Risk and expected utility

Assume an individual who must decide whether to commit a crime or join the labor market. If they join the labor market, the individual receives R; if they commit the crime, there are two possible outcomes: successfully robbing and obtaining 200 or being caught by the police and receiving 0. The probability of each situation is 0.5. The individual has the following utility function: $u = x^2$.

1. Is this individual risk-averse, risk-neutral, or risk-loving? What does this mean?
2. If $R = 100$, what does the individual prefer, to go out to rob or to join the labor market?
3. Suppose the state offers a bonus to individuals with a salary of $R = 100$. How much should this bonus be for the individual to decide to join the labor market instead of robbing?
4. Going back to the situation where $R = 100$, suppose the mayor decides to fight crime by increasing police presence. The mayor has the following utility: $u = x$. If the individual decides to rob, the mayor faces the following expected utility: $u = -200 * 0.5 + 0 * 0.5$, where 0.5 is the probability of the individual being caught. If the individual does not rob, the mayor receives: $u = -w$, where w is the cost of increasing police presence. If the mayor can increase the probability of the individual being caught to 0.80 at a cost of $w = 50$, is it advisable to do so? Justify.

Solution

1. We calculate the expected utility of each situation:

$$0.5 * 200^2 + 0.5 * 0^2 = 20000$$

While if they join the labor market:

$$100^2 = 10000$$

Therefore, they prefer to go out to rob.

2. We solve for:

$$(x + 100)^2 \geq 20000$$

$$x \geq 41.42$$

With a bonus of 41.42, the individual is indifferent between going out to rob and joining the labor market. Any amount above this would make the individual decide to join the labor market.

3. We calculate the minimum probability of being caught required for the individual to decide to join the labor market:

$$(1 - p) * 200^2 + (p) * 0^2 \leq 10000$$

$$40000 - 40000p \leq 10000$$

$$0.75 \leq p$$

Therefore, if $p = 0.8$, the individual decides not to rob and the mayor would have a utility of $u = -50$, which is better than the situation in which the individual decides to rob, receiving $u = -200 * 0.5 = -100$.