 3'. Then a competitive equilibrium with no trade exists. Moreover, no equilibrium with a positive mass of trade exists.

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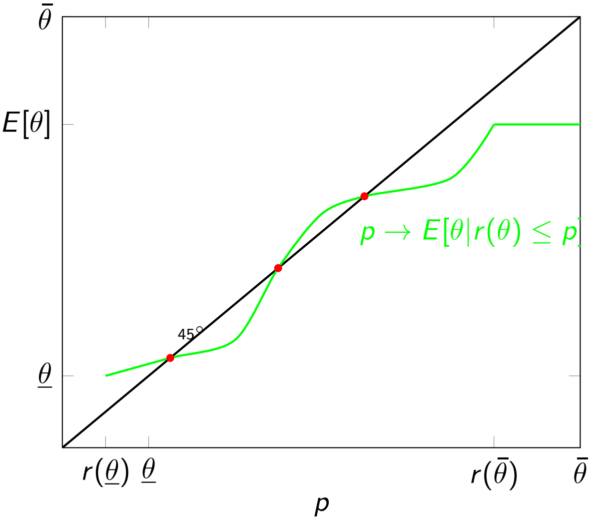
Parametric Examples

- **Example 1**: constant opportunity cost.
  - F uniform on $[0, 1]$.
  - $r(\theta) = \bar{r}$.
- For which $\bar{r}$ is the CE efficient?

- **Example 2**: linear opportunity cost.
  - F uniform on $[0, 1]$.
  - $r(\theta) = \alpha \cdot \theta$.
- For which α is the CE efficient?

Overview

Equilibrium multiplicity



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- When there are multiple equilibria, these can be Pareto ranked:
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Game-theoretic approach

- Same underlying structure with F and $r(\cdot)$ common knowledge.
  - Three players: Buyer 1, Buyer 2, Seller.
- Timing is as follows:
  - Buyers offer prices p_1, p_2 simultaneously.
  - Nature chooses car quality θ according to F.
  - Seller decides whom to trade with, if anyone.

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Pure-strategy subgame-perfect Nash equilibria

- We assume negative selection, no atoms, and no market breakdown.
- Let p^* be the highest competitive equilibrium price.
- **Extra assumption**: *"genericity"*

$$\exists \epsilon > 0 : \qquad \text{for all } p \in (p^* - \epsilon, p^*) \qquad E[\theta | r(\theta) \leq p] > p$$

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- **Seller's decision**: in any SPNE the seller
  - sells at price $\max\{p_1, p_2\}$ if greater than $r(\theta)$
  - keeps the good if $\max\{p_1, p_2\} < r(\theta)$
- Each buyer's SPNE expected payoff is zero.
  - Proof by contradiction.
- Total Payoff of buyers:

$$F(r^{-1}(p))[E[\theta|r(\theta) < p] - p] = 0$$

- Thus, p must be a CE price or below $r(\underline{\theta})$.
- If $p < p^*$ there is a profitable deviation. Which one?

Overview

Market with one buyer

- **Variant**: only one buyer and one seller.
  - In general, the equilibrium differs from the two-buyer case.
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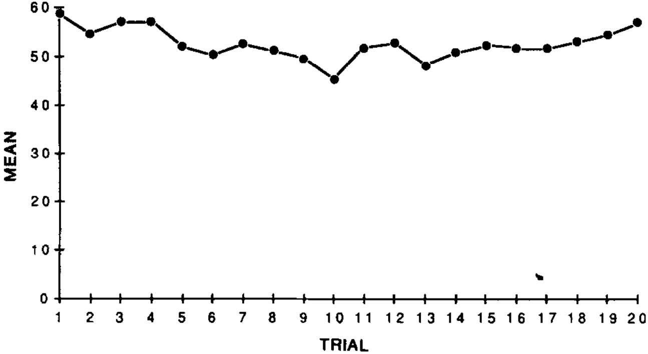

FIG. 1. Mean bids across trials for subjects in Experiment 1.

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Overview

Relationship between information and trade

- Buyer and Seller can potentially trade a good of uncertain quality.
- Good's quality is equally likely to be of three types: $\omega \in \{L, M, H\}$.
- Buyer's valuation:

$$b(\omega) = \begin{cases} 14 & \text{if} \quad \omega = L \\ 28 & \text{if} \quad \omega = M \\ 42 & \text{if} \quad \omega = H \end{cases}$$

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- **Case 2**: Seller partially uninformed: {{L}, {M,H}}
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Relationship between information and trade

- **Case 3**: Seller is perfectly informed.
  - L and M can be traded at a price in $[20, 21]$.

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- Example shows that the market can expand in the face of greater information asymmetry.
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