Weeks 13 & 14 Adverse Selection

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Outline

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Difference From Moral Hazard

Two types of games of asymmetric information

- Moral Hazard: agents are identical, but actions are different.
- Adverse Selection: agents are different.

Emphasis of adverse selection

Under adverse selection, the principal tries to sort out agents of different types by providing a set of contracts that are attractive to different types.

Illustration

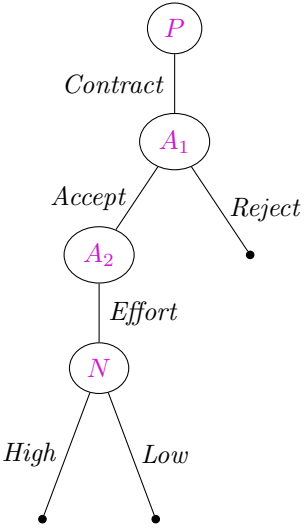


Figure: Moral Hazard

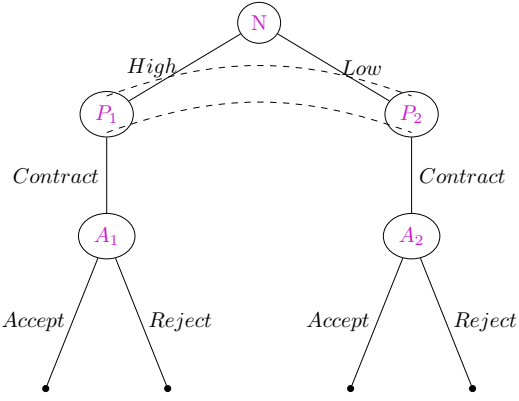


Figure: Adverse Selection

Production Game II

Players

The Principal and the Agent.

The Order of Play

1. Nature chooses A's ability a, unobserved by P, according to distribution $F(a)$, which puts probability 0.9 on *low* ability, $a = 0$, and probability 0.1 on *high* ability, $a = 10$.
2. P offers A one or more wage contracts $W_1 = \{w_1(q = 0), w_1(q = 10)\}, W_2 = \{w_2(q = 0), w_2(q = 10)\}...$
3. A accepts one contract or reject them all.
4. N chooses a value for the state of the world, θ, according to distribution $G(\theta)$, which puts equal weight on 0 and 10. Output is then $q = \min\{a + \theta, 10\}$.

Payoffs

If A rejects all contracts, the reservation payoffs for two types of A are $\bar{\pi}_L = 3$ and $\bar{\pi}_H = 4$, and $\bar{\pi}_P = 0$.

Otherwise, $\pi_A = w$ and $\pi_P = q - w$.

Participation of Each Type

Each type of A prefers one contract to his reservation utility.

Participation constraint

$$\begin{aligned} U_L(W_1) \geq \bar{\pi}_L &\Rightarrow 0.5w_1(0) + 0.5w_1(10) \geq 3 \\ U_H(W_2) \geq \bar{\pi}_H &\Rightarrow 0.5w_2(10) + 0.5w_2(10) \geq 4 \end{aligned} \tag{1}$$

Self-Selection Constraint

In adverse selection, the incentive compatibility constraint is called the **self-selection constraint**, because it induces the different types of agents to pick different contracts.

Self-selection

$$\begin{aligned} U_L(W_1) \geq U_L(W_2) &\Rightarrow 0.5w_1(0) + 0.5w_1(10) \geq 0.5w_2(0) + 0.5w_2(10) \\ U_H(W_2) \geq U_H(W_1) &\Rightarrow 0.5w_2(10) + 0.5w_2(10) \geq 0.5w_1(10) + 0.5w_1(10) \end{aligned} \tag{2}$$

Equilibrium

- P offers $W_1 = \{w_1(q = 0) = 3, w_1(q = 10) = 3\}$, $W_2 = \{w_2(q = 0) = 0, w_2(q = 10) = 4\}$.
- Low A: *Accept* W_1
- High A: *Accept* W_2

Maximize P's utility

P has driven the agents down to their reservation utilities, so P cannot further reduce their pay.

Outline

Most Famous Economic Paper in History

Akerlof (1970)

Akerlof stimulated an entire field of research with his 1970 model of the market for shoddy used cars ("lemons"), in which adverse selection arises because car quality is better known to the seller than to the buyer.

Lemons

Players

A Buyer and a Seller.

The Order of Play

1. Nature chooses quality type θ according to the distribution $F(\theta)$. S knows θ, but while B knows F, he does not know the θ of the particular S he faces.
2. B offers a price P.
3. S accepts or rejects the offer.

Payoffs

If B rejects, both players receive 0.
Otherwise, $\pi_B = V(\theta) - P$ and $\pi_S = P - U(\theta)$.

Lemons I

Discrete types of cars

Let $\theta \in \{2000, 6000\}$.
Suppose half of the cars have quality 2000 and half 6000.
$\pi_B = \theta - P$
$\pi_S = P - \theta$

Game Tree

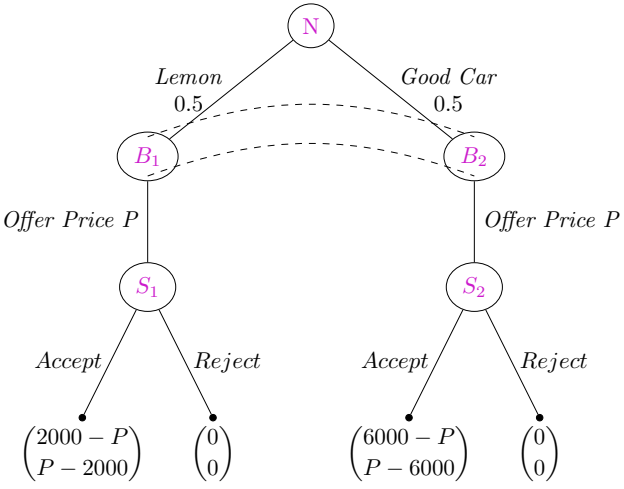


Figure: Lemons I

Equilibrium Outcome

- B does not observe the true quality.
  - The expected quality is 4000.
- B would not pay more than 4000.
- But S with 6000 would not accept at 4000.
  - The very fact that S would like to accept a price lower than 4000 means that his car has quality 2000.
- B only wants to offer 2000.
  - S with quality 2000 sells.

Lemons II: A Continuous Types of Sellers

Let $\theta \in [2000, 6000]$ and the average quality $\bar{\theta} = 4000$.
θ is uniformly distributed.
Cumulative distribution function: $F(\theta) = \frac{\theta}{4000} - 0.5$.
$\pi_B = \theta - P$
$\pi_S = P - \theta$

Inductive Reasoning

- B won't accept any $P \geq 4000$
  - S with $\theta \geq 4000$ quit
- The average quality offered for sale is 3000
  - $P \leq 3000$
- S with $\theta \in [3000, 4000]$ quit
  - The average quality drops to 2500
- So on and so forth, P converges to 2000 and no car is sold.
- The market COLLAPSES!

"Supply" and "Demand"

Demand

The demand curve indicates for each average quality level, what is the price B would like to offer.

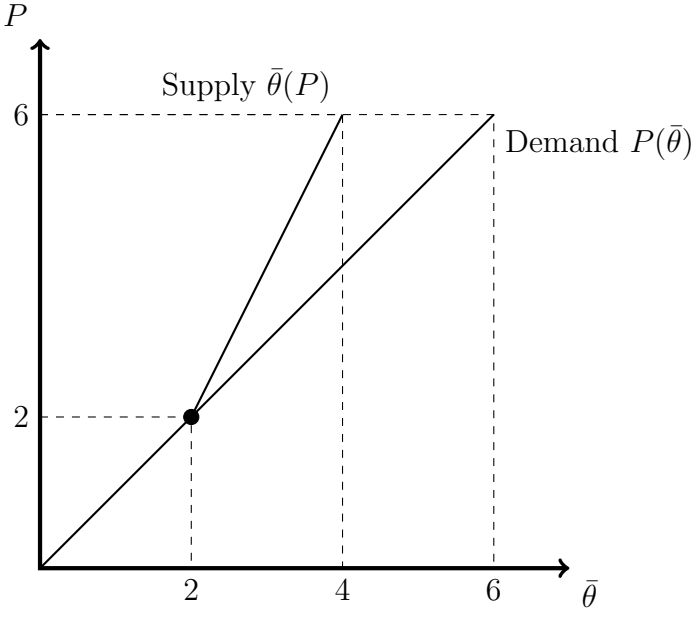
$$\mathbb{E}[\pi_B] = \bar{\theta} - P(\bar{\theta}) \geq 0$$

Supply

The supply curve indicates the average quality of S remaining in the market at each price level.

$$\bar{\theta} = \mathbb{E}[\theta \,|\, \theta \leq P]$$

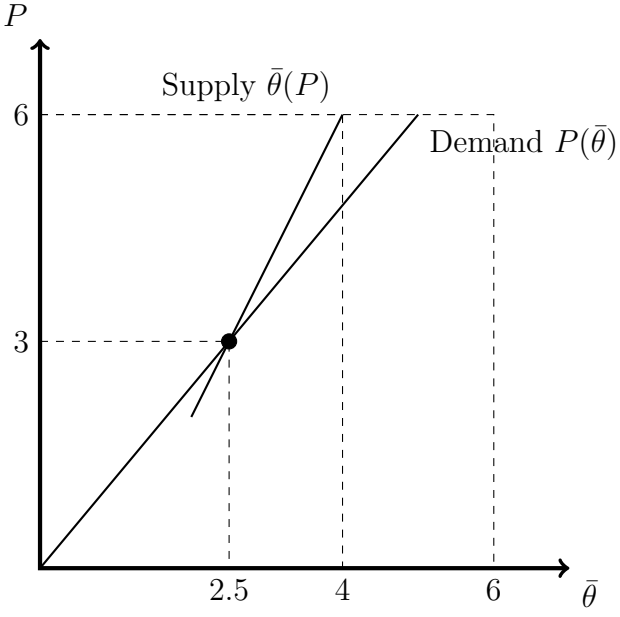
Lemons II



Lemons III: Buyers Value Cars More than Sellers

- Seller values their cars at exactly their qualities θ.
- Buyer has valuations 20 percent greater.
- $\pi_B = 1.2\theta - P$
- $\pi_S = P - \theta$

Lemons III



Outline

Insurance Game II

Players

Smith and two insurance companies. Smith has a car with market value 12.

The Order of Play

1. Nature chooses Smith to be either *Safe*, with 60%, or *Unsafe*, with 40%. Smith knows his type, but the insurance companies do not.
2. Each insurance company offers its own contract (x, y), under which x is the premium and y the compensation.
3. Smith picks a contract.
4. Nature chooses whether there is a theft, with probability 0.5 if Smith is $Safe$ and 0.75 if Smith is $Unsafe$.

Insurance Game

Payoffs

Smith is risk averse and the insurance company is risk neutral.

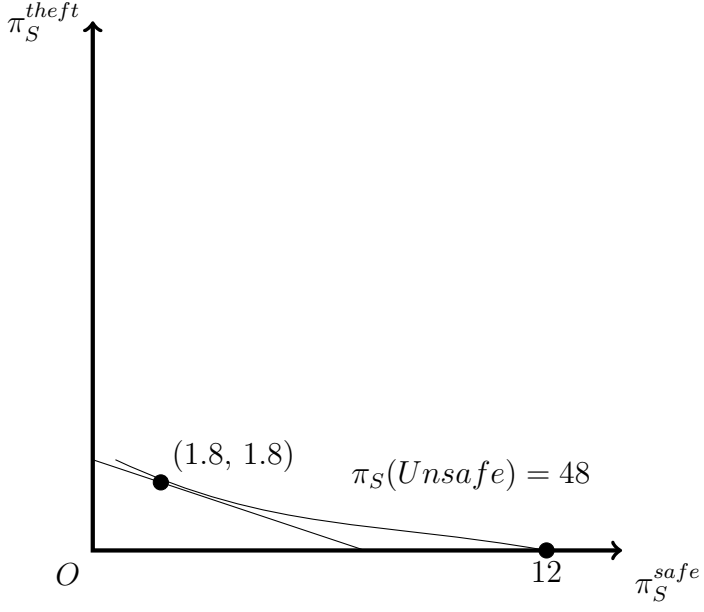
$$\begin{aligned} \pi_S(Safe) &= 0.5U(12-x) + 0.5U(y-x) \\ \pi_S(Unsafe) &= 0.25U(12-x) + 0.75U(y-x) \end{aligned}$$

$$\begin{aligned} \pi_I(Safe) &= 0.5 \cdot x + 0.5 \cdot (x-y) \\ \pi_I(Unsafe) &= 0.25 \cdot x + 0.75 \cdot (x-y) \end{aligned}$$

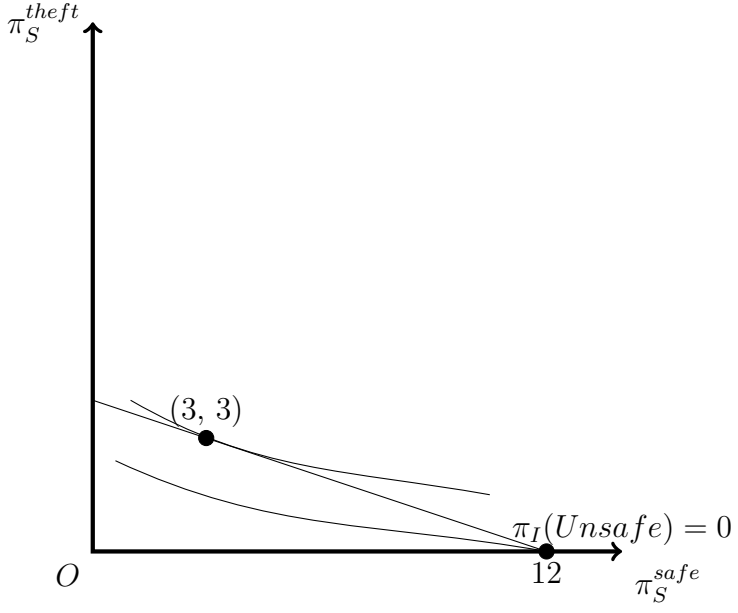
Difference From Insurance I

- Here are two companies competing with each other. They will provide Smith with the MOST attractive contract.
- In moral hazard, what is unknown is the agent's ACTIONS; In adverse selection, what is unknown is the agent's TYPES.

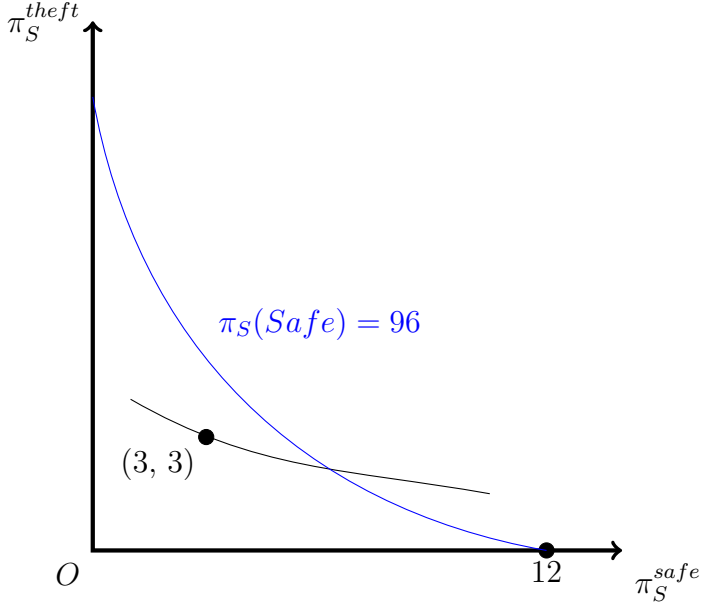
Participation of the Unsafe Type



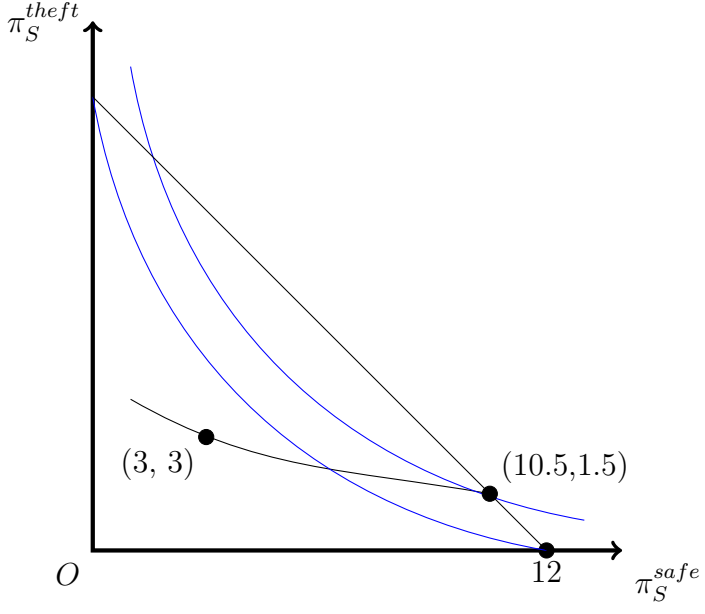
Participation of the Insurance Company (Unsafe)

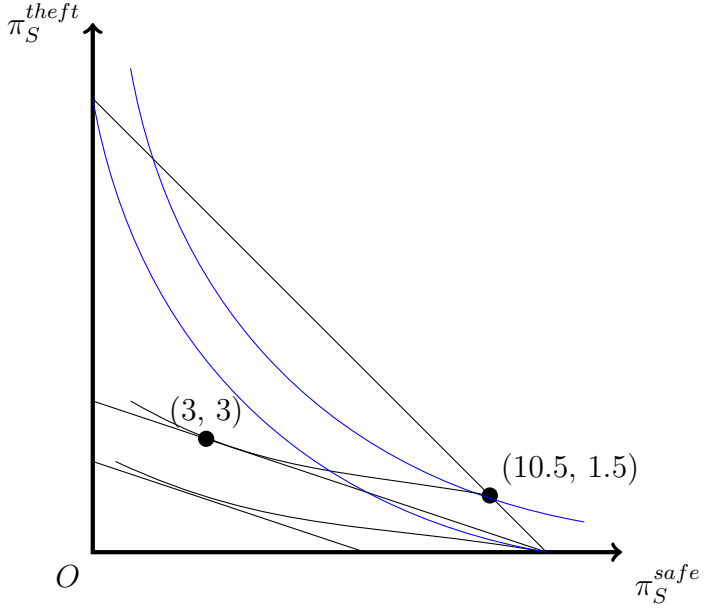


Participation of the Safe Type and Self-Selection



Participation of the Insurance Company (Safe)





Equilibrium Outcome

- P offers $W_1 = (9, 12)$ and $W_2 = (1.5, 1.5)$.
- Safe A picks W_2: Utility=$111.75 > 96$.
- Unsafe A picks W_1: Utility=$75 > 48$.

Vocabulary

adverse selection	逆向选择	market for lemons	柠檬货市场
self-selection constraint	自选择约束		