$L = \begin{pmatrix} \$x_1 & \cdots & \$x_n \\ p_1 & & p_n \end{pmatrix}$

Given a money lottery *L,* its **certainty equivalent**, for a particular individual, denoted by C_L, is that sum of money such that

$\begin{pmatrix} \$C_L \\ 1 \end{pmatrix} \rightarrow \$C_L \sim L$

Assuming that the individual in question prefers more money to less,

- $C_L < E[L]$ if she is **risk averse relative to *L***

- $C_L = E[L]$ if she is **risk neutral relative to *L***

- $C_L > E[L]$ if she is **risk loving relative to *L***

Given a money lottery L, its **risk premium**, for a particular individual, denoted by R_L, is that sum of money such that

$$E[L] - R_L \sim L$$

Assuming that the individual in question prefers more money to less,

- $R_L > 0$ if she is **risk averse relative to *L***
- $R_L = 0$ if she is **risk neutral relative to *L***
- $R_L < 0$ if she is **risk loving relative to *L***

The relationship between $\mathbb{E}[L]$, C_L and R_L:

$$C_L = E[L] - R_L$$

$$R_L = E[L] - C_L$$

$$\begin{pmatrix} \$0 & \$10,000 \\ \frac{1}{2} & \frac{1}{2} \end{pmatrix} \text{ vs } \$5,000$$

Note that if an individual

(1) prefers more money to less,

(2) is risk neutral relative to every money lottery,

(3) has transitive preferences,

then he ranks money lotteries according to their expected values, that is

$$L = \begin{pmatrix} \$0 & \$100 \\ \frac{1}{2} & \frac{1}{2} \end{pmatrix} \succ M = \begin{pmatrix} \$30 & \$60 \\ \frac{1}{2} & \frac{1}{2} \end{pmatrix}$$

$$E[L] = \frac{1}{2}0 + \frac{1}{2}100 = 50 \quad > \quad E[M] = \frac{1}{2}30 + \frac{1}{2}60 = 45$$

INSURANCE MARKETS

Consider an individual with

	W	initial wealth	
	L	potential loss	$0 < L \leq W$
given	p	probability of loss	$0 < p < 1$

With no insurance she faces the money lottery

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

no insurance

$$E[NI] = p(W-L) + (1-p)W = W - \underbrace{pL}_{\text{expected loss}}$$

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

$$E[\text{loss}] = pL$$

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

h	premium
d	deductible part of loss that is not covered
$L-d$	insured amount of the loss

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

$$N = \begin{pmatrix} W-h-d & W-h \\ p & 1-p \end{pmatrix}$$

- If $d = 0$ we call the contract a FULL-INSURANCE **contract**
- If $d > 0$ we call the contract a PARTIAL-INSURANCE **contract** $d \leq L$

With a full-insurance contract $(h, 0)$ the individual is guaranteed a sure wealth of $W-h$

$(h = pL, d = 0) \rightarrow$ guaranteed $W - pL$

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

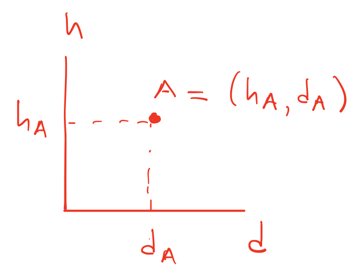
Yes for sure if risk averse

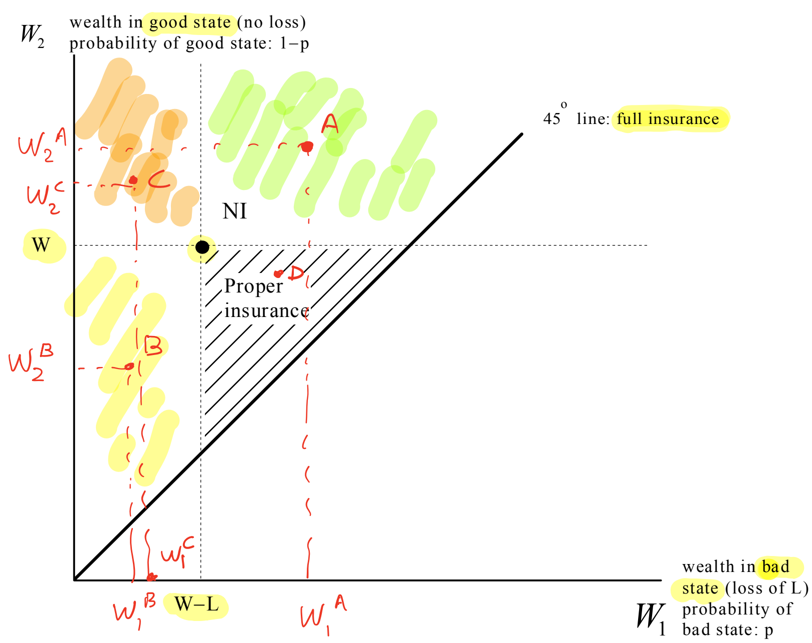
(indifferent if risk neutral, No if risk loving)

- If she is risk averse then

- If she is risk neutral then

- If she is risk loving then





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

$p = ?$

$W = 40{,}000$

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

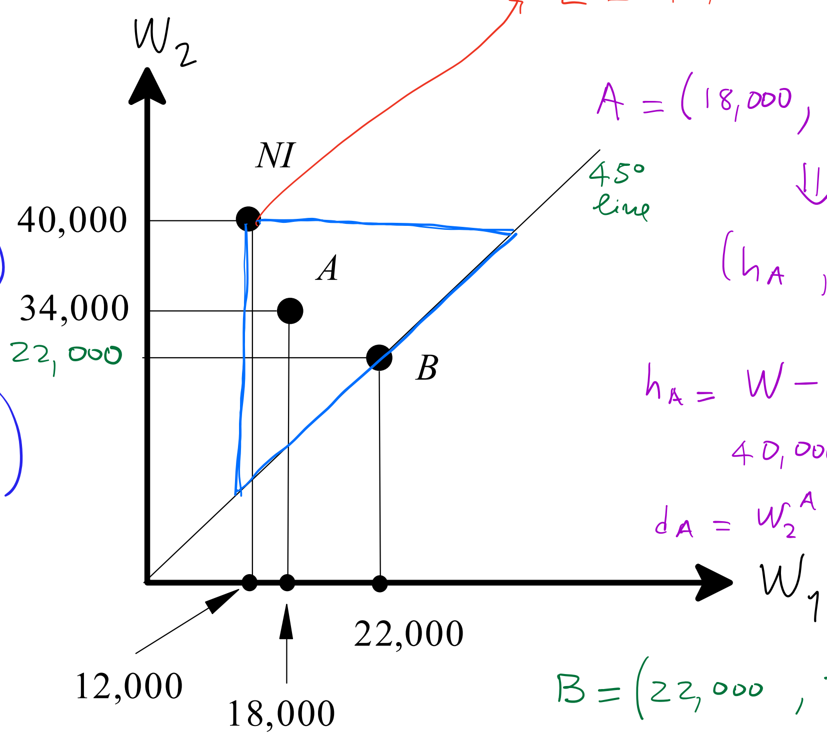
Compare

$$NI = \begin{pmatrix} 12{,}000 & 40{,}000 \\ p & 1-p \end{pmatrix}$$

to

$$A = \begin{pmatrix} 18{,}000 & 34{,}000 \\ p & 1-p \end{pmatrix}$$

$$B = \begin{pmatrix} 22{,}000 \\ 1 \end{pmatrix}$$



$A = (18{,}000,\ 34{,}000)$

$\Downarrow$

$(h_A,\ d_A) = (6{,}000,\ 16{,}000)$

$h_A = W - W_2^A =$

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

$d_A = W_2^A - W_1^A = 34{,}000 -$

$18{,}000 = 16{,}000$

$B = (22{,}000,\ 22{,}000)$

$d_B = 0$

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

$h_B = 40{,}000 - 22{,}000 = 18{,}000$

$(h_B = 18{,}000,\ d_B = 0)$

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: $\mathbb{E}[C] = p[h-(L-d)] + (1-p)h = h - p(L-d) = \underbrace{h - pL + pd}$

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

$$\pi(h,d) = h - p(L-d) = h - pL + pd$$

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