Intermediate Microeconomics

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Week 14b: Asymmetric Information (II)

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Hidden Types

- In the hidden-type model
  - The individual has private information about an innate characteristic he cannot choose
- The agent’s private information
  - At the time of signing the contract
  - Puts him in a better position

Hidden Types

- The principal
  - Will try to extract as much surplus as possible from agents through clever contract design
  - Include options targeted to every agent type

Adverse Selection

- Adverse selection

  Is a problem facing insurers where the risky types are more likely to accept an insurance policy and are more expensive to serve

Adverse Selection in Car Insurance

- Suppose there are two types of car owners:
- Type A has already installed the antitheft device but Type B does not have the antitheft device.
- The insurance company cannot distinguish between the two types of owners.

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- Suppose there are two types of car owners:
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- Assume there are no administrative costs of writing insurance.
- Let $W_0 = 100{,}000$, $L = 20{,}000$, $U(W) = \ln(W)$
- The antitheft device reduces the probability of theft from 0.25 to 0.15.

First scenario

- If the insurance company offers fair insurance and charges every car owner $5,000 (0.25*20,000) for a full coverage ($20,000),
- then the expected utility of an insured car owner = ln(100,000-5,000) = ln(95,000) = 11.4616

- This is because

(a) for Type A owners: expected utility =

(b) for Type B owners: expected utility =

First scenario

- Type A owners will **not** purchase this insurance policy because the expected utility without insurance = 0.15 ln(100000-20000) + 0.85 ln(100000) = 11.4795 > 11.4616

- Type B owners will purchase this insurance policy because the expected utility without insurance = 0.25ln(100000-20000)+0.75ln(100000)= 11.4571 < 11.4616

- There is adverse selection because only the high-risk owners (i.e., Type B) will purchase the insurance policy.

First scenario

- If the insurance company charges every car owner $3,000 (0.15*20,000) for a full coverage ($20,000),
- then the expected utility of an insured owner = ln(100,000-3,000) = ln(97,000) = 11.4825 (which is higher than 11.4795 and 11.4571).
- Clearly, both Type A and Type B owners will purchase this insurance policy.

First scenario

- Suppose the numbers of Type A and Type B owners are the same, therefore the proportion of Type B owners is 0.5.

- If the company offers the $3,000 policy, then it will lose on average 0.5(3000-0.25*20000)+0.5(3000-0.15*20000)= -1000 for underwriting such an insurance policy.

- Therefore, the insurance company will not offer this policy.

First scenario

- Suppose the insurance company sets the premium at the average level, i.e., $4000 (0.5*5000+0.5*3000=4000) for a full coverage ($20,000),

- Type B owners will buy the policy because the expected utility = ln(100000-4000) = ln(96000) = 11.4721 > 11.4571
- Type A owners will not buy the policy because their expected utility without insurance is 11.4795 > 11.4721

- Therefore, the pooling equilibrium is not viable because the company will lose on average (4000- 0.25*20000) = -1000. There is adverse selection because only the high-risk owners (i.e., Type B) are insured.

Second scenario

- The insurance company can separate Type A owners from Type B owners by offering the following policy:

- charge \$5,000 for a full coverage (\$20,000) and $0.15M$ for a partial coverage of M dollars (the magnitude of M is to be determined). Under this policy, a Type B car owner will buy the full insurance but not the partial insurance if

$$0.25 \ln(100000 - 20000 + M - 0.15M) + 0.75 \ln(100000 - 0.15M) < \ln 95000$$

- Solving this inequality numerically, M < 3000

Second scenario

- A Type A owner will buy the partial insurance M = 3000 because

$$0.15\ln(100000-20000+M-0.15M)+0.85\ln(100000-0.15M)$$

$$=0.15\ln(100000-20000+3000-0.15*3000)+0.85\ln(100000-0.15*3000) = 11.4803$$

- which is greater than

$$0.15\ln(100000-20000)+0.85\ln(100000) = 11.4795$$

- A Type B owner will not buy the partial insurance because

$$0.25\ln(100000-20000+3000-0.15*3000)$$
$$+0.75\ln(100000-0.15*3000)$$
$$=11.46160134 < \ln 95000 = 11.46163217$$

Second scenario

- This is called a *separating equilibrium*.
- Of course, this coverage will be regarded as too small by Type A owners as it offers only $3,000 out of a loss of $20,000.

- Question: Suppose the numbers of Type A and Type B owners are the same, what is the profit of the insurance company? 0

Third scenario

- Assume that full insurance is available at $3000. If Type A owners could buy a certificate to prove that they have installed the antitheft device, they will be willing to pay at most Y_A such that
$$\ln(100000 - 3000 - Y_A) = 11.4795$$

- As expected utility without insurance = 0.15 ln(100000-20000) + 0.85 ln(100000) = 11.4795

- thus Y_A = 287.

Third scenario

- A Type B owner will not buy the certificate if

$$\ln(100000 - 3000 - Y_B) < 11.4616$$

- As expected utility of full insurance at $5000 is ln(95000)=11.4616

- thus Y_B>2003.

Third scenario

- Therefore, if it costs a Type A owner $287 to prove that he has installed the device and a Type B owner $2,004 to fake that he has installed the device (e.g., forgery is costly), then the Type A owner will pay $287 to do so but the Type B owner will not pay to do so.

- This is a *signaling equilibrium*. It requires differential costs in obtaining the signal, otherwise the equilibrium will not be viable.

A summary

- Pooling equilibrium: An equilibrium in which different people are treated (paid) alike or behave alike.

- Separating equilibrium: An equilibrium in which one type of people is differentiated from other types of people.

A summary

- Signaling equilibrium: An equilibrium in which one type of people takes an action to send information to a less informed party in order to differentiate themselves from other types of people.

- Screening equilibrium: An equilibrium in which a less informed party takes an action to differentiate one type of people from other types of people.

$$\begin{array}{ccc} \text{Party} & \text{Action} & \text{Party} \\ & & \\ \text{informed} & \begin{array}{c} \xrightarrow{\textbf{signal}} \\ \\ \xleftarrow[\textbf{screen}]{} \end{array} & \text{less informed} \end{array}$$

Market for Lemons

- Akerlof's Lemon Model (1970)
  - Lemons: a colloquialism for defective cars

- Akerlof's idea may be illustrated by a simple example.
- Assume that a good is sold in indivisible units and is available in two qualities, low and high, in fixed shares λ and $1-\lambda$.

Market for Lemons

- Each buyer is potentially interested in purchasing one unit, but cannot observe the difference between the two qualities at the time of the purchase.

- All buyers have the same valuation of the two qualities: one unit of low quality is worth w^L dollars to the buyer, while one high-quality unit is worth $w^H > w^L$ dollars.

- Each seller knows the quality of the units he sells, and values low-quality units at $v^L < w^L$ dollars and high-quality units at $v^H < w^H$.

	High-quality Unit	Low-quality Unit
Buyers' Valuation	w^H	w^L
Sellers' Valuation	v^H	v^L

Market for Lemons

- If there were separate markets for low and high quality,
- every price between v^L and w^L would induce beneficial transactions for both parties in the market for low quality,
- as would every price between v^H and w^H in the market for high quality.

- This would amount to a socially efficient outcome: all gains from trade would be realized.

Market for Lemons

- But if the markets are not regulated and buyers cannot observe product quality, unscrupulous sellers of low-quality products will choose to trade on the market for high quality.

Market for Lemons

- In practice, the markets would merge into a single market with *one and the same price* for all units.

- In other words, buyers are only willing to pay the average valuation $\bar{w} = \lambda w^L + (1-\lambda) w^H$;
- therefore the market price could not exceed $\bar{w}$ (assuming that buyers are risk averse or risk neutral).

- If $v^H > \bar{w}$, then sellers with high-quality goods would exit from the market, leaving only an **adverse selection** of low-quality goods, the lemons. The market has adversely selected only the low-quality goods.

Market for Lemons

- However, if $v^H < \bar{w}$, then there will be no adverse selection. Both high-quality and low-quality goods will be sold in the market.

- The lemon problem: With asymmetric information, low-quality goods can drive high-quality goods out of the market.

- Adverse selection in the labor market: People who believe that they are of high value may take themselves out of the labor market because they consider the market wage rate too low.

How to mitigate adverse selection problems?

- 1. Restrict opportunistic behavior
- (a) Universal Coverage
  - Government provides insurance to everyone or mandates everyone to buy insurance (e.g., third-party auto insurance)
  - Firm provides health insurance to all employees rather than paying them a higher wage and letting them decide whether to buy health insurance on their own
- (b) Laws to Prevent Opportunism
  - Product liability laws

How to mitigate adverse selection problems?

- 2. Equalize Information
- (a) Screening Action taken by a less informed person (or party) to determine the information possessed by informed people
  - Life insurance companies: check health history, lifestyle, and habits of clients
  - Consumer screening: consumers buy information from objective experts (appraisal),
  - learn of a company's reputation
  - Genetic testing and insurance (The Human Genome Project): Should insurers have access to genetic test results?

How to mitigate adverse selection problems?

- 2. Equalize Information
- (b) Signaling Action taken by an informed person to send information to a less in-formed person (or party)
  - MBA degree?
  - Establish brand name
  - Guarantees and warranties

How to mitigate adverse selection problems?

2. Equalize Information

- (b) Signaling Action taken by an informed person to send information to a less in-formed person (or party)

  - Questions:
  - Are low-quality or high-quality producers more likely to offer warranties for their products?
  - Are warranties a sign of weakness or an indicator of confidence?

How to mitigate adverse selection problems?

- 3. Third-party Comparison
  - Consumer groups (for-profit or not-for-profit firms), Consumer Council

How to mitigate adverse selection problems?

4. Standards and Certification

- ISO 9000 (International Organization for Standardization) for quality management standards
- Certify doctors, dentists, electricians, real estate agents, car mechanics, beauticians, plumbers, economists, ...
- Concerns: drive up prices, anticompetitive, barriers to entry

EXAMPLE 18.8 Used-Car Market

- Quality, q, of used cars
  - Is uniformly distributed between 0 and 20,000
- Sellers
  - Value their cars at q
- Buyers
  - Place a higher value on cars, $q + b$
- Full information about quality
  - All used cars would be sold

EXAMPLE 18.8 Used-Car Market

- Sellers have private information about quality
  - And buyers know only the distribution
  - Market price, *p*
  - Sellers offer their cars for sale if and only if $q \le p$
  - Quality of a car offered for sale
    - Uniformly distributed between 0 and *p*
  - Expected quality: $$\int_0^p q\left(\frac{1}{p}\right)dq = \frac{p}{2}$$
  - Buyer's expected net surplus = $p/2 + b - p = b - p/2$
  - There may be multiple equilibria, but the one with the most sales involves the highest value of *p* for which net surplus is non-negative.
  - One equilibrium: $p^*=2b$