# Baylor University
# Hankamer School of Business
# Department of Finance, Insurance & Real Estate

Risk Management
Dr. Garven
Problem Set 5

Name: SOLUTIONS

Assume that interest rates are zero and there is only one period. You have initial wealth of $50,000, $U(W) = \sqrt{W}$, and your terminal wealth is subject to the following loss distribution:

| **Loss Amount** | **Probability** |
|---|---|
| $0 | 0.60 |
| $5000 | 0.25 |
| $50,000 | 0.15 |

A. Determine the actuarially fair price for full insurance coverage.

SOLUTION: The actuarially fair price for full insurance coverage corresponds in this case to the expected value of loss:

$$E(L) = .6(0) + .25(5000) + .15(50{,}000) = \$8{,}750.$$

B. Determine the actuarially fair price for a policy with a deductible of $10,000.

SOLUTION: In this case, since the state-contingent value of the insurance indemnity is $I_s = \max(0, L_s - d)$, the actuarially fair price corresponds to the expected value of the insurance indemnity, which is $E(I) = E(\max(0, L_s - d)) = .15(\$40,000) = \$6,000$.

C. Suppose the premium loading on a full insurance coverage contract is 30%, and that the deductible policy has a premium loading of 40%. Which contract do you prefer?

SOLUTION: With a 30% loading, the full insurance coverage contract costs $8,750(1.3) = $11,375, and the deductible policy costs $6,000(1.4) = $8,400. With full insurance, state contingent wealth is the same regardless of which state of the world occurs; consequently, $W_s$= $50,000 - $11,375 = $38,625 for all states, and expected utility is $E(U(W)) = \sqrt{38,625}$= 196.53.

For the deductible policy, we must compute state contingent wealth $W_s$ for all three states of the world. Here, $W_s = W_s - P_i - (L_s - \max(0, L_s - d))$; i.e., state contingent wealth equals initial wealth less the insurance premium on the deductible policy less the uninsured loss. The following table shows the details behind these calculations:

| $p_s$ | $L_s$ | max($L_s$- $d$,0) | $L_s$ -max($L_s$- $d$,0) | $W_s$ | $U(W_s)$ |
|---|---|---|---|---|---|
| 60% | $0 | $0 | $0 | $41,600 | 203.96 |
| 25% | $5,000 | $0 | $5,000 | $36,600 | 191.31 |
| 15% | $50,000 | $40,000 | $10,000 | $31,600 | 177.76 |
| Expected Value | $8,750 | $6,000 | $2,750 | $38,850 | 196.87 |

Since $E(U(W))$= 196.53 for full insurance and 196.87 for deductible insurance, I prefer deductible insurance.

D. If full insurance was the only option available, what is the maximum insurance premium that you would be willing to pay for such a policy?

SOLUTION: To determine this, we must find the certainty equivalent of wealth. To find the certainty equivalent of wealth, we need to calculate the expected utility of wealth associated with being uninsured.

- $E(U(W)) = .6(50{,}000^{.5}) + .25(45{,}000^{.5}) = .6(223.6068) + .25(212.1320) = 187.20$.
- $W_{CE} = 187.20^2 = \$35{,}042.75$

Therefore, the maximum amount that this consumer would be willing to pay in order to fully insure this risk is equal to $W_0 - W_{CE} = \$50,000 - \$35,042.75 = \$14,957.25$.