University of California, Berkeley Spring 2007
ECON 100A Section 115, 116

Insurance, Adverse Selection and Moral Hazard

I. Risk Premium

Risk Premium is the amount of money an individual is willing to pay to avoid a lottery. Remember lottery in our course represents any situation with risk.

Graph

Risk Premium is the horizontal difference between the expected utility from a bet and the utility function *at the same utility level*. See the graph below.

Mathematical formula

Let *r* be the risk premium, *r* can be found from the following formula:

$$E[U(X)] = U(E[X] - r)$$

If you are unfamiliar with expected utility refer back to section handout 4 "Choice under Uncertainty". Risk premium is positive for risk averse, zero for risk neutral and negative for risk loving individuals.

Example

$U(X) = \sqrt{X}$

Probability	Payoff
0.5	100
0.5	0

$$E[U(X)] = 0.5\sqrt{100} + 0.5\sqrt{0}$$
$$= 5$$
$$E[U(X)] = 0.5(100) + 0.5(0) = 50$$

So risk premium *r* is

$$5 = \sqrt{50 - r}$$
$$r = 25$$

In other words this individual is willing to pay half of her expected payoff to avoid the risk she is facing.

II. Insurance

Insurance is also about avoiding risk, with the key difference that there is the individual has an initial wealth. In general the situation would be in the form of

1. *Lottery*

Probability	Payoff
p	Initial wealth (good)
1 - p	Smaller than initial wealth (bad)

2. *Insurance policy*

   $1 premium pays $$I$ coverage if the bad situation happens, pays nothing otherwise.

A. Cost of Full Coverage

The cost of full coverage is

$$\frac{\text{Loss when Bad Situation Happens}}{I} = \frac{\text{Payoff in Good Situation - Payoff in Bad Situation}}{I}$$

With full coverage an individual always get the same payoff no matter what happens.

B. Maximum Willingness to Pay for Full Coverage

Graph

Maximum WTP for full coverage is the horizontal difference between initial wealth and the amount of wealth that gives the same level of utility as expected utility from lottery. See the graph below.

Mathematical formula

Let w be the initial wealth, the maximum willingness to pay for full coverage m is

$$E[U(X)] = U(w - m)$$

C. Fair Insurance

An insurance policy is fair if it satisfy

$$p \cdot 1 + (1 - p) \cdot (1 - I) = 0$$

Remember I is coverage per dollar. The left hand side of the equality is per-dollar expected profit of the insurance company; thus fair insurance is *the case when the insurance company is not making profit out of its insurance service*.

Example

$U(X) = \sqrt{X}$

Probability	Payoff
0.5	100 (initial wealth)
0.5	0

Insurance Policy: \$1 pays \$2

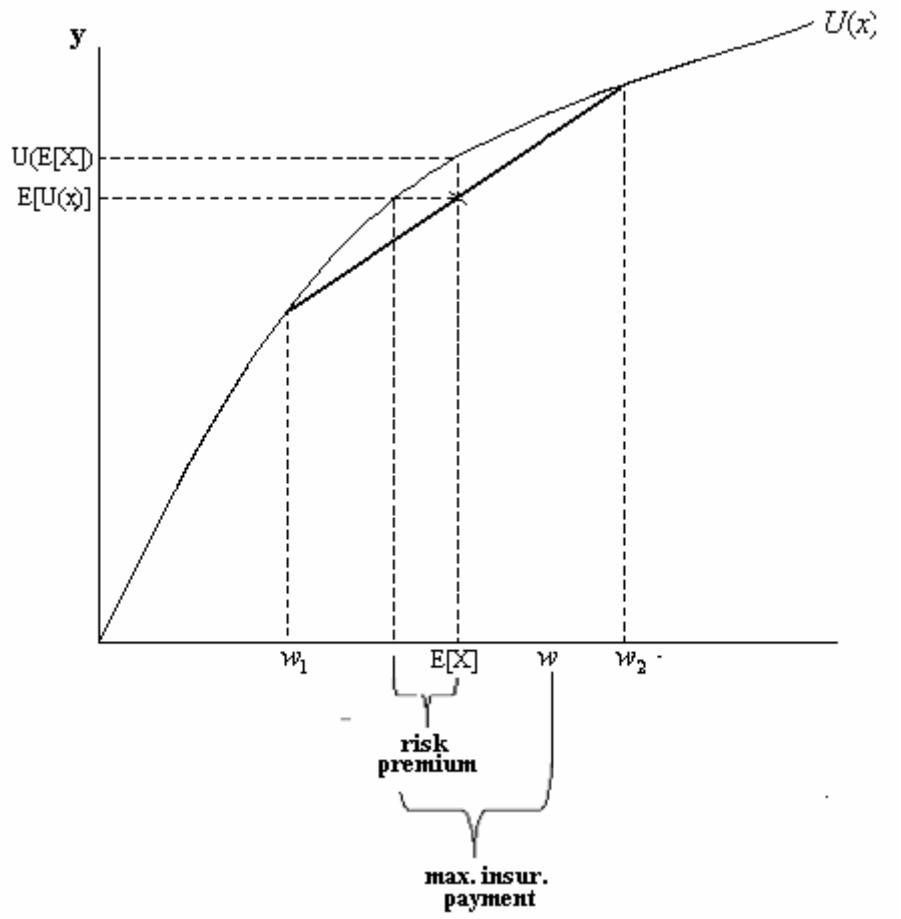
Full coverage costs (100 – 0)/2 = 50

Fair Insurance: 0.5(1) + 0.5(1 – 2) = 0 so insurance is fair

Maximum WTP for full coverage:

$5 = \sqrt{100 - m}$

$m = 75$



III. Adverse Selection

Adverse Selection refers to the situation where poor quality good drives out good quality ones due to the existence of *asymmetric information* among buyers and sellers. In some cases no trade occur at all.

Asymmetric information in our context is just saying that *sellers know more about their products than buyers do*.

Example

You are selling your good car which worth $90 to you and $100 to potential buyers. I am also selling my bad car which worth $50 to me and $60 to potential buyers.

Assumption: *Buyers cannot distinguish the two cars from each other before buying them.* Given this assumption, the maximum buyers are willing to pay for either car is their average value = ($100 + $60)/2 = $80

Since $80 < $90 = how much your car worth to you, you are not going to sell your good car; the result is the market is left with the bad car. This is inefficient because the potential buyers worth your car more than you do; trade would make both of you better off. This happens all because of the existence of asymmetric information. We call cases like this where socially beneficial trade fail to happen as *market failure*.

Notice that if my bad car worth $40 to potential buyers instead, no trade would ever occur because once buyers realize that only the bad car will be on the market, they would adjust their offer accordingly. Since I value my bad car more than the buyers there would be no trade. In this case there is no market at all.

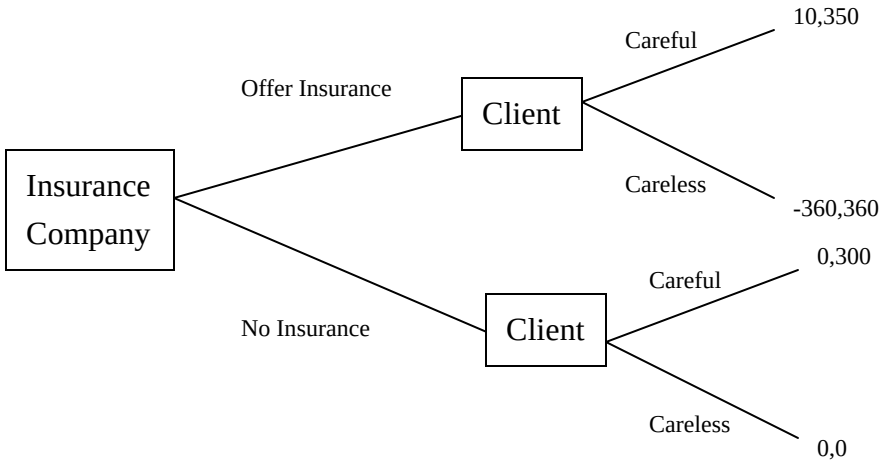
Solution: Better information. For example in buying used cars you can go to websites which tells you the history of the cars you have in mind.

In insurance context: You are a healthy/careful potential client while I am an unhealthy/careless one. Both you and the insurance company would like to setup a low premium insurance contact; this is no possible however if the insurance company cannot distinguish between us. As above if giving me coverage cost the insurance company more than what I value the coverage, there could be no insurance market at all.

Moral Hazard

Moral Hazard refers to the phenomenon that *an insurance client has incentive to be less careful once she obtained insurance.*

Consider the following extensive form game,



The idea behind the payoffs is

- If insurance company offers insurance and client is careful, insurance company gets profit and client gets coverage
- If insurance company offers insurance but client is careless, insurance company lose a lot of money in coverage. Client gets an even higher payoff because of the saving (in effort, money, etc.) from not being careful
- If insurance company offers no insurance it gets no profit and suffers no loss. Client gets no coverage and loses a lot if she is careless.

You should be able to recognize that the only Nash Equilibrium here is (No Insurance, Careful), which is Pareto inferior to (Offer Insurance, Careful). The problem is that once under coverage the client has incentive to not being careful, and the insurance company cannot observe the client's carefulness.

Solution: Better monitoring.