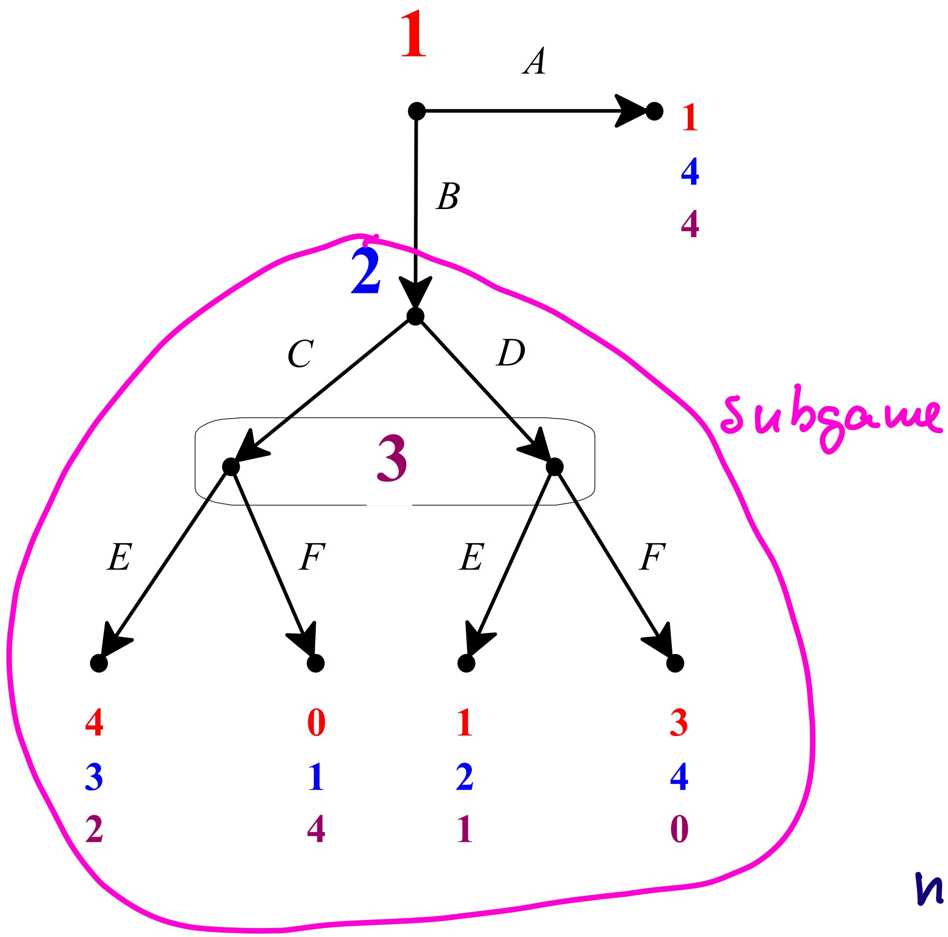


		3	
		q E	$1-q$ F
2	$p \rightarrow$ C	3, 2	1, 4
	$1-p$ D	2, 1	4, 0

no pure-strategy NE

NE: $= \left(\underbrace{\begin{pmatrix} C & D \\ \frac{1}{3} & \frac{2}{3} \end{pmatrix}}_{\sigma_2}, \underbrace{\begin{pmatrix} E & F \\ \frac{3}{4} & \frac{1}{4} \end{pmatrix}}_{\sigma_3} \right)$

need : $3q + 1 - q = 2q + 4(1-q)$

Solution $q = \frac{3}{4}$

need $2p + 1 - p = 4p$ Solution $p = \frac{1}{3}$

$\pi_2 = 3 \frac{3}{4} + 1 \cdot \frac{1}{4} = \frac{10}{4}$

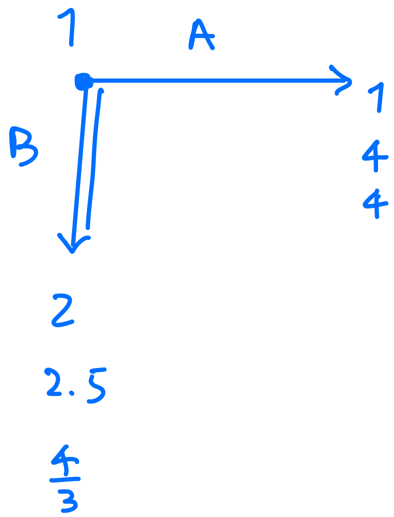
$\pi_3 = 4 \frac{1}{3} = \frac{4}{3}$

By indifference theorem:

$\pi_2(\sigma_2, \sigma_3) = \pi_2(C, \sigma_3)$

$\pi_3(\sigma_2, \sigma_3) = \pi_3(\sigma_2, F)$

$$\pi_1 : \frac{1}{3} \cdot \frac{3}{4} \cdot 4 + \frac{1}{3} \cdot \frac{1}{4} 0 + \frac{2}{3} \cdot \frac{3}{4} 1 + \frac{2}{3} \cdot \frac{1}{4} 3 = 2$$



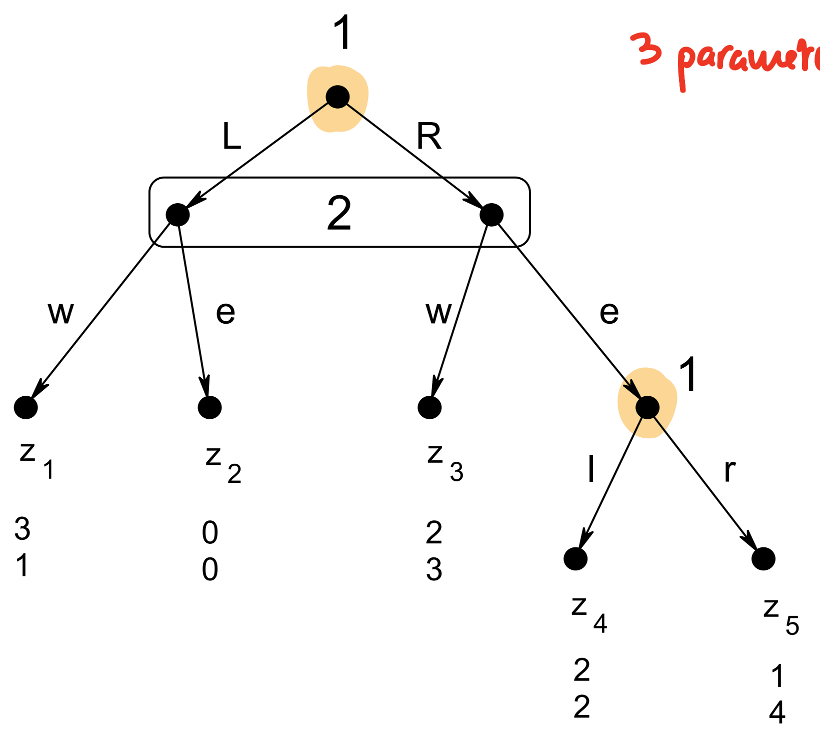
SPE:

$$\left(\begin{pmatrix} A & B \\ 0 & 1 \end{pmatrix}, \begin{pmatrix} C & D \\ \frac{1}{3} & \frac{2}{3} \end{pmatrix}, \begin{pmatrix} E & F \\ \frac{3}{4} & \frac{1}{4} \end{pmatrix} \right)$$

Kuhn

$S_1 = \{Ll, Lr, Rl, Rr\}$

BEHAVIORAL STRATEGIES IN EXTENSIVE GAMES



3 parameters

$$\left(\begin{pmatrix} Ll & Lr & Rl & Rr \\ \frac{1}{12} & \frac{4}{12} & \frac{2}{12} & \frac{5}{12} \end{pmatrix}, \begin{pmatrix} w & e \\ \frac{1}{3} & \frac{2}{3} \end{pmatrix} \right)$$

mixed strategy

outcome	z_1	z_2	z_3	z_4	z_5
probability	$\frac{5}{36}$	$\frac{10}{36}$	$\frac{7}{36}$	$\frac{4}{36}$	$\frac{10}{36}$

$$\left(\left(\begin{array}{cc|cc} L & R & l & r \\ \frac{5}{12} & \frac{7}{12} & \frac{2}{7} & \frac{5}{7} \end{array} \right), \begin{pmatrix} w & e \\ \frac{1}{3} & \frac{2}{3} \end{pmatrix} \right)$$

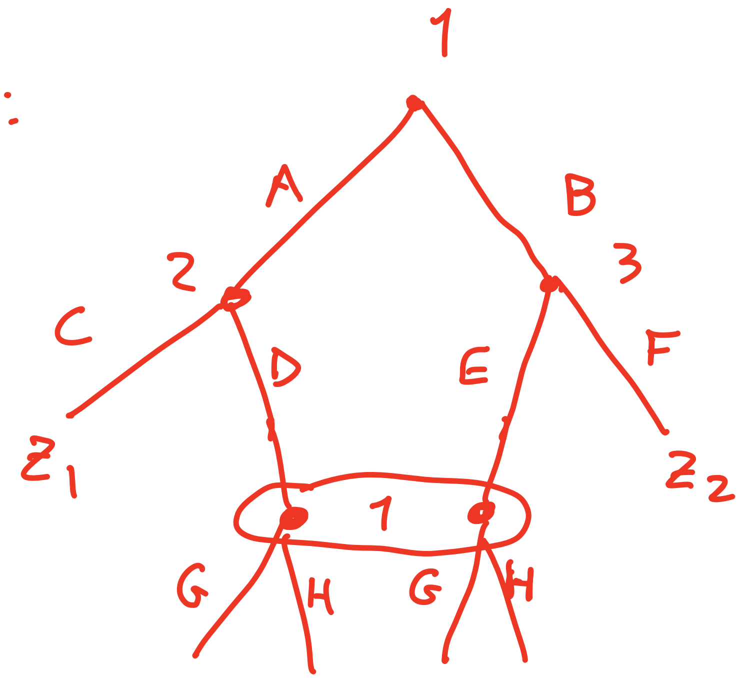
two parameters

behavioral strategy

THEOREM (Kuhn, 1953). In an extensive game **with perfect recall**, mixed and behavior strategies are equivalent. [For a precise statement of "equivalence" see the textbook.]

What does Perfect Recall mean?

Lack of perfect recall :



ASYMMETRIC INFORMATION

INSURANCE MARKETS

Consider an individual with risk averse

W_0 initial wealth $0 \le L \le W_0$

L potential loss

p probability of loss

With no insurance she faces the money lottery

$$NI = \begin{pmatrix} W_0 - L & W_0 \\ p & (1-p) \end{pmatrix}$$

An **insurance contract** is a pair (h,d)

h premium

d deductible

$L - d$ insured amount of the loss

With contract (h,d) the individual faces the lottery

$$\begin{pmatrix} W_0 - d - h & W_0 - h \\ p & 1-p \end{pmatrix}$$

- If $d = 0$ Full-insurance contract $d < L$
- If $d > 0$ partial- " "

loss : $\begin{pmatrix} L & 0 \\ p & 1-p \end{pmatrix}$

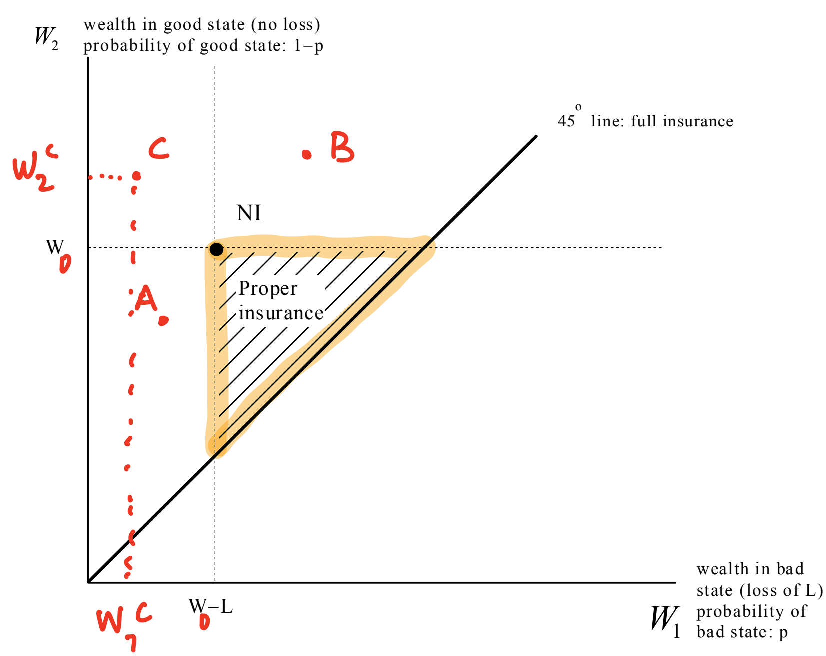
exp. value $= pL$ $\qquad h \geq pL$

Would the individual purchase the full-insurance contract with $h = pL$?

NI : $\begin{pmatrix} W_0 - L & W_0 \\ p & 1-p \end{pmatrix}$ $\qquad E[NI] = pW_0 - pL + (1-p)W_0 = W_0 - pL$

with contract $h = pL$, $d = 0$: customer is guaranteed $W_0 - pL$

- If she is risk averse then $U(W_0 - pL) > E[U(NI)]$
- If she is risk neutral then $U(W_0 - pL) = E[U(NI)]$
- If she is risk loving then $U(W_0 - pL) < E[U(NI)]$



A contract expressed as a pair (h,d) can be translated into a point in wealth space as follows:

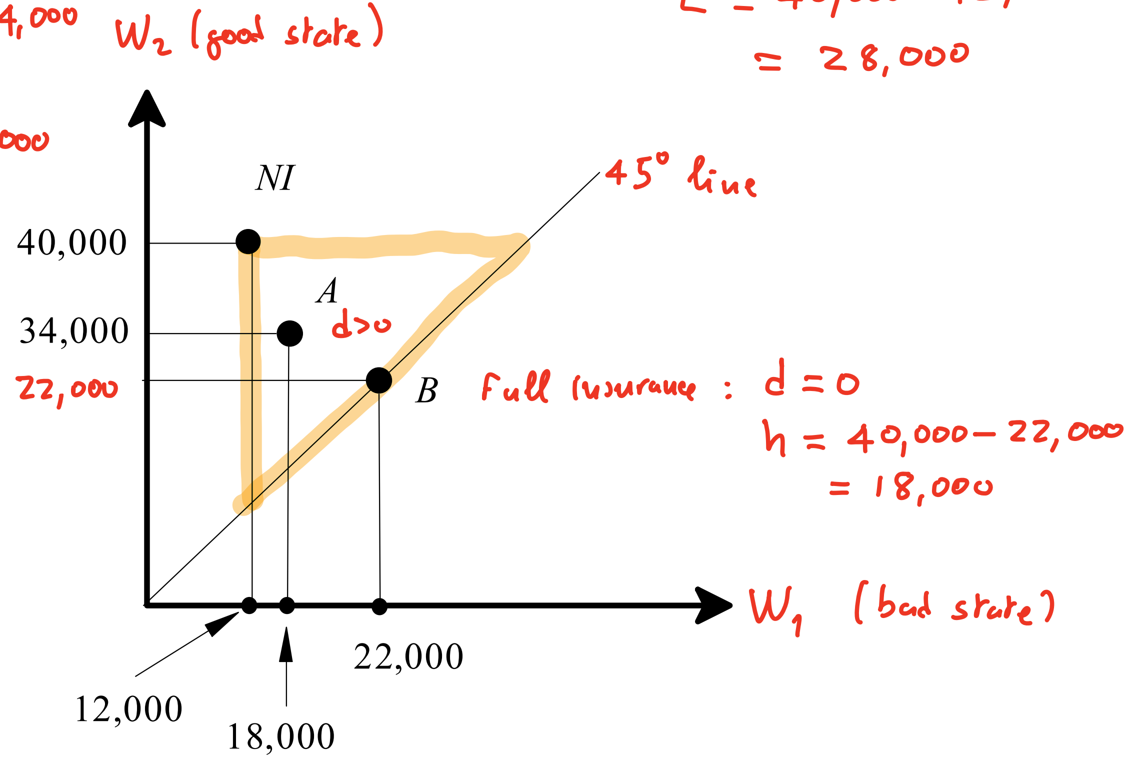
Contract A:

$h_A = 40{,}000 - 34{,}000 = 6{,}000$

$d_A = 34000 - 18{,}000 = 16{,}000$

$W_0 = 40{,}000$

$L = 40{,}000 - 12{,}000 = 28{,}000$



(W_1, W_2)

$h = W_0 - W_2$

$d = W_2 - W_1$

Here we have: $W =$ $L =$

ISOPROFIT LINES

Assume that the **insurance company** is **risk neutral** so that it considers selling an insurance contract $C = (h,d)$, corresponding to the lottery

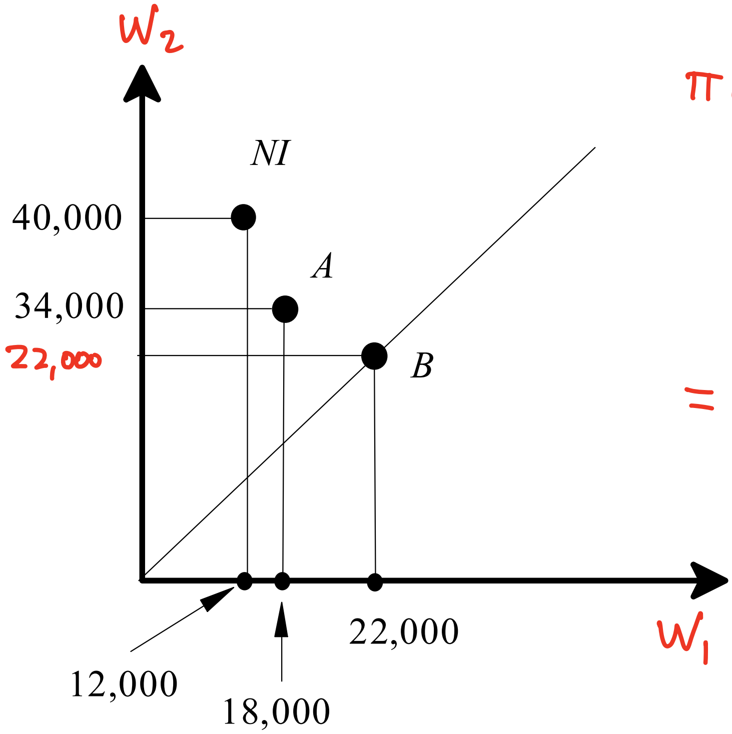
$$C = \begin{pmatrix} h-(L-d) & h \\ p & (1-p) \end{pmatrix},$$ as equivalent to getting its expected value for sure: $\mathbb{E}[C] = p[h-(L-d)] + (1-p)h = h - \underbrace{p(L-d)}_{\text{expected payment}}$

We denote the expected profit from contract (h,d) by $\pi(h,d)$. Thus

$$\pi(h,d) = h - \underbrace{p(L-d)}_{\text{expected payment}} = h - pL + pd$$

If the contract is expressed as a point (W_1, W_2) in wealth space then

$$\pi(W_1, W_2) = \underbrace{(W_0 - W_2)}_{h} - pL + p\underbrace{(W_2 - W_1)}_{d}$$



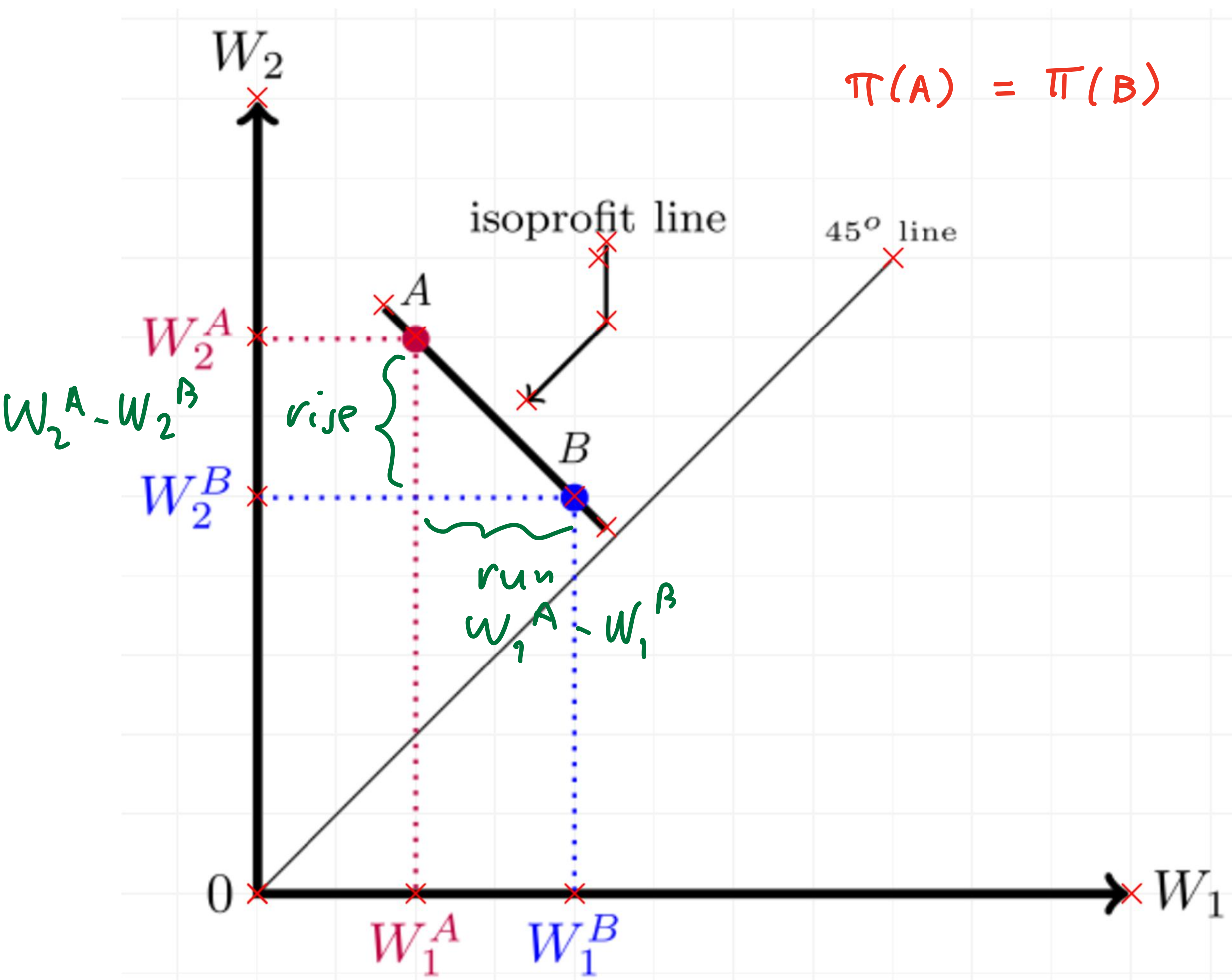
$\pi(A) = \underbrace{W_0 - W_2}_{h} - \frac{1}{10} 28000 + \frac{1}{10}(W_2 - W_1)$

$= 40000 - 34000 - 2800 + \frac{1}{10}(34000 - 18000)$

$\pi(B) = \underbrace{(40000 - 22,000)}_{h} - \frac{1}{10} 28000$

Suppose that $p = \frac{1}{10}$. What is $\pi(A)$? What is $\pi(B)$?

An **isoprofit line** is defined as a line joining contracts that give the same expected profit. Let $A = (W_1^A, W_2^A)$ and $B = (W_1^B, W_2^B)$ be such that $\pi(A) = \pi(B)$



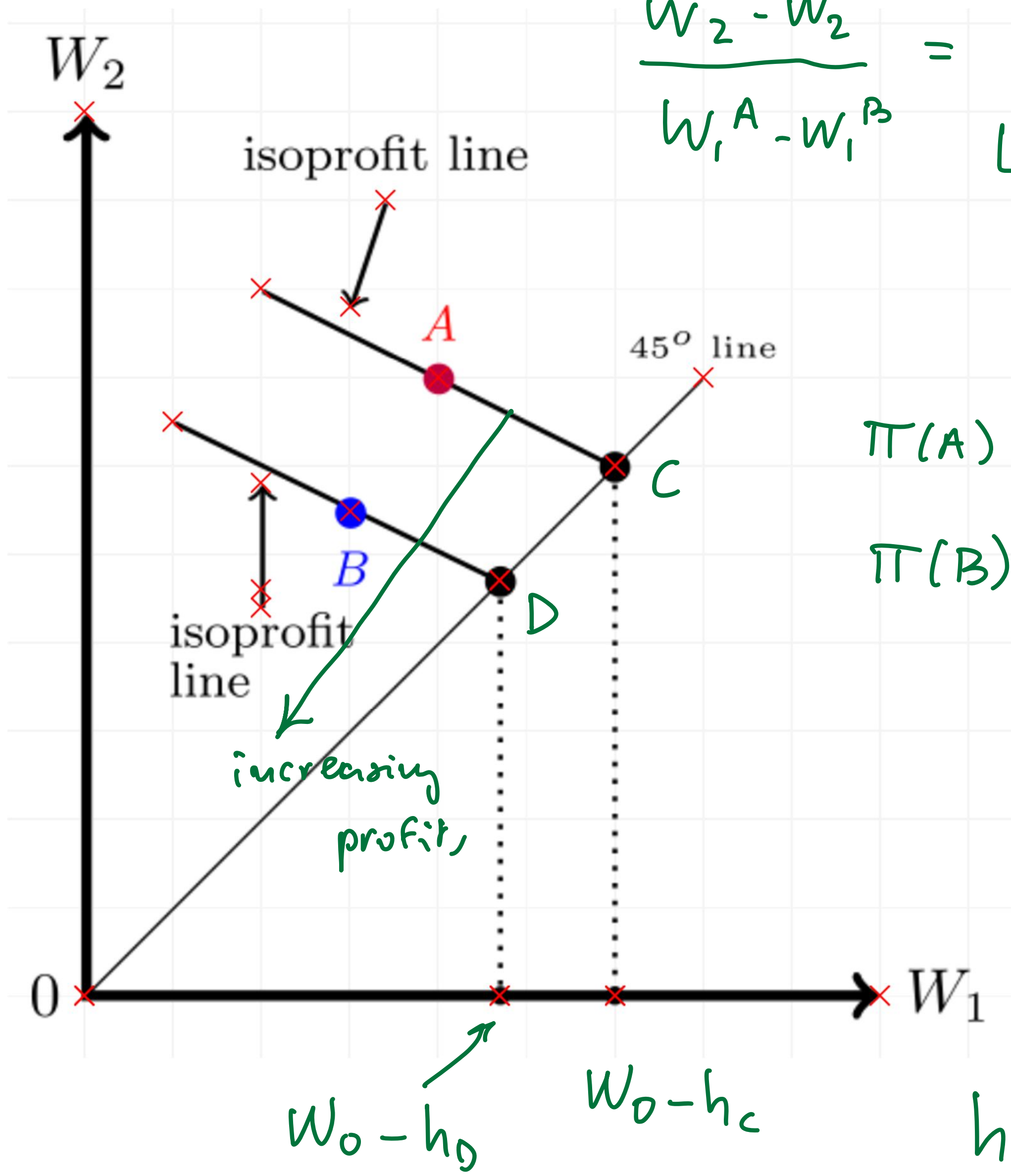
$$\pi(A) = \cancel{W_0} - W_2^A - \cancel{pL} + p(W_2^A - W_1^A)$$

$$\pi(B) = \cancel{W_0} - W_2^B - \cancel{pL} + p(W_2^B - W_1^B)$$

Set them equal

$$-W_2^A + p(W_2^A - W_1^A) = -W_2^B + p(W_2^B - W_1^B)$$

$$\frac{W_2^A - W_2^B}{W_1^A - W_1^B} = -\frac{p}{1-p}$$



$\pi(A) = \pi(C)$

$\pi(B) = \pi(D)$

$h_D > h_C$

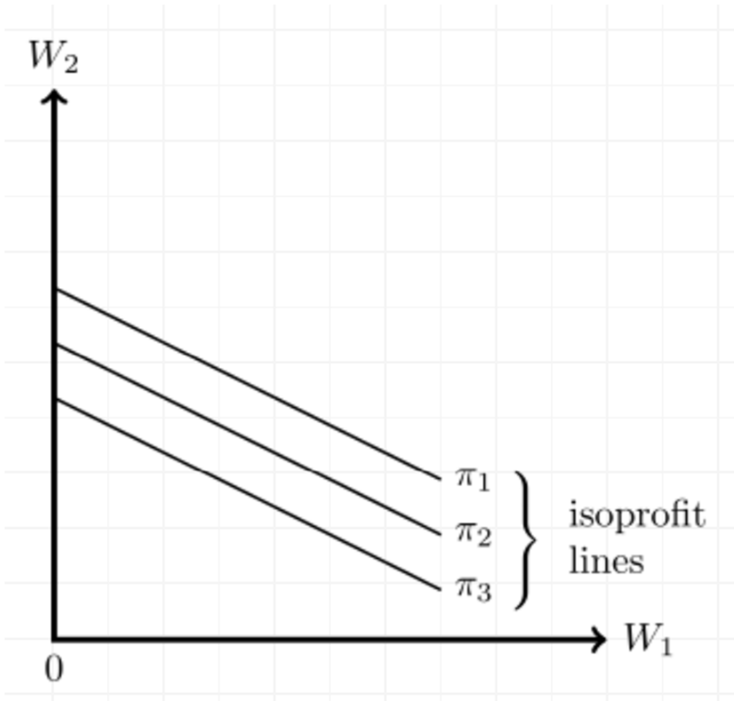
$\pi(C) = h_C - pL$

$\pi(D) = h_D - pL$

$\pi(D) > \pi(C)$

$\parallel \qquad \parallel$

$\pi(B) > \pi(A)$



$\pi_3 > \pi_2 > \pi_1$

Since No Insurance can be thought of as the trivial contract $h = 0$ and $d = L$, which gives zero profits, the isoprofit line going through the NI point is the zero-profit line:

trivial contract

think of it as h: $h = 0$

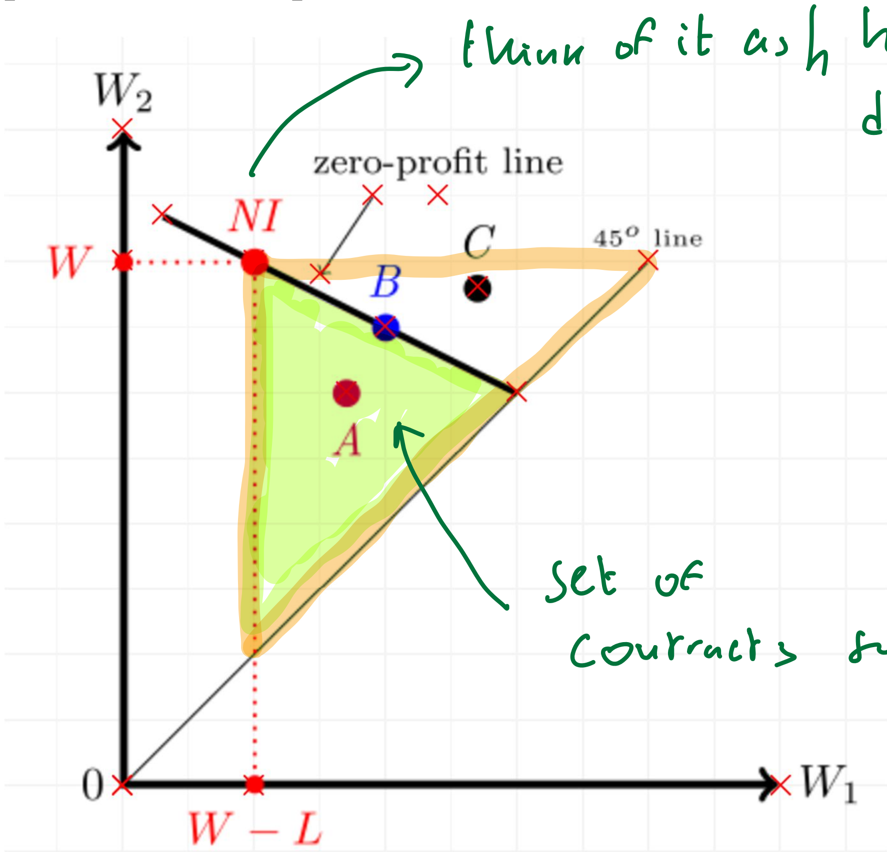
$d = L$

$\pi = 0$

$\pi(C) < 0$

$\pi(B) = 0$

$\pi(A) > 0$



set of contracts such that $\pi \geq$

Contract (W_1, W_2) $(W_2 - W_1)$

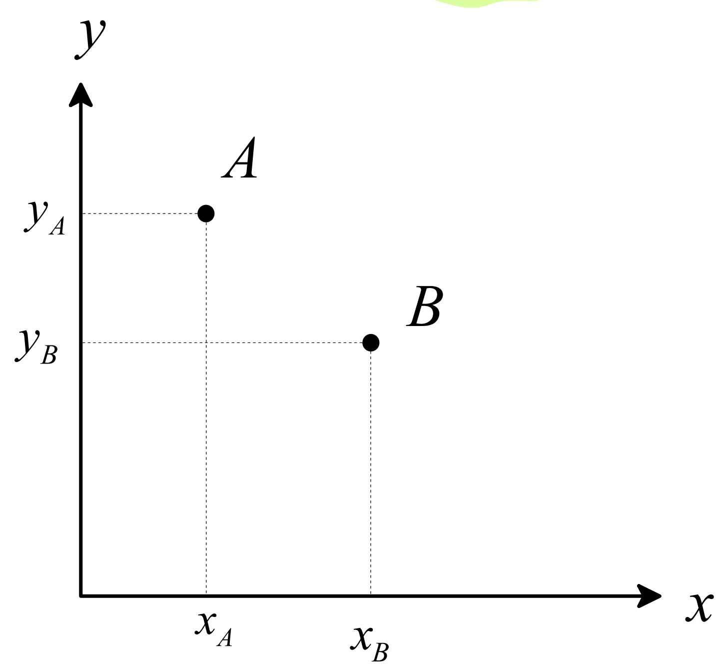
From consumer's point of view $(W_0 - (W_0 - W_2) - p$

BINARY LOTTERIES

$W_0 - (W_0 - W_1)$

$1-p$

Lotteries of the form $\begin{pmatrix} \$x & \$y \\ p & 1-p \end{pmatrix}$ with p fixed and x and y allowed to vary.



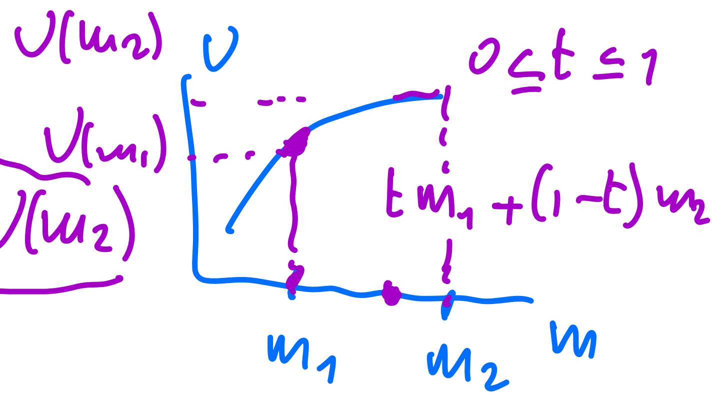
$U(\$m)$

$E[U(A)] = E[U(B)]$

draw indifference curve through A

$E[U(L)]$

Risk averse if



We want to draw indifference curves in this diagram.

$$U(tm_1 + (1-t)m_2) > tU(m_1) + (1-t)U(m_2)$$

$E[L]$ $\quad L = \begin{pmatrix} m_1 & m_2 \\ t & 1-t \end{pmatrix}$