

# ECO202

## Practice Problems III: Risk

March 26, 2019

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Q1. 1. A painting is for sale at \$100. If it is authentic, you can resell it at \$300. But there is a 50% chance it is a fake. If the painting is a fake, you have to throw it away. Your utility function for money is given as  $U(Y) = (500+Y)^2$ . Should you buy the painting?

Q2. Your friend offers you a coin-toss gamble. If heads, you get \$150. If tails, you lose \$20. Your utility function for income  $Y$  is  $U(Y) = (100 + Y)^{1/3}$ . Should you take the gamble? If another friend offers you \$5 to let him take gamble, should you take the certain \$5 instead of the gamble?

Q3. Farmer Brown grows wheat. He knows rainfall patterns are highly productive (HP) 20% of the time, moderately productive (MP) 50% of the time, and not productive (NP) 30% of the time. Wheat yields are \$50,000 with HP weather, \$30,000 with MP weather, and \$20,000 with NP weather. What is the expected yield from growing wheat? If Farmer Brown would rather lease out his farm each year for \$30,000 is he risk-averse or risk-loving?

A1. A painting is for sale at \$100. If it is authentic, you can resell it at \$300. But there is a 50% chance it is a fake. If the painting is a fake, you have to throw it away. Your utility function for money is given as  $U(Y) = (500+Y)^2$ . Should you buy the painting?

If you buy the painting:

$$E(U_{buy}) = 0.5 \times U(real) + 0.5 \times U(fake)$$

$$U(real) = (500 - 100 + 300)^2 = 490,000$$

$$U(fake) = (500 - 100)^2 = 160,000$$

$$E(U_{buy}) = 325,000$$

If you do not buy the painting:

$$E(U_{notbuy}) = 1 \times U(notbuy)$$

$$U(notbuy) = (500)^2 = 250,000$$

As  $E(U_{buy}) > E(U_{notbuy})$ , then you should **buy the painting**

2. Your friend offers you a coin-toss gamble. If heads, you get \$60. If tails, you lose \$20. Your utility function for income Y is  $U(Y) = (100 + Y)^{1/3}$ . Should you take the gamble? If another friend offers you \$5 to let him take gamble, should you take the certain \$5 instead of the gamble?

$$\begin{aligned} E(U_{gamble}) &= 0.5(100 + 60)^{1/3} + 0.5(100 - 20)^{1/3} \\ &= 2.2 + 2.7 \\ &= 4.9 \end{aligned}$$

$$\begin{aligned} E(U_{nogamble}) &= (100)^{1/3} \\ &= 4.6 \end{aligned}$$

You should take the gamble

$$\text{Certainty equivalent} = (105)^{1/3} = 4.7$$

You should not let your friend take the gamble because the gamble has a higher utility than the certainty equivalent.

3. Farmer Brown grows wheat. He knows rainfall patterns are highly productive (HP) 20% of the time, moderately productive (MP) 50% of the time, and not productive (NP) 30% of the time. Wheat yields are \$50,000 with HP weather, \$30,000 with MP weather, and \$20,000 with NP weather.

What is the expected yield from growing wheat? If Farmer Brown would rather lease out his farm each year for \$30,000 is he risk-averse or risk-loving?

The expected value is:

$$E(V) = 0.2(\$50,000) + 0.5(\$30,000) + 0.3(\$20,000) = \$31,000$$

If Farmer Brown chooses the certain \$30,000 option he must be risk-averse because the utility of the \$31,000 must be lower.