

**UNIVERSITÄT KONSTANZ****Insurance Management**

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Professor Schlesinger

KLAUSUR

Answer **any 5** of the following 6 questions. Answers may be written in German or in English. Each question answered is worth 20 points (100 points in total). To get full credit you must show how you derive your answers. You need to earn at least 50 points to pass the course. Note that I will not grade all 6 questions, so only answer 5. **Please write neatly.**

YOU MUST TURN IN THIS QUESTION SHEET WITH YOUR EXAM!

Use the following abbreviated mortality table to answer question 1.

Age	Probability of Dying	Number of People	Number of Deaths
70	0.03951	627,416	24,789
71	0.04330	602,627	26,094
72	0.04765	576,533	27,472
73	0.05264	549,061	28,903
74	0.05819	520,159	30,268

1. Binfast Tot just turned 71 years old and wishes to purchase a three-year term life insurance policy. This policy pays €100,000 if death occurs during the three year term of the policy. Any premium is paid at the beginning of the year, and death benefits are paid out at the end of the year of death. Assume that the interest rate for borrowing and lending is 5%. Further assume that there is a premium loading of 20% (i.e. $\lambda = 0.2$).

- Determine the single premium that Mr. Tot would be charged for such a policy.
- Determine the level premium that Mr. Tot would be charged for such a policy.
- Is the insurer's expected profit higher with the premiums given in part (a) or part (b)? Explain.

2. A risk-averse art collector owns two original Picasso paintings (painted by Joachim Picasso, no relation to Pablo). Each painting is worth €40 and each has a probability $p = \frac{1}{4}$ of being stolen. Because the paintings are kept at different locations, these risks are independent from one another. Upper-limit insurance is available at a fair price, but the level of insurance is limited to a total insurance premium of €10.

- Suppose that the collector must purchase a separate policy for each painting, with upper limits of θ_1 and θ_2 respectively. Each policy pays indemnity $I(x_i) = \min(x_i, \theta_i)$, where x_i is the amount of loss for painting i , $i = 1, 2$. Show that spending an equal insurance premium of €5 per painting is optimal.
- Suppose that the collector is allowed to use her €10 to purchase one policy for both paintings, with an upper limit of θ . Determine the level of the upper limit θ that she can purchase and show whether or not one upper limit policy is preferred to the two separate upper-limit policies.

3. Consider the adverse-selection model of Rothschild and Stiglitz and suppose that there are an equal number of good risks and bad risks. Under the pair of separating contracts that determines a Rothschild-Stiglitz separating equilibrium, the good risks would receive 30% coverage. At a fair pooling price, the optimal level of insurance coverage for the good risks would pay for 70% of the loss. Now suppose that the good risks are indifferent between these two contracts: 70% coverage at the fair pooling price and 30% coverage at the fair good-risk price. Consider the following two potential markets:

- all insurers offer only the Rothschild-Stiglitz pair of separating contracts.
- all insurers offer only pooling contracts for 70% coverage at a fair price.

- Can either (i) or (ii) define the Rothschild-Stiglitz equilibrium for this market? Explain fully.
- Can either (i) or (ii) define the Wilson equilibrium for this market? Explain fully.

4. Mr. Meslbeisl has €100,000 in cash plus his new car, an Audi A4 worth €25,000. Thus, Mr. Meslbeisl's total wealth is €125,000. His preferences are represented by the utility function $u(w) = \sqrt{w}$. Coinsurance is available at all levels for a premium that equals the expected losses, plus a loading equal to 15% of the expected losses ($\lambda = 0.15$). He currently owns an insurance policy that pays for 75% of any damages to his car. Suppose that Mr. Meslbeisl receives a cash gift of €20,000, making his total wealth €145,000.

(a) Assuming that he keeps the same car, will Mr. Meslbeisl desire a coinsurance level of the original 75% after receiving his cash gift? Or will he wish to change his level of coinsurance to something higher or lower than 75%? Explain carefully.

(b) Suppose that, in addition to the €20,000 cash gift, Mr. Meslbeisl also receives a gift of a new sport-performance system for his car worth €5000. After installing the new performance equipment, his car has a value of €30,000. Thus, his total wealth now consists of €120,000 in cash plus the €30,000 auto. This causes him to revise his insurance policy. Will he desire a coinsurance level of 75%? Or will he wish to change his level of coinsurance to something higher or lower than 75%? Explain carefully.

(c) If the premium loading is changed from 15% to 20% ($\lambda = 0.2$), would Mr. Meslbeisl buy more insurance or less insurance than in part (a)? Either explain why he would buy more or less insurance, or explain what additional information you would need in order to determine an answer to this question.

5. (a) Write out the first-order condition for choosing the optimal level of deductibility for an insurance policy. Assume that there is a positive premium loading $\lambda > 0$.

(b) Show that an increase in risk aversion for the consumer in part (a) will cause her to choose a lower deductible, *ceteris paribus*.

6. Suppose that losses have a uniform distribution on the interval $[0,100]$. Thus, the density function is $f(x) = 0.01$ for $0 \leq x \leq 100$ and $f(x) = 0$ elsewhere.

Insurance is available with an insurance premium loading of $\lambda = 0.2$. Suppose you want to spend €48 on insurance.

(a) If there is co-insurance available, what level of co-insurance can you purchase for €48?

(b) If there is deductible insurance available, what level of deductibility can you purchase for €48?

(c) Prove that every risk averter would prefer the deductible insurance policy in (b) to the coinsurance policy in (a).

Checklist before turning in your exam:

-- PLEASE PUT YOUR MATRIKEL-NUMBER ON THE FIRST PAGE

-- CHECK TO BE SURE THAT YOU ANSWERED 5 (AND ONLY 5) QUESTIONS

-- DO NOT FORGET TO INCLUDE ALL OF THE PAGES WITH YOUR ANSWERS

-- REMEMBER TO TURN IN THIS QUESTION SHEET WITH YOUR EXAM