

Übungsblatt 4

- **4-1 State dependent utility functions**

We usually assume that individuals only suffer monetary losses, or at least that a monetary compensation for loss is possible. In real life, this often seems to be a rather heroic assumption. Being in hospital with a broken leg and having received a fair monetary compensation may not be as good as going skiing. Let us now consider state dependent utility functions which capture the idea that individuals may value things differently when in different states of the world.

a) Consider an individual with initial endowment W , probability π for loss L in state 2 and utility functions $u_1(y)$ and $u_2(y)$ for states 1 and 2 respectively. The individual can buy fair insurance for a premium rate $p = \pi$, and for any income level she derives a higher marginal utility from this income in state 1 than in state 2, i. e. $u'_1(y) > u'_2(y)$. Calculate the slope of the individual's expected utility indifference curve where it crosses the security line. Compare this slope to the slope of the insurance line. What does this mean for the optimal demand for insurance? Draw your result in a two-states-of-the-world-diagram.

b) Now, suppose that the individual's utility functions are state dependent with $u_2(y) = a + bu_1(y)$, with $a < 0$ and $b > 0$. Insurance cover is available at a rate p . What is the effect on the demand for insurance of increases in a and b ? Under what circumstances will full cover be bought even though $p > \pi$?

- **4-2 Incomplete markets: background risk**

Consider a farmer who faces with probability π an insurable risk to suffer a loss L from a certain wheat disease. In addition he is confronted with the uninsurable risk of losing D with probability τ because of hurricanes, which regularly severely damage the whole country. The four possible states of the world, i. e. no loss at all, a loss of D , a loss of L , and a loss of $L + D$, occur with probabilities f_i , $i \in \{1, 2, 3, 4\}$. Insurance against L is available at rate p .

a) What is the farmer's income y_i in the four possible states of the world? How do π and τ depend on f_i ? Derive the First Order Condition of the farmer's maximization problem with respect to cover C against L , s. t. $C \geq 0$ (Kuhn-Tucker!). Can the situation with a missing insurance market make the individual better off compared to a full set of insurance markets with fair premia?

b) Suppose that L and D are perfectly negatively correlated, but $L > D$. The premium rate for insurance purchase is now $p = \pi$. Show that the perfect negative correlation provides a partial hedge against the larger insurable loss.

c) Consider the effect of a “small” uninsurable risk on the demand for insurance against the other risk: Suppose that initially $D = 0$, and that there is a premium rate $p \geq \pi$ for cover against L . Assume that initially, even if the premium rate is unfair, the individual buys some positive amount of cover. (What does this mean for the FOC derived above?) Show that the effect of introducing a small uninsurable risk on the demand for insurance against the insurable risk depends on the risk aversion of the insured and the correlation of the insurable and uninsurable risks. What is your answer if the initial premium rate for cover against L is actuarially fair? (Hint: Use the FOC and its partial derivative with respect to D at $D = 0$ for your analysis.)

• 4-3 Limited liability

Consider a society which consists of three individuals with utility functions $u(y) = \ln(y)$, $v(y) = \sqrt{y}$, $w(y) = -e^{-0.5y}$. Each of them has an initial endowment of $W = 10$ and suffers from a disease with probability $\pi = 0.5$. In case she gets sick, each person has to cover treatment costs $T = 8$. The individuals can buy fair insurance cover against the treatment costs.

The government, though, considers $\underline{W} = 4$ as the minimum income that a person should have in each state of the world. Thus, the government covers the gap between \underline{W} and any lower income (Do not consider the question how the government finances this minimum income.).

a) Are the individuals going to buy insurance cover? How big is the expected cost to society from providing a minimum income level?

b) Now the government decides to make insurance compulsory. Argue whether this is welfare improving for each individual. Is there scope for a Pareto improvement for society as a whole? Calculate the compensating payments that would be necessary for each individual such that they are not made worse off by compulsory insurance. Compare the sum of these payments to the expected costs from providing a minimum income. What would your answer be if all individuals were risk neutral?

c) Illustrate your answers in a two-states-of-the-world diagram.

d) Do you think that health insurance - or at least insurance against certain treatments - should be compulsory for reasons of limited liability?