Law and Economics

Review of Economic Concepts

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Review of Economic Concepts

- Welfare Theorems.
- Externalities.
- Game Theory.
  - Solution concepts in static and dynamic games.
  - Bayesian games.
- **Choice under uncertainty**.
- **Asymmetric information**.
  - **Moral Hazard**.
  - **Adverse Selection**.

Choice Under Uncertainty

- Gains from driving: 500 EUR a month.
- Probability of accident: 0.01.
- Cost of accident. 10.000 EUR.
- Expected value of driving:

$$EV = 0.99 \times \$500 + 0.01 \times (\$500 - \$10.000)$$

Choice Under Uncertainty

- Would the person drive if the EV is positive?

- utility: $u : R_+ \to R$

$$EU = 0.99 \times u(\$500) + 0.01 \times u(\$500 - \$10.000)$$

Insurance

The driver is offered full insurance for a price z. Would the driver buy the insurance?

$$EU(\text{insured}) = 0.99 \cdot u(\$500 - z) + 0.01 \cdot u(\$500 - z) = u(\$500 - z)$$

- $z = 0.01 * \$10.000 = \$100$.
- u str. concave $\Rightarrow$ driver buys the insurance.

Proof.

$$u \text{ str. concave} \quad \Leftrightarrow \quad u(\alpha \cdot x + (1-\alpha) \cdot y) > \alpha \cdot u(x) + (1-\alpha) \cdot u(y) \quad \forall \alpha$$

So,

$$u(0.99 \cdot 500 + 0.01 \cdot (500 - 10000) > 0.99 \cdot u(500) + 0.01 \cdot u(500 - 10000))$$

$$u(400) > 0.99 \cdot u(500) + 0.01 \cdot u(-9500)$$

Insurance

- What if the price is not actuarial?
- Threshold $\bar{z}$ such that driver buys if $z < \bar{z}$.

- Solve for $u(x) = \sqrt{20000 + x}$.

$$\sqrt{(20500 - \bar{z})} = 0.99 \cdot \underbrace{\sqrt{20500}}_{\sim 143.1782} + 0.01 \cdot \underbrace{\sqrt{10500}}_{102.4695}$$

$\bar{z} = 20500 - (142.7711)^2 = \$116.41$

  - The driver is willing to pay more than the actuarial price.
  - Risk-aversion.

Continuous driving

Decision to drive might not be binary.

- amount of driving $x \in R_+$.
- accident $a \in \{0, 1\}$ with loss K.
- Probability of accident $p(x)$ increasing.
- Initial wealth $W_0 > K$.
- utility from driving and money $u : R_+ \times R_+ \to R$
- **Assumption**: separable preferences $u(x, w) = \hat{u}(x) + v(w)$ with $v'(0) = 1$.

Uninsured driver

- Uninsured driver's problem:

$$\max_{x \geq 0} \quad \hat{u}(x) + p(x) \cdot v(W_0 - K) + (1 - p(x)) \cdot v(W_0)$$

- If $\hat{u}$ concave and $p(x)$ convex and smooth, the FOC characterizes the optimum:

$$\hat{u}'(x) = p'(x) \cdot [v(W_0) - v(W_0 - K)]$$

.

- Solution x^U.

Efficient allocation

- Social problem:

$$\max_{x \geq 0} \quad \hat{u}(x) - p(x) \cdot K$$

  - Under previous concavity and smoothness assumptions, optimum satisfies:

$$\hat{u}'(x) = p'(x) \cdot K$$

  - Solution $x^* > x^U$.

$$\begin{aligned} v(W_0) &= v(W_0 - K) + \int_{W_0 - K}^{K} v'(s)\, ds \\ &\leq v(W_0 - K) + K \end{aligned}$$

Insurance

- **Insurance contract**: driver drives x^* and pays the actuarial price $p(x^*)K$.
- This contract is good for a risk-averse driver.

$$\hat{u}(x^*)+v(W_0-p(x^*)\cdot K) \geq \hat{u}(x^*)+(1-p(x^*))\cdot v(W_0)+p(x^*)\cdot v(w_0-K)$$

- Insurance company breaks even.
- Two problems:
  - x might not be observable.
  - Different drivers might have different risks (different $p(\cdot)$).

Moral Hazard

- If x is not observable, the driver has incentives to increase the miles driven per month.

$$\hat{u}'(x^*) = p'(x^*) \cdot K > 0$$

- $\hat{u}$ has a local max at $\hat{x}$, this is what the driver will choose.
- $\hat{x} > x^* > x^U$.

Adverse Selection

- Two type of drivers: reckless (R) and safe (S).
- For simplicity, assume they are risk-neutral ($v(w) = w$).
- $p_R(x) > p_S(x)$ for all x.
- Proportion α of reckless drivers, with

$$p(x) := \alpha \cdot p_R(x) + (1 - \alpha) \cdot p_S(x)$$

- "Actuarially fair" insurance: x^* with premium $p(x^*) \cdot K$.
- Reckless driver will buy the insurance (if not risk-loving).

$$\begin{aligned} \hat{u}(x^*) - p(x^*)K &\geq u(\hat{x}_R) - p(\hat{x}_R)K \\ &> u(\hat{x}_R) - p_R(\hat{x}_R)K \end{aligned}$$

Adverse Selection

- Safe driver will NOT buy the insurance:

$$\begin{aligned} u(\hat{x}_S) - p_S(\hat{x}_S)K &\geq u(x^*) - p_S(x^*)K \\ &> u(x^*) - p(x^*)K \end{aligned}$$

- If only the reckless driver buys the insurance, the insurance company does not break even:

$$p(x^*)K - p_R(x^*)K < 0.$$