

ECON 612: MONEY AND BANKING
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FALL 2023

EXAMPLE 7.6*
SOLUTIONS AND EXPLANATIONS

COLOR LEGEND

- ⌘ HEADINGS
- ⌘ GIVEN/PREVIOUSLY FOUND INFORMATION
- ⌘ CONCEPTS YOU SHOULD ALREADY KNOW
- ⌘ ANSWER
- ⌘ ANNOTATIONS AND EXTRA EXPLANATIONS

* A COPY OF THE PROBLEMS IS ATTACHED AT THE END OF THIS DOCUMENT. THERE MAY BE SOME DIFFERENCES BETWEEN THIS VERSION AND THE ONE AVAILABLE ON CANVAS.

GIVEN INFORMATION

$L = \$100$ THIS IS THE LOAN AMOUNT.

$S = \$300$ THIS IS THE SUCCESSFUL STATE OF THE PROJECT.

$F = \$0$ THIS IS THE UNSUCCESSFUL / "FAILURE" STATE OF THE PROJECT.

$P(S|H) = 0.8$ THIS IS THE PROBABILITY OF SUCCESS GIVEN THE BORROWER CHOOSES HIGH EFFORT.
 $\Rightarrow P(F|H) = 0.2$ THIS IS GIVEN IMPLICITLY SINCE $P(F|H) = 1 - P(S|H)$.

$P(S|L) = 0.6$ THIS IS THE PROBABILITY OF SUCCESS GIVEN THE BORROWER CHOOSES LOW EFFORT.
 $\Rightarrow P(F|L) = 0.4$ THIS IS GIVEN IMPLICITLY SINCE $P(F|L) = 1 - P(S|L)$.

$C(H) = \$40$ THIS IS THE COST OF HIGH EFFORT.

$i = 0.10$ THIS IS THE RISKLESS RATE.

$0.90C$ TO THE BANK THIS IS THE VALUE OF COLLATERAL.

1 DEFINING ICC(H)

$$ICC(H) : OT(H)|H \geq OT(H)|L \quad "OT" \text{ MEANS OUTCOME.}$$

$$P(S|H)(S-R) + P(F|H)(F-C) - C(H) \geq P(S|L)(S-R) + P(F|L)(F-C)$$

$$ICC(H) : 0.8(300-R) + 0.2(0-C) - 40 \geq 0.6(300-R) + 0.4(0-C)$$

2 FINDING C

$$0.8(300-R) + 0.2(0-C) - 40 = 0.6(300-R) + 0.4(0-C)$$

$$240 - 0.8R - 0.2C - 40 = 180 - 0.6R - 0.4C$$

$$C = R - 100$$

FINDING R^*

$$OT(H) : P(S|H)R + P(F|H)C = (1+i)L$$

$$0.8R + 0.2(0.90C) = (1+0.10)(100)$$

$$0.8R + 0.2[0.90(R-100)] = 110$$

$$0.8R + 0.18R - 18 = 110$$

$$R^* = 130.6122\dots$$

$$R^* = \$130.61$$

FINDING C^*

$$C = R - 100$$

$$C = 130.6122\dots - 100$$

$$C^* = 30.6122\dots$$

$$C^* = \$30.61$$

Moral Hazard of Effort

Example 7.6

Mr. John Beige would like to borrow \$100 from your bank to invest in a project that will pay off one period from now. This project is risky and its payoff depends on Mr. Beige's effort in managing it. If the project is successful, it pays off \$300, but if it's unsuccessful, it pays nothing. Mr. Beige can choose two levels of effort: high or low. If he chooses high effort levels, the probability that the project is 0.8 and 0.6 for the high and low effort levels, respectively. The cost of high effort is \$40. The riskless interest rate is 10%, and the use of collateral is costly since, for every \$1 of collateral, the bank values it at \$0.90. Assume that you cannot observe Mr. Beige's effort.

- (1) Write the binding ICC so that Mr. Beige will choose high effort.
- (2) Using the zero-profit condition and ICC from (1), find the optimal level of repayments and collateral the bank will ask for in its loan contract.