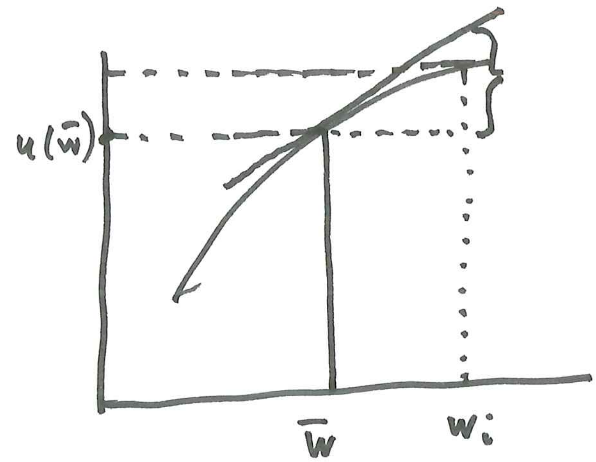
Formula for Cost of Risk.

w can be w_i with prob p_i ; $\bar{w} = E(w) = \sum p_i w_i$

$$u(w_i) \doteq u(\bar{w}) + u'(\bar{w})\cdot(w_i - \bar{w}) + \frac{1}{2}u''(\bar{w})\cdot(w_i-\bar{w})^2 + \cdots$$



$$\bar{u} = EU(w_i) = \sum p_i u(w_i)$$

$$\simeq \sum_{i=1}^{n} p_i u(\bar{w}) + \sum p_i u'(\bar{w})(w_i - \bar{w}) + \sum p_i \cdot \frac{1}{2}u''(\bar{w})(w_i-\bar{w})^2$$

$$\simeq u(\bar{w})\cdot \underbrace{\sum p_i}_{=1} + u'(\bar{w}) \underbrace{\sum p_i (w_i - \bar{w})}_{=0} + \frac{1}{2}u''(\bar{w})\sum p_i (w_i-\bar{w})^2$$

$$\simeq u(\bar{w}) + \frac{1}{2}u''(\bar{w})\cdot V(w)$$

$$C = \bar{w} - w_{CE}$$

$$w_{CE} = \bar{w} - C$$

$$u(w_{CE}) = u(\bar{w} - C)$$
$$= u(\bar{w}) + u'(\bar{w})\cdot(\bar{w} - C - \bar{w}) + \cdots$$

$$u(w_{CE}) \simeq u(\bar{w}) + u'(\bar{w}) \cdot (-c)$$
$$= u(\bar{w}) - c \cdot u'(\bar{w})$$

$$u(w_{CE}) = \bar{u} = EU(w_i)$$

$$\cancel{u(\bar{w})} + \frac{1}{2} u''(\bar{w}) \cdot V(w) \simeq \cancel{u(\bar{w})} - c \cdot u'(\bar{w})$$

$$c = -\frac{1}{2} \frac{u''(\bar{w})}{u'(\bar{w})} \cdot V(w)$$

$$= k \cdot V(w)$$

$$R_A = -\frac{u''(\bar{w})}{u'(\bar{w})}$$ degree of absolute risk aversion

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<u>Risk-pooling</u> : insurance, mutual funds

w . independent + identically distributed

$$nc_i = nkV(w)$$

$$c_i = k \cdot V(w)$$

$$c_i^p = k \cdot V\left(\frac{\Sigma w_i}{n}\right)$$
$$= \frac{k}{n^2} \cdot V(\Sigma w_i)$$

Total cost of risk:

$$TC_i^p = n \cdot c_i^p = n \cdot \frac{k}{n^2} \cdot V(\Sigma w_i) = \frac{k}{\cancel{n}} \cdot \cancel{n} V(w)$$

Risk-spreading : corporations, reinsurance

$$y$$

$$C = k \cdot V(y)$$

$$C_i = k\,V\left(\frac{y}{n}\right) = \frac{k}{n^2} V(y)$$

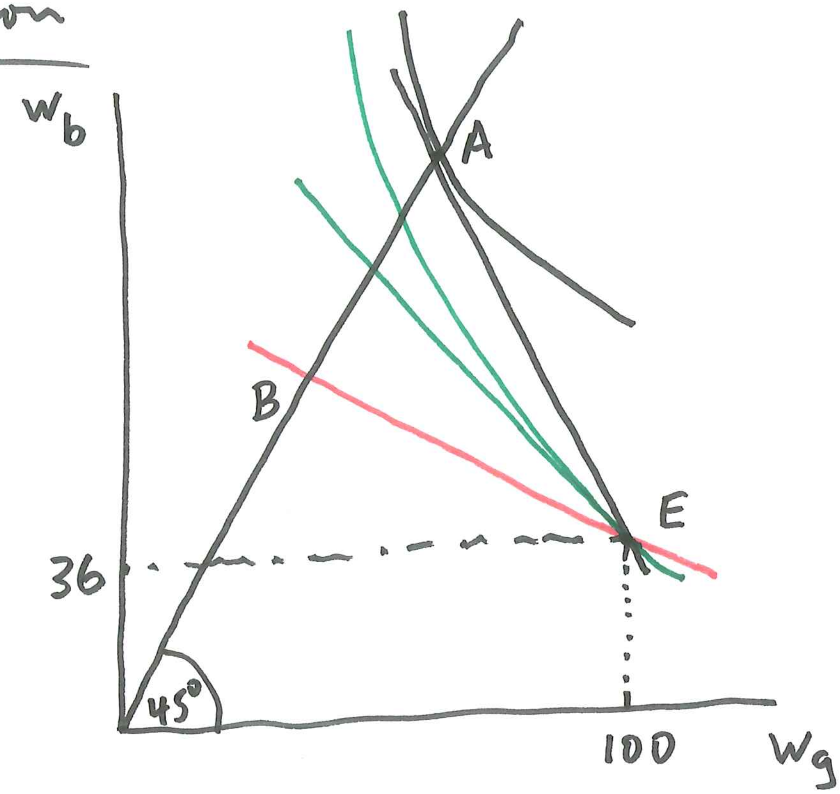
$$TC = \Sigma C_i = n \cdot \frac{k}{n^2} V(y) = \frac{k}{n} V(y)$$

$$\lim_{n \to \infty} TC = 0$$

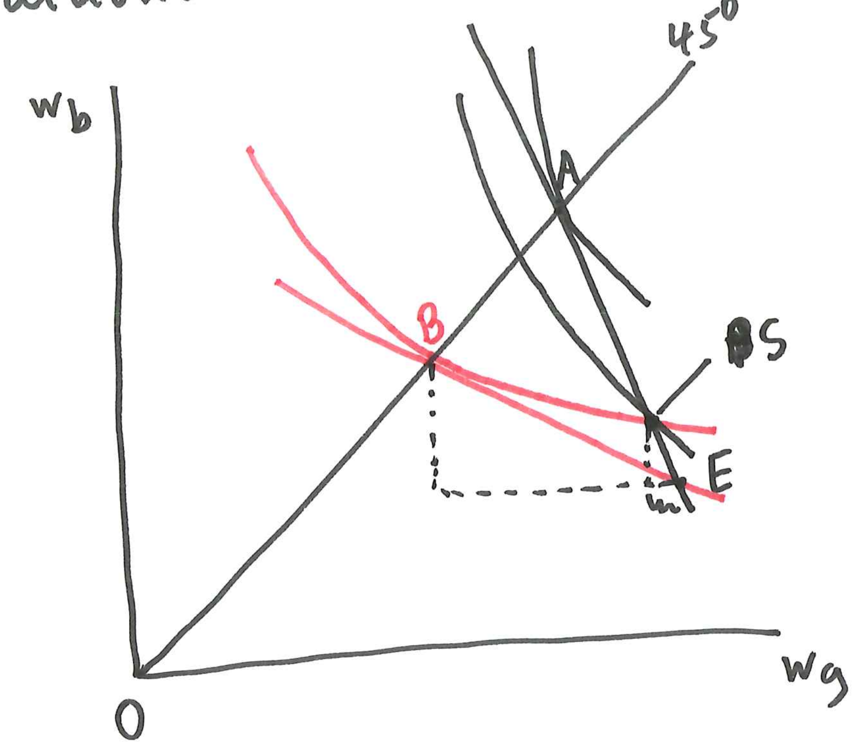
Problems with Market Solutions

1. Covariant risk
2. Asymmetric information.
   - Adverse Selection
   - Moral hazard.

Adverse Selection



Separating Equilibrium.



Moral hazard

Behavior changes with insurance

Health Care: