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14.03/003 Microeconomic Theory & Public Policy Fall 2025

Lecture slides 19. Private Information and Adverse Selection

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Health insurance with adverse selection

Basics: Health insurance with adverse selection

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3. Consumers are risk averse, meaning that the risk of loss has a direct utility cost
   - Let W equal wealth and $L = 10,000$ equal the potential loss. Consumer utility is:

$$\begin{aligned} U(W, L, r_i) =& r_i \times (W - L) + (1 - r_i)W - 0.5 \times r_i L \\ =& W - 1.5 \times r_i L \\ =& W - 1.5 \times E[L|r_i] \end{aligned}$$

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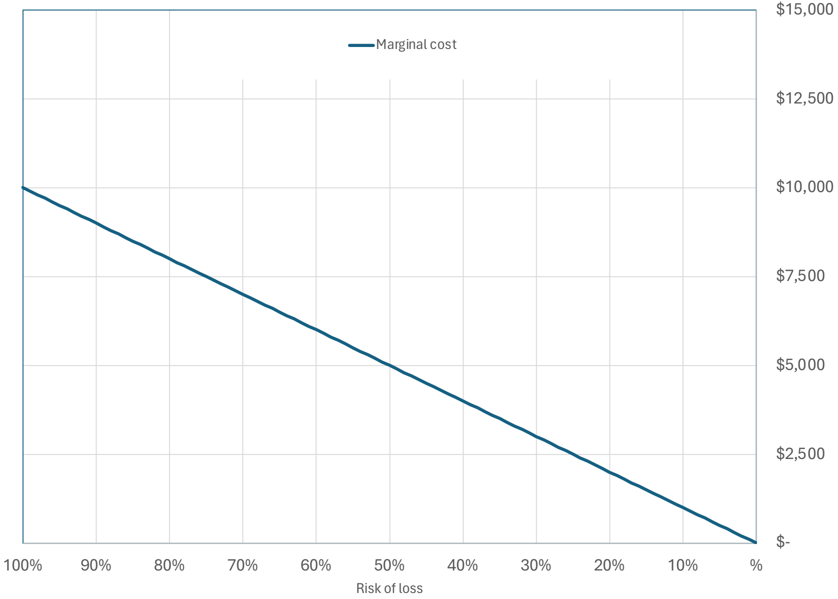
4. Consumers know their own risks r_i, but insurers cannot observe any individual's risk
5. Insurers will offer *actuarially fair policies*, but they must break even: they cannot offer policies that lose money *on average*

How we'll approach this problem

1. Solve for the free market equilibrium
   - Find the policy I^* that breaks even
   - Consider its efficiency/inefficiency
   - Consider what's going wrong
2. Consider instead an insurance mandate
   - Determine the mandated price
   - Consider aggregate efficiency
   - Consider Pareto efficiency

Expected losses of risky consumers



Willingness to pay for insurance

- Consumers are *risk averse*, meaning that the *risk* of loss has a direct utility cost, independent of the expected loss
- Let this cost equal 50% of the expected loss
- Let W equal wealth and $L = 10,000$ equal the potential loss. Consumer utility is:

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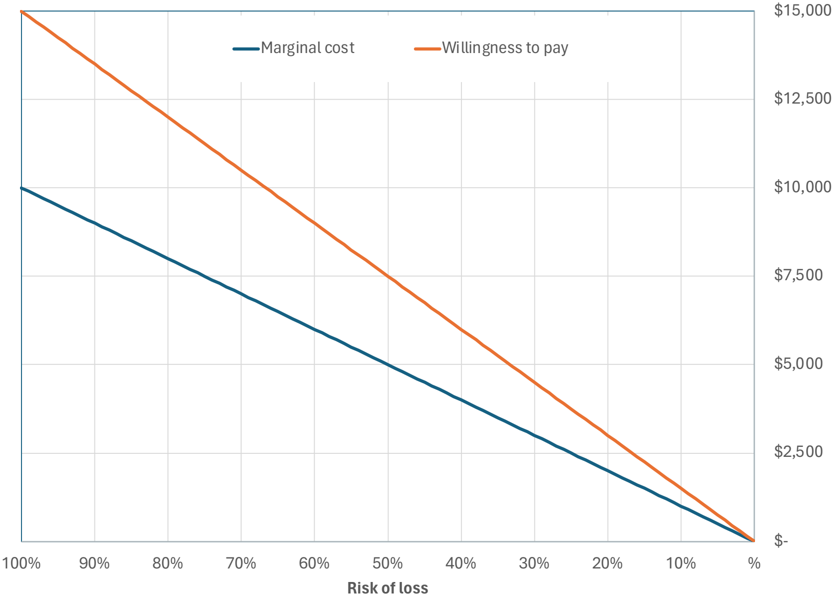
Willingness to pay for insurance

- Because risk has a direct negative effect on utility, consumers would like to buy insurance to eliminate this risk
- How much would they be willing to pay for a policy that completely eliminates the risk?
- Let I equal the cost of the policy. The consumer will buy the policy if:

$$U(W-I, L=0, r_i) \geq U(W, L, r_i)$$
$$W - I \geq W - 1.5 \times r_i 10,000$$
$$r_i \geq I/15,000$$

- Define $R(I) \equiv I/15,000$ equals the *lowest risk* customer who will buy policy with cost I
- At insurance price I, consumers with risk $r \geq R(I) = I/15K$ will buy insurance
  - If $I = 0$, consumers with $r_i \geq 0$ will purchase policy
  - If $I = 15,000 - \varepsilon$, only with consumers with $r_i \approx 1$ will purchase

Expected losses and willingness to pay for insurance



Adverse selection

- Insurance companies *cannot* assess risks of individual policyholders
- If so, insurers can offer only one policy at price I. They *cannot* condition I on the actual risk of buyers
- Insurers **know** the following
  - $L = 10K$ in the event of loss
  - Risk of loss is $r \sim U[0,1] \rightarrow E[L] = \$5K$
  - Each consumer i knows their own risk level r_i
- Insurers also **understand** adverse selection
  - The riskiest buyers (large r_i) will have the highest WTP for insurance
  - Let $R(I)$ be the *least risky* buyer of insurance policy I
  - Since risks are uniformly distributed on $r \in U\,[0,1]$, the average buyer of a policy that costs I will have risk $E[r|I] = 0.5 \times (1 + R(I))$

Adverse selection

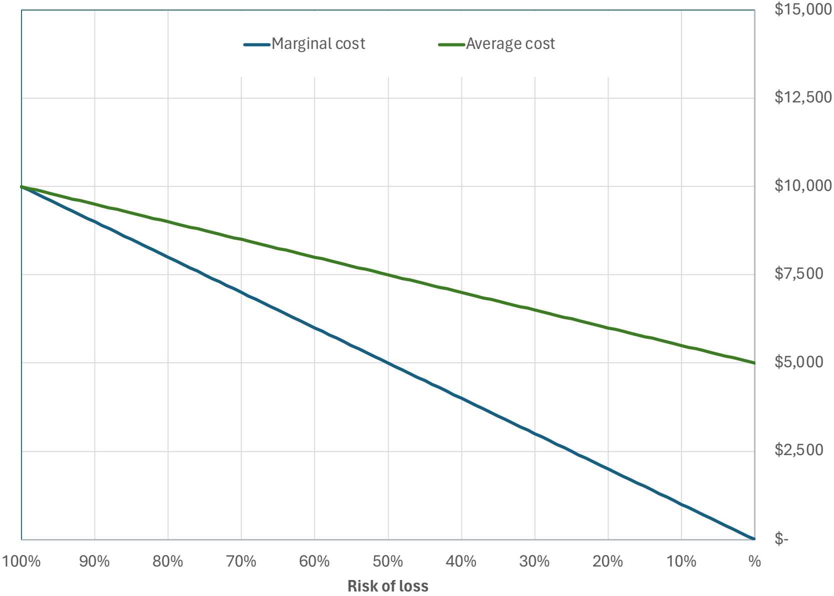
- Insurance company's expected costs depend on the price it sets I
- At price I the least risky (i.e., **marginal**) customer who buys is $R(I) = \frac{I}{15{,}000}$
- For example, if insurer sets $I = \$9,000$, **marginal** customer has expected loss of $\$6,000$
- The **expected** (i.e., average) cost of purchasers as a function of price I is

$$E[L|I] = 0.5\,(1 + R(I)) \times 10,000$$

- If insurer sets $I = 9,000$, expected costs will be

$$\begin{aligned} E[L|I = 9,000] &= 0.5\,(1 + R(I)) \times 10,000 \\ &= 0.5\,(1 + 0.6) \times 10,000 \\ &= 0.8 \times 10,000 \\ &= 8,000 \end{aligned}$$

Marginal and average cost of insured population



The free market equilibrium

- **Adverse selection gives rise to the following properties**
  - Insurer must set price according to *average* cost of insured
  - Average cost of insured depends on the price the insurer charges
  - Purchasers are not interested in average cost of insured
  - Their question: Is my utility higher or lower with an insurance policy that costs I?
  - They are comparing insurer's *average* cost with their own *marginal* willingness to pay

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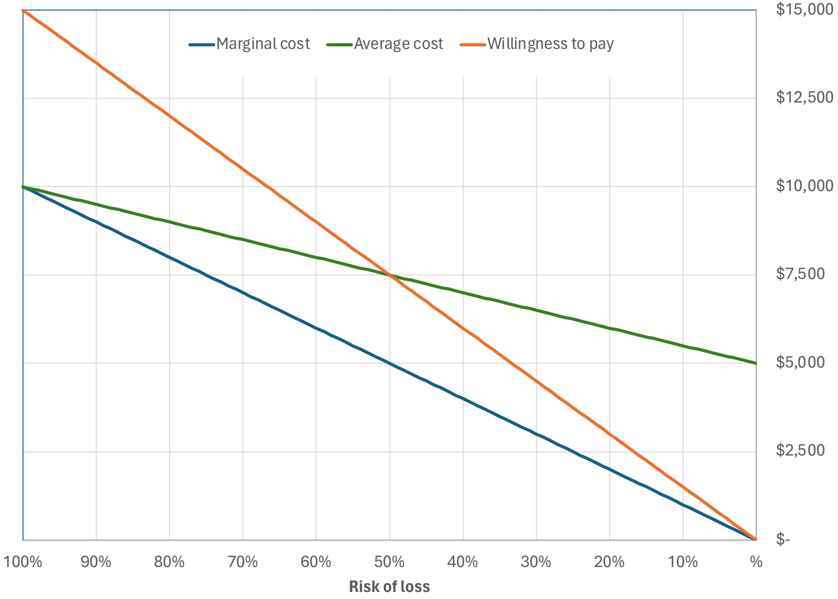
- **Equilibrium occurs where**
  - **Average** cost of insured customers equals **marginal** willingness to pay of **lowest risk** customer

Free market equilibrium in the health insurance market



The Free Market Equilibrium

- Equilibrium: Average cost of insured equals marginal WTP of lowest risk purchaser
  - WTP of lowest risk purchaser is $15,000 \times R(I)$
  - Average cost of insured is $10,000 \times 0.5(1 + R(I))$

The Free Market Equilibrium

- Equilibrium: Average cost of insured equals marginal WTP of lowest risk purchaser
  - WTP of lowest risk purchaser is $15,000 \times R(I)$
  - Average cost of insured is $10,000 \times 0.5(1 + R(I))$
- Solving for I^*

$$
\begin{aligned}
I^* : E[L|I^*] &= 15,000 \times R(I^*) \\
10,000 \times 0.5(1 + R(I^*)) &= 15,000 \times I^*/15,000 \\
1 + I^*/15,000 &= I^*/5,000 \\
5000 + I^*/3 &= I^* \\
(2/3)I^* &= 5,000 \\
I^* &= 7,500
\end{aligned}
$$

The Free Market Policy

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- **Q** Is this equilibrium inefficient (and why)?
- **Q** Why do so few people buy insurance given that all are risk averse and the insurer is trying only to break even?
    - **The problem is *adverse selection***
    - At any price, people with greatest expected losses always buy the policy
    - The insured population is adversely selected, and hence the premium will be higher than if 'average' consumers were insured
    - Adverse selection deters lower cost consumers from buying insurance
    - Only a subset insure

The free market policy

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The free market policy

- **Q:** Why does the market not completely unravel — leading to no one buying insurance?
  - Because some consumers will sign up for the policy even though it is actuarially unfair *for them*
  - They prefer a 'bad deal' on insurance to no insurance at all

The free market policy: Inefficiency

- Only one-half of consumers are insured even though all would pay greater than expected cost to get insurance
- Consumer surplus is $(15,000 - 7,500) \times 0.5 \times 0.5 = 1,875$. (That's base times height times one-half of the consumer surplus triangle)
- DWL is $(7,500 - 5,000) \times 0.5 \times 0.5 = 625$
- There is no producer surplus because insurance seller breaks even
- **Can we do better?**

Correcting the market failure

Note that

1. All consumers place positive value on insurance (except consumer $i = 0$, who has zero risk)

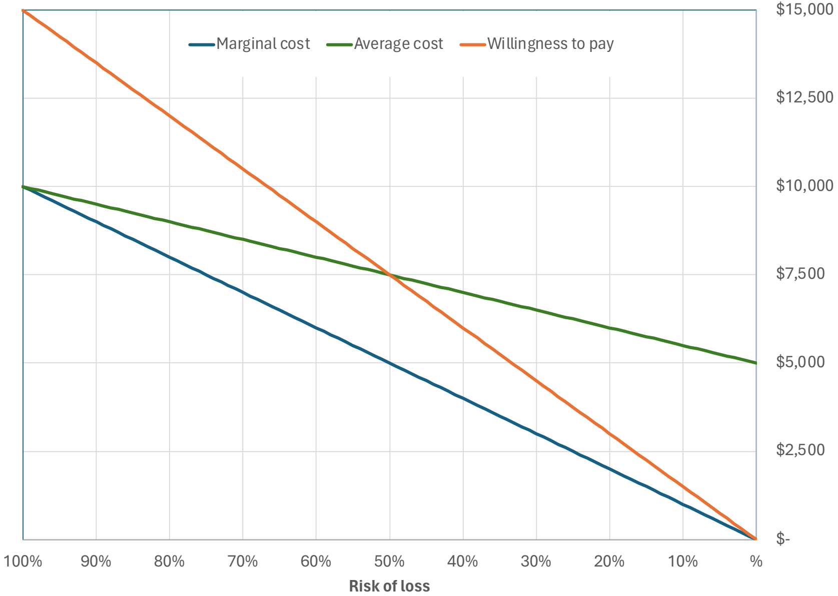
2. The marginal cost of insuring each consumer is less than or equal to her willingness to pay for this insurance, all consumers should be insured.

Correcting the market failure

Q: What would be an efficient insurance solution in this case?

- All consumers place positive value on insurance (except consumer $i = 0$, who has zero risk)
- An efficient market solution involves all consumers obtaining insurance
- Since the marginal cost of insuring each consumer is less than or equal to her willingness to pay for this insurance, all consumers should be insured.
- The efficient policy has a premium of $\$5000$, but this policy is *mandatory*.

Mandating insurance



Mandate

- Notice that **not** every consumer is better off under the mandatory policy
- At price \$5,000, consumers with expected cost of less than $(2/3) \times \$5,000 = \$3,333$ ($r = 0.33$) prefer not to purchase
- **Q**: In what sense is it efficient to require them to buy insurance?

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- **Q**: In what sense is it efficient to require them to buy insurance?
  - Think of the mandatory policy as having two parts: an insurance value and a transfer value
  - The transfer is from low cost to high cost consumers
  - Consumers with $r < 0.33$ effectively subsidize consumers with $r \geq 0.33$
  - While the insurance component makes consumers better off, the transfer component makes consumers with $r < 0.33$ worse off

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  - Consumers with $r < 0.33$ effectively subsidize consumers with $r \geq 0.33$
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- **Average consumer welfare** is higher under the *mandatory* insurance policy than either the *no-insurance* or the *free market insurance* case

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- Compare with consumer surplus in free market case of $(15,000 - 7,500) \times 0.5 \times 0.5 = 1,875$

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- Compare with consumer surplus in free market case of $(15,000 - 7,500) \times 0.5 \times 0.5 = 1,875$
- What is maximum attainable consumer surplus?

$$[(15,000 - 10,000) \times 1 \times 0.5] = 2,500$$

- Thus, the mandatory policy achieves maximum consumer surplus (is fully efficient) but it is not Pareto-improving