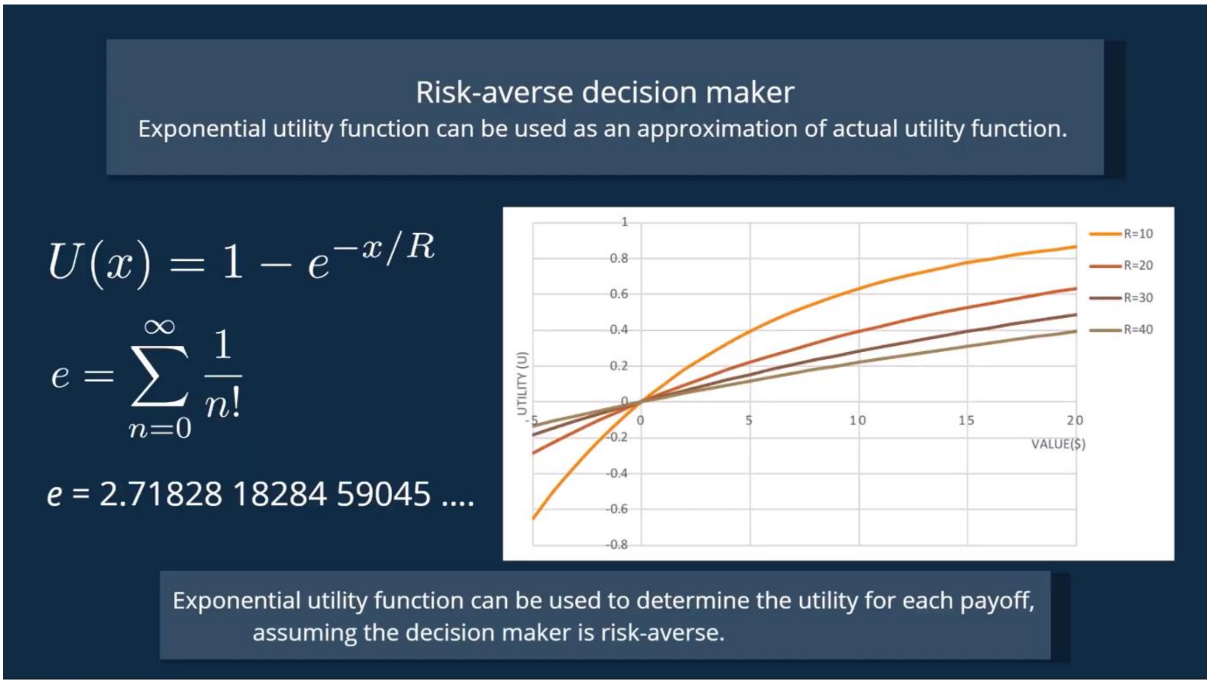
M4L18. Utility Function and Risk Tolerance

Slide #1

In this topic, we will relate the utility function to the risk propensity of managers.

Slide #2



If a decision maker is risk averse, the exponential utility function can be used as an approximation of the decision maker's actual utility function. The general form of the exponential utility function is u of x equals 1 minus e to the power of negative x over R.

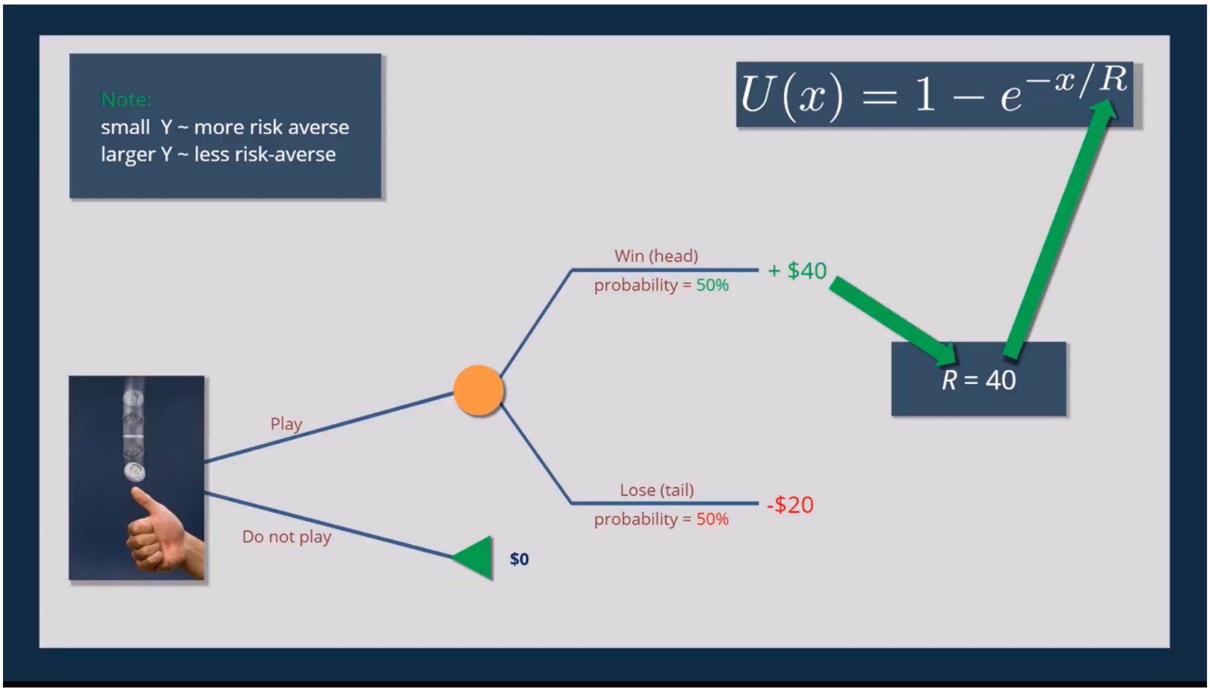
In this formula, E is the base of the natural logarithms and R is a parameter that controls the shape of the utility function according to the decision maker's risk tolerance profile. The figure shows examples of the graph of this function for several values of R. Note that as R increases, the shape of the utility curve becomes flatter or less risk averse.

As x becomes large, u of x approaches 1.

When x equals 0, then u of x equals 0. And if x is less than 0, then u of x is less than 0.

In a complicated decision problem, with numerous possible payoff values, the exponential utility function can be used to determine the utility for each payoff, assuming the decision maker is risk-averse.

Slide #3



To use the exponential utility function, we must determine a reasonable value for the risk tolerance parameter R.

A method for doing so involves determining the maximum value of Y for which the decision maker is willing to participate in a game of chance with the following possible outcomes, win Y money with probability of 50% or lose Y over 2 money with the same probability 50%.

So, this is a 50-50 chance game.

The maximum value of Y for which the decision maker would accept this gamble should give us a reasonable estimate of R.

This is a very simple estimation of R.

We can use this estimation, this game, to do a survey with our managers to get their approximation of R.

Note that a decision maker who is willing to accept this gamble only at a small value of Y is more risk averse, while a decision maker who is willing to pay a larger value of Y is less risk averse.

For instance, if a person's maximum acceptable value is 10, which means this person is willing to take the gamble with a 50 50 chance.

If the payoff winning is 10 and the cost of losing is 5, then his risk tolerance parameter R is 10.

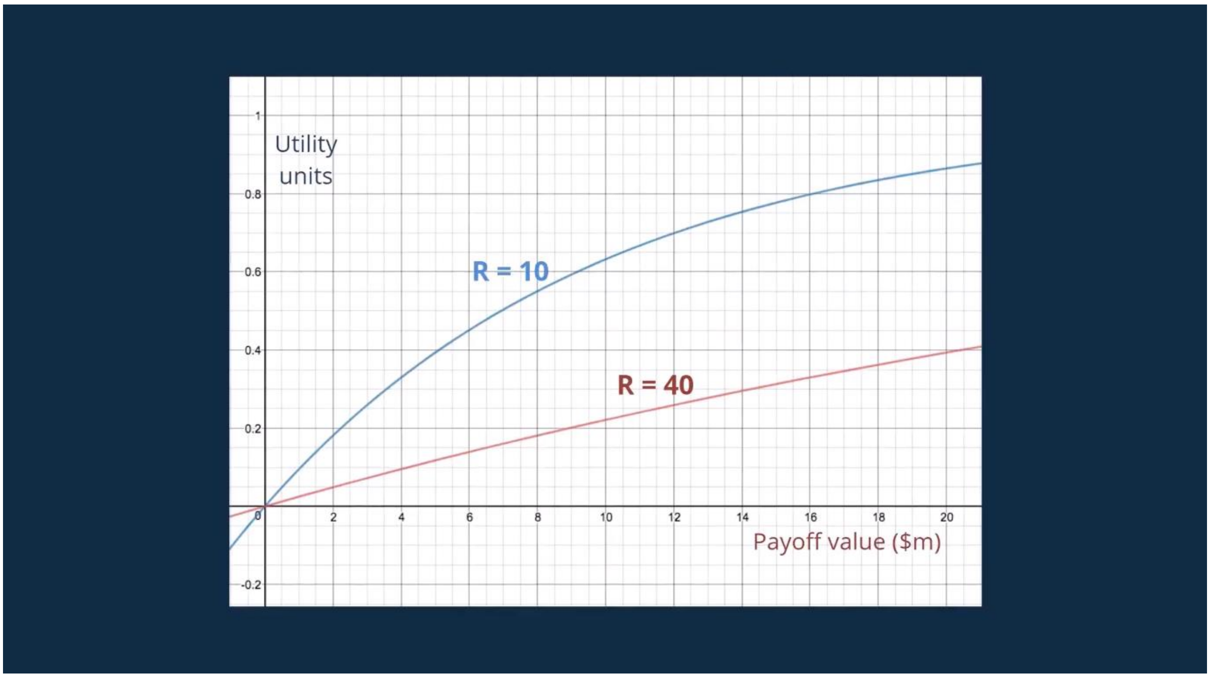
If another person's maximum acceptable value is 40, Which means this person is willing to gamble if the payoff of winning is 40 and the cost of losing is half of it.

His risk tolerance parameter R is 40.

The second person is less risk averse than the first whose risk tolerance parameter is only 10.

The second person is more willing to take risky actions, while the first person is more likely to choose an action with much lower certain payoff.

Slide #4



This corresponds well with the relationship between the utility curves and the values of R shown in the chart.