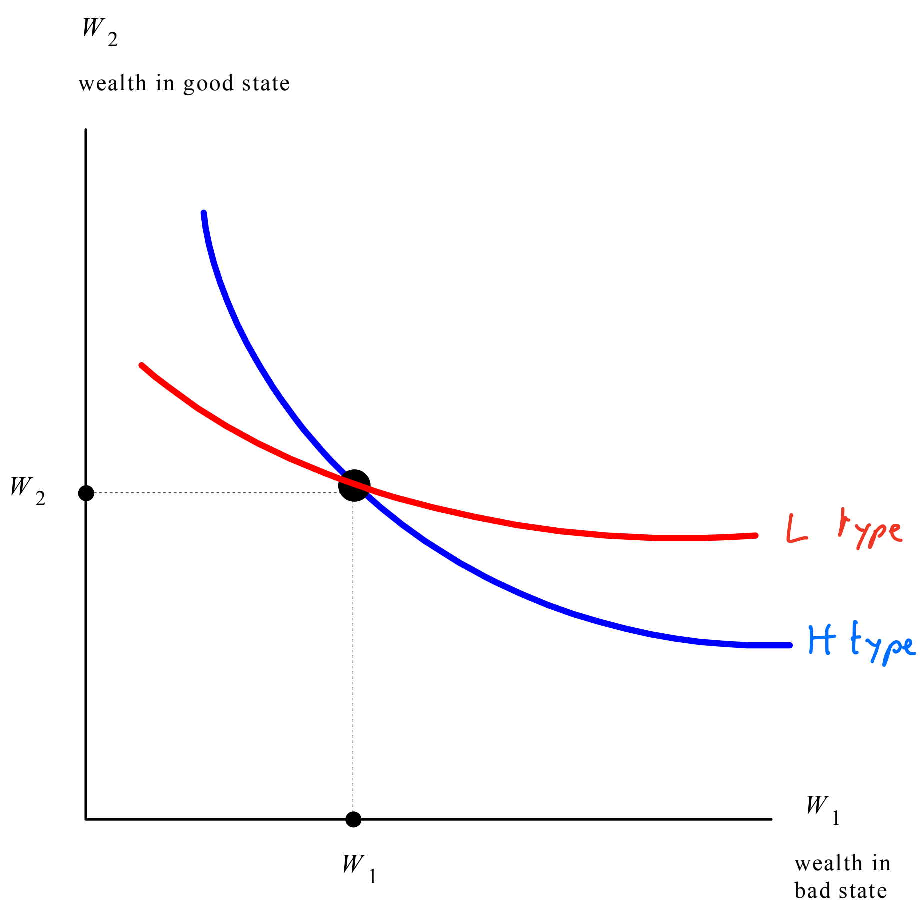
Adverse selection in insurance markets

Two types of customers, H and L, identical in terms of initial wealth W, potential loss L and vNM utility-of-money function U, but with different probability of loss: $\boxed{p_H > p_L}$. $\Rightarrow 1-p_H < 1-p_L$

Slope of indifference curves at point (w_1, w_2)

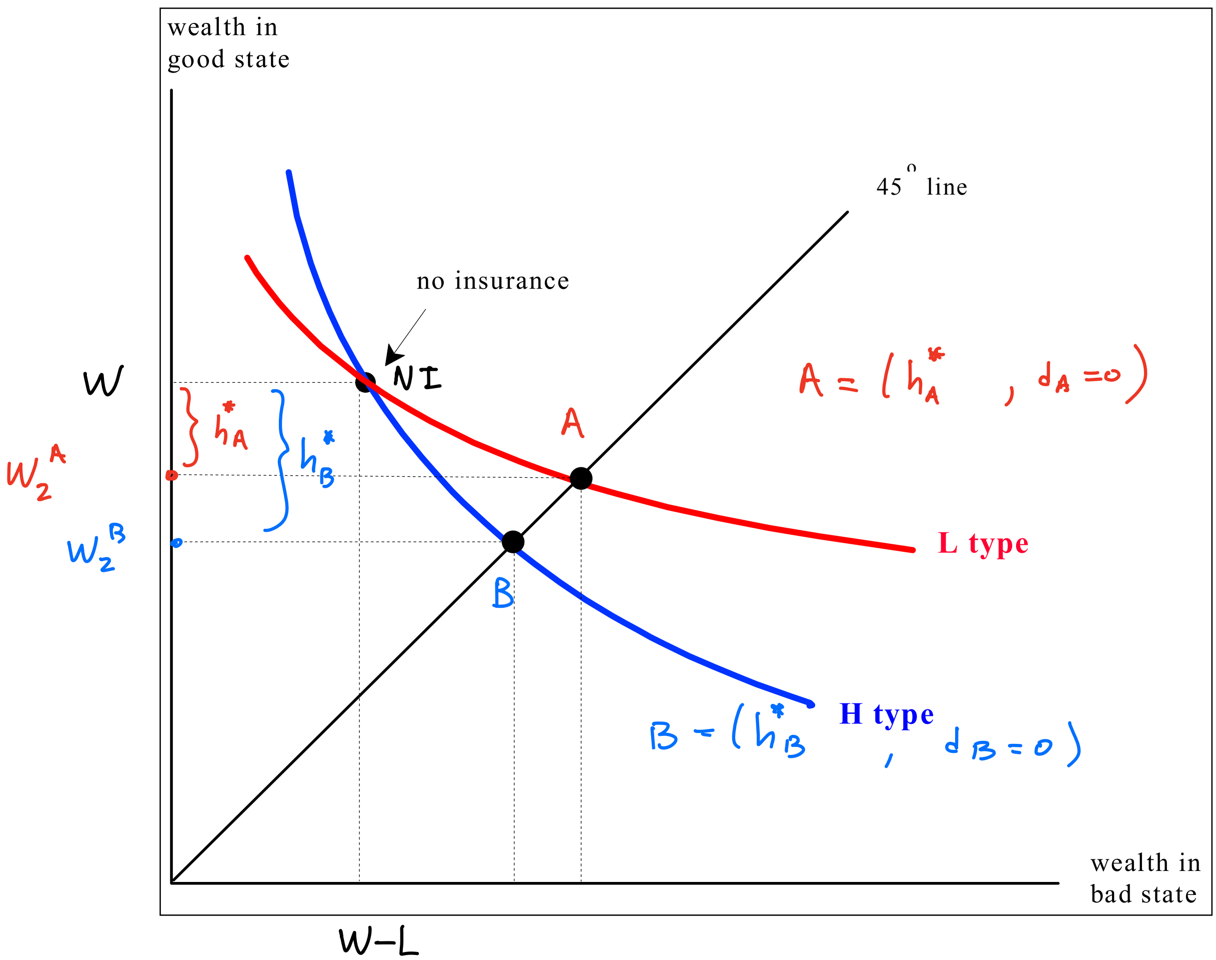
$$-\frac{p_H}{1-p_H}\frac{U'(w_1)}{U'(w_2)} \quad \text{steeper} \qquad -\frac{p_L}{1-p_L}\frac{U'(w_1)}{U'(w_2)} \quad \text{less steep}$$

$$\frac{p_L}{1-p_L} < \frac{p_L}{1-p_H} < \frac{p_H}{1-p_H}$$



h_H^* maximum premium that the H people are willing to pay for full insurance

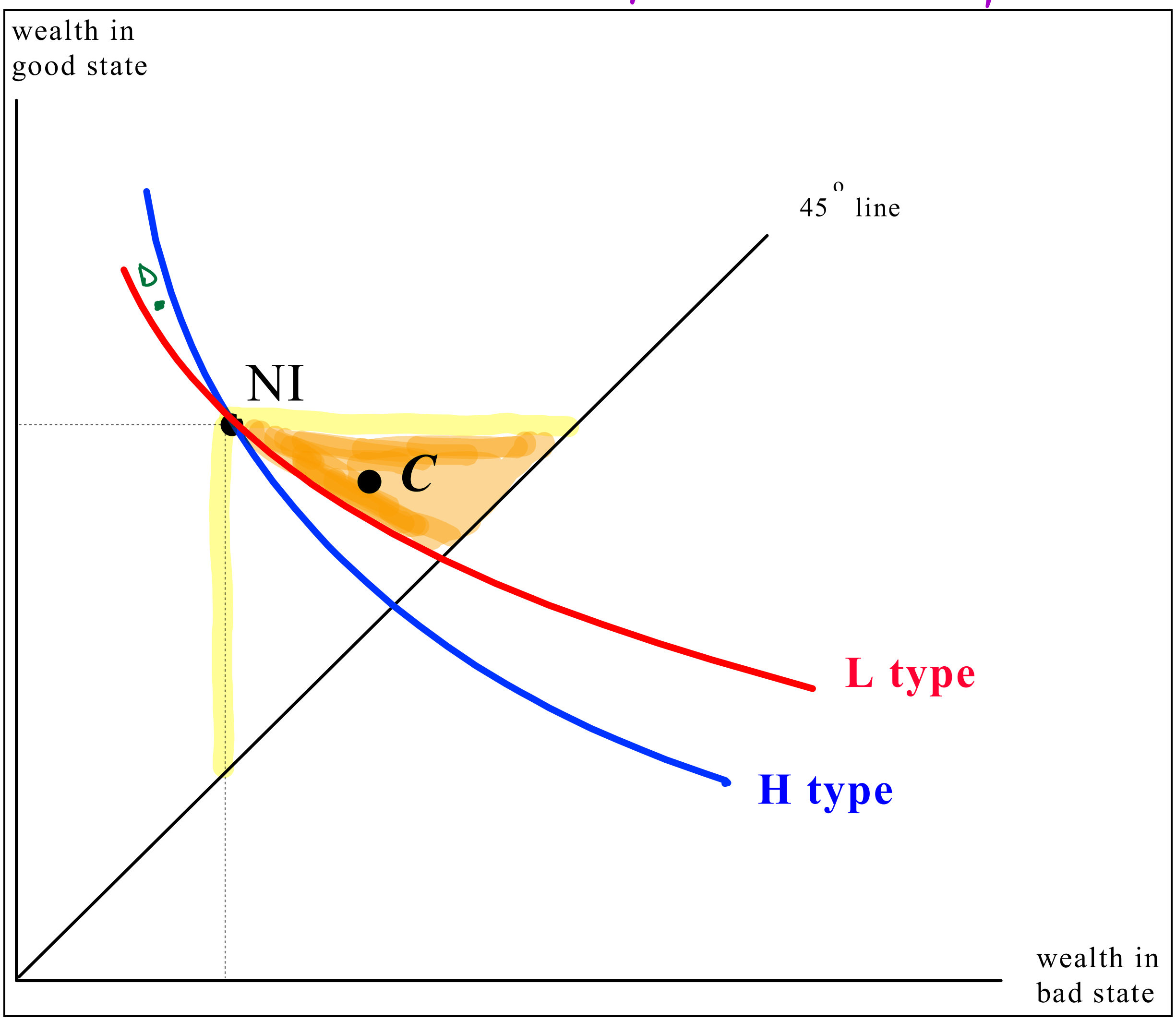
h_L^* maximum premium that the L people are willing to pay for full insurance:



Let q_H be the fraction of H types in the population $0 < q_H < 1$

$$\text{If } \underbrace{\mathbb{E}[U_L(C)] \geq \mathbb{E}[U_L(NI)]}_{\text{C is acceptable to L}} \text{ then } \underbrace{\mathbb{E}[U_H(C)] \geq \mathbb{E}[U_H(NI)]}_{\text{C is acceptable to H}}$$

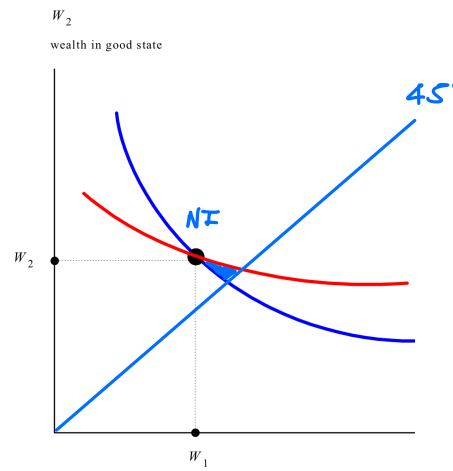
If contract C is acceptable to the L types then it is also acceptable to the H types



Case 1: MONOPOLY

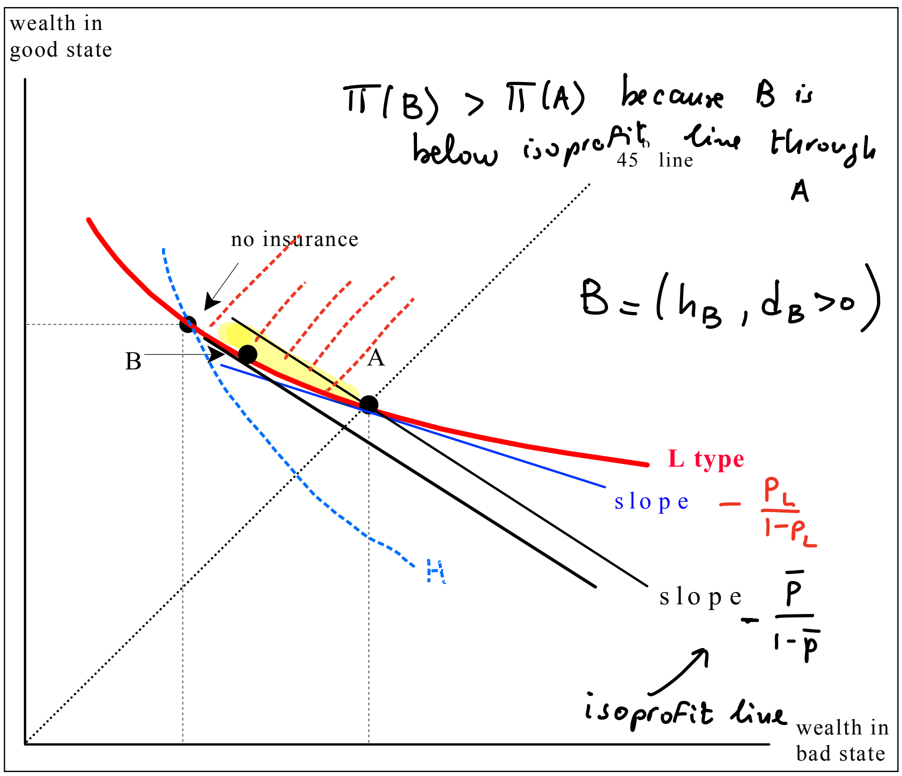
OPTION 1. Offer only one contract, which the H type.

$C_1 = (h_H^* \ , \ 0 \ )$ Profits: $\pi_1^* =$



$$\pi_1^* = q_H N \underbrace{(h_H^* - p_H L)}_{\text{profit from a single contract}}$$

OPTION 2. Offer only one contract, which types. **Not optimal to offer full insurance**



slope of L reservation indiff. curve at point A is in absolute value $\frac{p_L}{1-p_L}$

probability of making a payment

$\bar{p} = q_H p_H + (1-q_H) p_L > p_L$

↑ average probability of loss

$\frac{\bar{p}}{1-\bar{p}} > \frac{p_L}{1-p_L}$

Best contract under Option 2:

$$\pi_2^* = N \underbrace{[h_B - \bar{p}(L - d_B)]}_{\text{profit from a single contract}}$$

OPTION 3: Offer two contracts,

$C_H = (h_H, d_H)$, targeted to the H type

$C_L = (h_L, d_L)$ targeted to the L type.

expected utility for L-type from C_L: $EU_L[C_L] =$ $p_L U(W - h_L - d_L) + (1-p_L) U(W - h_L)$

expected utility for L-type from C_H: $EU_L[C_H] =$ $p_L U(W - h_H - d_H) + (1-p_L) U(W - h_H)$

expected utility for H-type from C_L: $EU_H[C_L] =$ $p_H U(W - h_L - d_L) + (1-p_H) U(W - h_L)$

expected utility for H-type from C_H: $EU_H[C_H] =$ $p_H U(W - h_H - d_H) + (1-p_H) U(W - h_H)$

expected utility for L-type from NI: $EU_L[NI] =$ $p_L U(W - L) + (1-p_L) U(W)$

expected utility for L-type from NI: $EU_H[NI] =$ $p_H U(W - L) + (1-p_H) U(W)$

$C_H = (h_H, d_H) \qquad C_L = (h_L, d_L)$

Monopolist's problem is to

$$\underset{h_H,\, \overset{}{\underset{d}{\cancel{D}}}_H,\, h_L,\, \underset{d}{\cancel{D}}_L}{Max} \; \pi_3 = q_H N \underbrace{\left[h_H - p_H(\overset{L}{\cancel{\ }} - \overset{d}{\cancel{D}}_H)\right]}_{\text{profit from a single H contract}} + (1-q_H) N \underbrace{\left[h_L - p_L(\overset{L}{\cancel{\ }} - \overset{d_L}{\cancel{D}}_L)\right]}_{\text{profit from a single L contract}}$$

subject to

(IR_L)

(IC_L)

(IR_H)

(IC_H)

(IR_H) follows from (IR_L) and (IC_H)

IR = individual rationality

IC = incentive compatibility