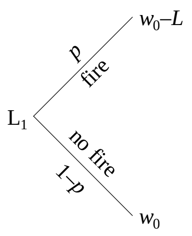
PUAF 8216 Microeconomics Section 3
Lab Summary 7
3 November 2000

1. Risk Pooling for two risk-averse individuals.

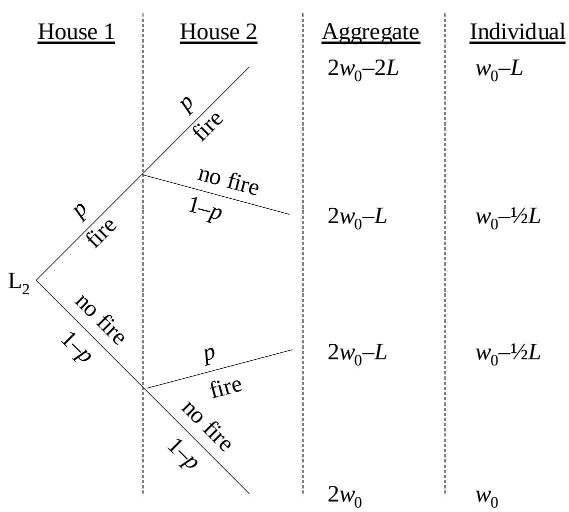
a. Suppose there exist 2 individuals, each with endowment w_0 (such as a house). Each faces a risk of a disaster (such as a fire) with probability p that they lose L wherein $L \le w_0$. Suppose further that these disasters are independent events; that is, that an occurrence of a disaster for one agent does not change the likelihood of an occurrence for the other.

b. Individual disaster probability tree:



Expected utility
$E\cdot U(L_1) = p\cdot U(w_0–L) + (1–p)\cdot U(w_0)$

c. Pooled disaster probability tree:



Expected utility
$E\cdot U(L_2) = p^2\cdot U(w_0–L) + p(1–p)\cdot U(w_0–½L) + (1–p)^2\cdot U(w_0)$

d. Proposition: If both individuals have *risk-averse* preferences, then they will prefer to insure each other because $E\cdot U(L_2) > E\cdot U(L_1)$.

e. Let us examine this example with some numbers.
Suppose w_0=100, L=36, p=½ and $U(w)=\sqrt{w}$.

$$E\cdot U(L_1) = \tfrac{1}{2}\cdot\sqrt{100-36} + \left(1-\tfrac{1}{2}\right)\sqrt{100} = 9$$
$$E\cdot U(L_2) = \left(\tfrac{1}{2}\right)^2\sqrt{100-36} + 2\left(\tfrac{1}{2}\right)\left(1-\tfrac{1}{2}\right)\sqrt{100-\tfrac{1}{2}\times 36} + \left(1-\tfrac{1}{2}\right)^2\sqrt{100} = 9.02 > 9$$

2. Risk Spreading is the example of the lottery ticket in lectures.

3. What are the differences between risk pooling and risk spreading?

	Risk Pooling	**Risk Spreading**
Principle	Multiple independent events with identical probabilities and payoffs Existence of "mixed state" wherein some individuals experience good states and some experience bad states	One event No "mixed states"
Good state	Payoff in good state is identical to not pooling	Payoff in good state is smaller than not spreading
Bad state	Payoff in bad state is identical to not pooling	Payoff in bad state is smaller than not spreading
Mixed state	Payoff in mixed state falls between good and bad states	Not applicable

4. Certainty Equivalent

a. Given a lottery L and utility function U.

b. If the expected utility, $E\cdot U(L) = p_1\cdot U(w_1) + p_2\cdot U(w_2) + p_3\cdot U(w_3) + p_4\cdot U(w_4) + \ldots$
Then certainty equivalent = $U^{-1}\ E\cdot U(L)$ wherein U^{-1} is the inverse function of U.

c. Some examples of inverse functions:
$U = \sqrt{w}$ then $w = U^2$
$U = \log w$ then $w = 10^U$
$U = \frac{1000}{w}$ then $w = \frac{1000}{U}$

d. Suppose L = (0.95, 0.05, 100, 64) and $U = \sqrt{w}$,

$E\cdot U(L) = 0.95\sqrt{100} + 0.05\sqrt{64}$ = 9.9
Certainty equivalent = 9.9^2 = 98.01