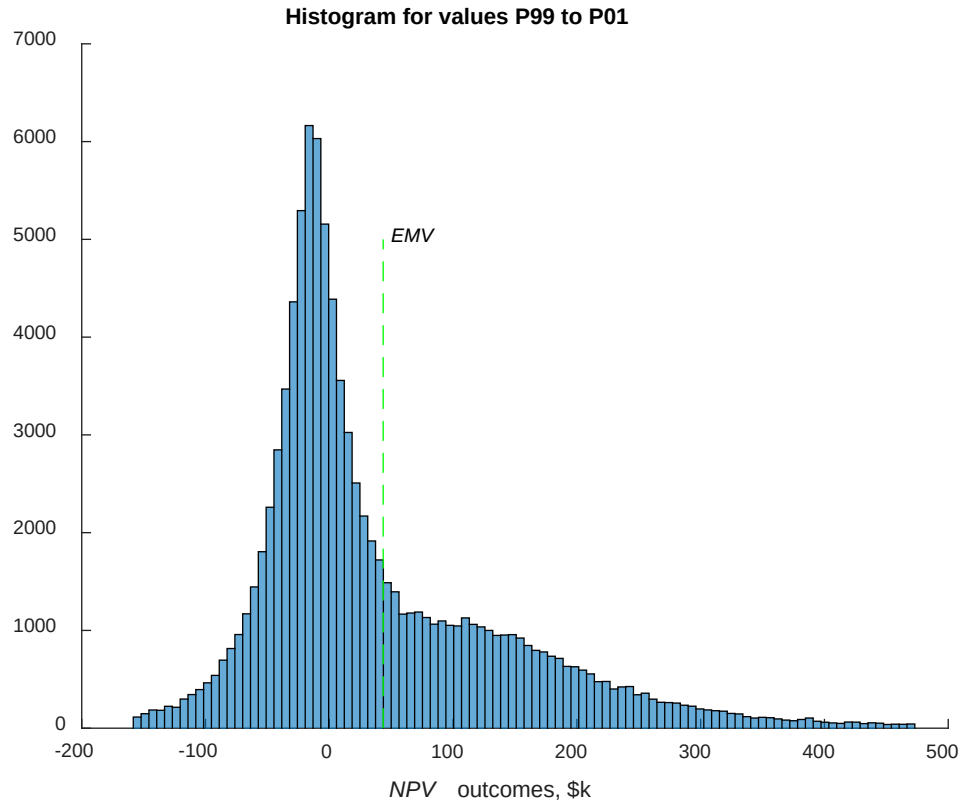
Utility Elicitation Questions II

Determining *r*'s from *CE*s of Non-Standard Continuous Distributions

The Utility Elicitation Program (UEP) presently offers binary risks. This document presents two additional calculation examples with continuous distributions. Please send your comments and suggestions to john@maxvalue.com.

Question 3. Complex distribution from a project feasibility analysis.

Consider an uncertain asset or venture that you can purchase or already own. Your project model produced this distribution of net present value (*NPV*) outcome:



The project scale is compatible for a decision maker whose typical maximum investment is $50k. For a corporate decision maker, these values should perhaps be millions. You may relabel the currency and factor the numbers so that the outcome amounts are important to you.

A 100k-trial Monte Carlo simulation produced *NPV* values ranging from -$1049k to 3782k.

The histogram shows a 98% confidence interval for *NPV*, ranging from -$158k to 473k.

EMV = $43.5 ± 0.40k

There has a .53 chance of an *NPV* gain. The average success *NPV* is $116k, and the average failure *NPV* is -$39k.

What is your *certain equivalent* (*CE*) for this distribution? Consider this from either a buy or sell perspective:

- What is the most you would be willing to pay to acquire this project or asset?
- Or, if you already own it, what is the smallest amount for which you would be willing to sell?

Your *CE* might be *negative*. This would be the case if someone would need to pay you to take the project. Of, if you already hold the project, your *CE* is the amount you would be willing to pay someone to take it away.

Consider your answer *CE* answer carefully. The next page lets you find the risk tolerance coefficient (*r*) corresponding to your *CE* answer.

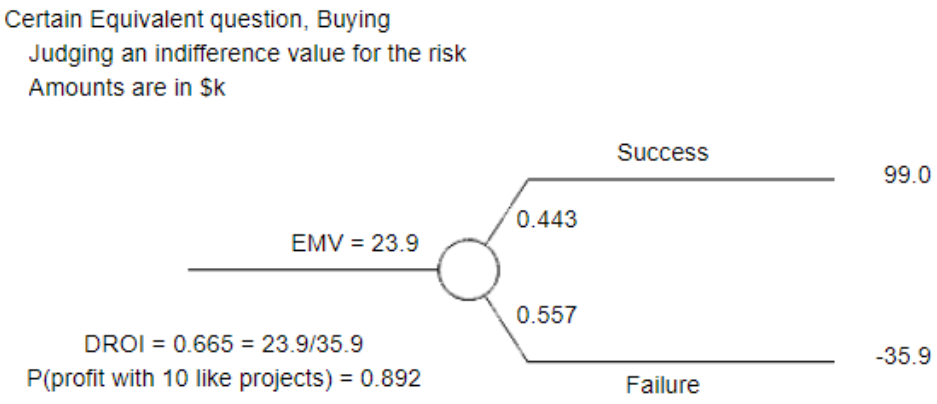
Utility Elicitation Program (UEP) presently generates questions only in binary form, such as:

Suppose you have an investment opportunity or project.
NPV of success = 99.0 $k
NPV of failure = -35.9 $k
EMV = 23.9$k with Ps = 0.443

DROI = 0.665 = 23.9/35.9

P(profit with 10 like projects) = 0.892

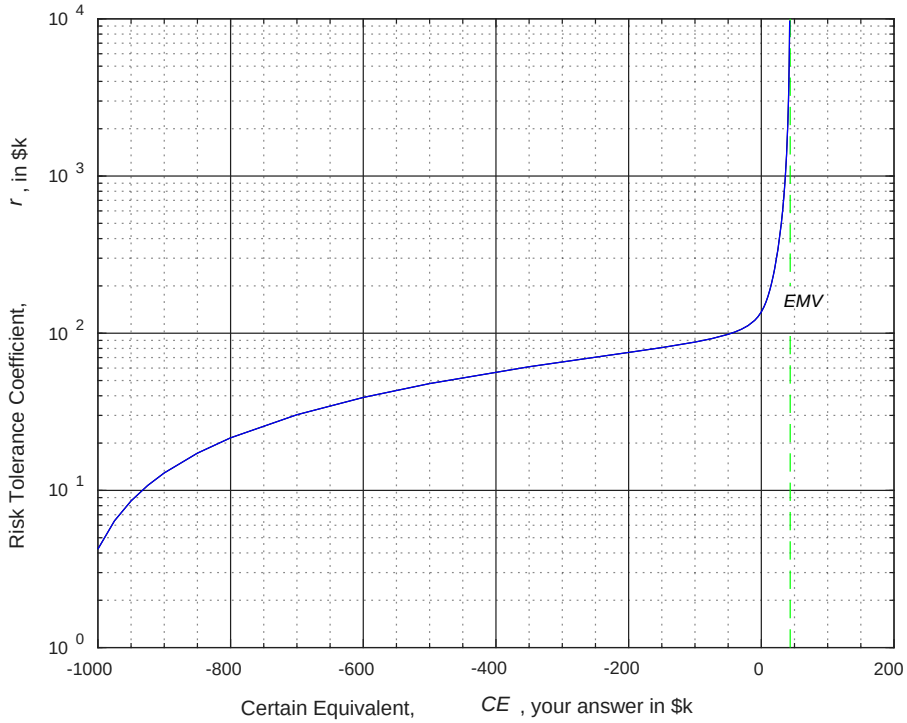
What is the most you would pay ($k) to acquire this project?

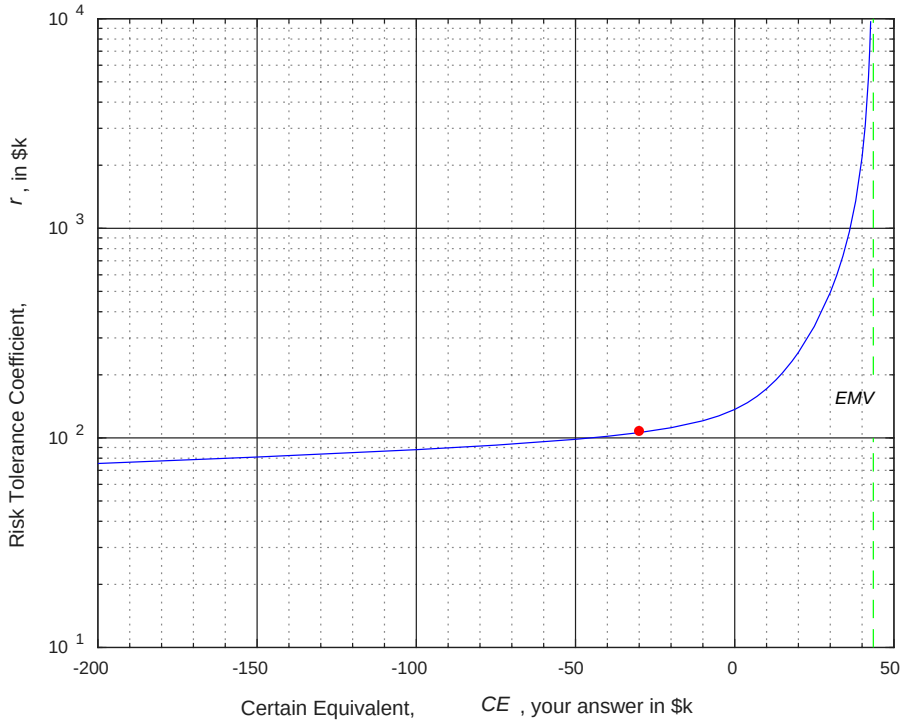


A planned enhancement (late 2018?) will add the alternative of considering continuous distributions, similar to the examples in this document.

Solution. Translate your certain equivalent (*CE*) answer to your risk tolerance coefficient (*r*) by finding or interpolating between values in the table or by using either chart. For example, if your answer is *CE* = -$30k (meaning you would pay to get rid of this risk, or someone would have to pay you $30k to take it.). This answer corresponds to *r* ≅ $106k.

Amounts in $k	
Judged CE	Corresponding r
-1048.749	0.000
-1000.000	4.234
-975.000	6.406
-950.000	8.577
-925.000	10.749
-900.000	12.920
-850.000	17.263
-800.000	21.607
-700.000	30.307
-600.000	39.041
-500.000	47.833
-350.000	61.213
-200.000	75.488
-150.000	81.039
-100.000	87.869
-75.000	92.350
-50.000	98.453
-40.000	101.767
-30.000	106.000
-20.000	111.813
-10.000	120.708
-5.000	127.368
0.000	136.710
4.000	147.258
7.000	157.835
10.000	171.559
13.000	189.438
15.000	204.299
18.000	232.292
20.000	255.809
25.000	340.326
30.000	493.657
32.000	594.327
34.000	738.820
36.000	962.236
38.000	1350.546
40.000	2184.756
41.000	3099.957
42.000	5216.055
42.400	7113.324
42.700	9737.944
43.530	∞





The probability-weighted *NPV* outcome, $43.5k, is the *expected monetary value* (*EMV*).
A risk-neutral person's *CE* equals the *EMV*. This person would be indifferent between having $43.5k cash in hand or the asset represented by the *NPV* distribution (first chart).

A risk-seeking person's *CE* would be *higher* than $43.5k.

And a risk-averse person (most of us) would value this project at less than the *EMV*. The risk tolerance coefficient (*r*) measures your degree of risk aversion. As your *r* increases, your *CE* approaches *EMV*. Your *CE* can never be lower than the worst possible outcome.

The purpose of UEP is to help you determine your personal or your organization's risk policy. And, the purpose of risk policy is to guide in making consistent risk versus value trade-offs. If you have a stochastic (probabilistic) model of your project, then calculating *CE* is straightforward. Think of *CE* as your risk attitude-adjusted *EMV*.

For a thorough discussion, please read "Risk Policy as a Utility Function" (pdf download or viewing) or watch the video.

Automating a utility elicitation session with UEP provides these advantages:

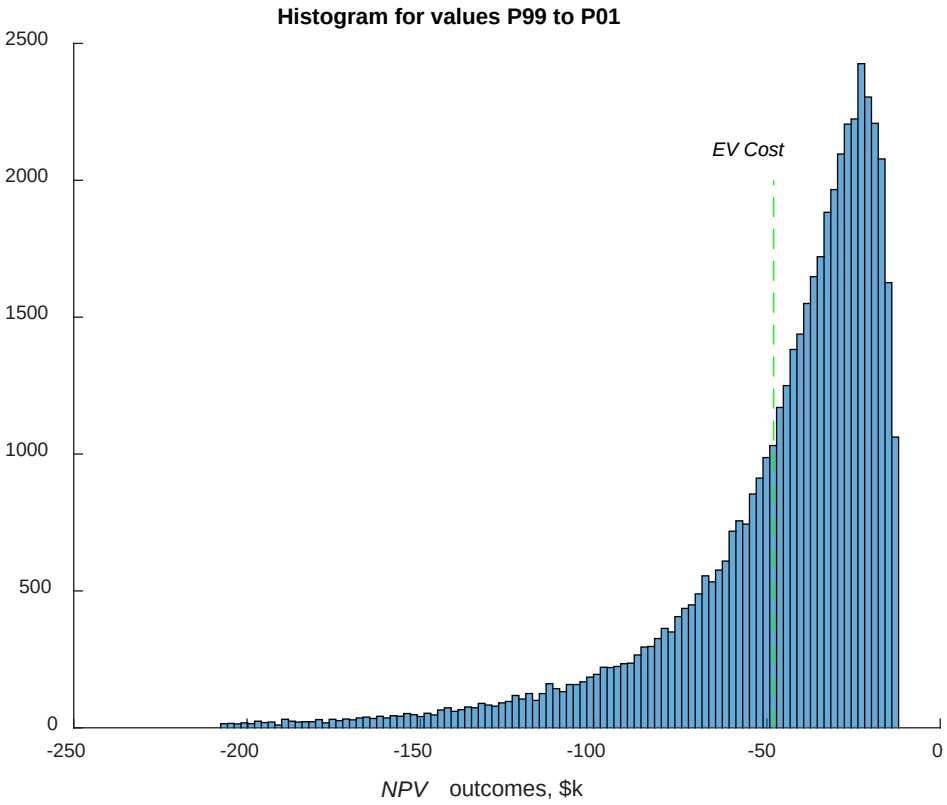
- Presenting questions in three forms or types:
  - Minimum acceptable probability of success (Ps)
  - Certain equivalent (*CE*, as in this document)
  - Optimal share of a large project
- Either buy or sell perspective
- Allowing an alternate currency unit label
- Scaling to amounts important to you (based on a typical, maximum investment amount)
- Presenting supplemental parameters for decision making, such as discounted return on investment (*DROI*)
- Automatically calculating imputed *r* values based on your answers
- And, with the latest UEP version, recording you session question parameters, your answers, and the calculated *r*'s.

  Note: UEP does not write or retain your session data. Your data are stored temporarily in your browser. While the tab is still open, you may view, copy, and paste the data records into a file or spreadsheet.

Question 4. A cost problem.

If a project is mandatory, then there is no need for a feasibility analysis. However, managing project cost is still important. You might find it useful to determine your *certain* equivalent (*CE*) if a fixed-price contract is a eliminate cost uncertainty.

Your project model has produced this distribution for *net present values* (*NPV*s) of after-tax net cashflows.



Values in a 50k trial Monte Carlo simulation ranged from -$855k to -$9k. The chart shows the frequencies of value in a 98% confidence interval, ranging from -$208k to -$12k.

The EV Cost is -$48.04 ± .18k.

What is your *certain equivalent* (*CE*) for this distribution? Consider this from either a buy or sell perspective:

- If you are bidding to perform this project, what is the minimum amount that you would require to bear this cost uncertainty?
- If this is your project, what is the most you would be willing to pay to replace this cost uncertainty with a fixed price?

The next page has a table and chart to convert your *CE* answer to a risk tolerance coefficient (*r*).

Translate your certain equivalent (*CE*) answer into your risk tolerance coefficient (*r*) by finding or interpolating between values in the table or by using the chart. For example, if your answer is *CE* = -$70k, this corresponds to *r* ≅ $102.5k.

Amounts in $k

Judged CE	Corresponding r
-855.487	0.000
-800.000	5.128
-775.000	7.439
-750.000	9.749
-700.000	14.371
-650.000	18.992
-600.000	23.614
-500.000	32.879
-400.000	42.244
-300.000	51.920
-200.000	62.759
-160.000	68.203
-120.000	75.738
-100.000	81.599
-90.000	85.834
-80.000	91.957
-75.000	96.368
-70.000	102.509
-66.000	109.678
-62.000	120.854
-60.000	129.298
-57.500	145.127
-55.000	173.106
-54.000	191.276
-53.000	217.144
-52.000	256.621
-51.000	323.592
-50.500	377.899
-49.500	599.567
-49.000	884.825
-48.500	1793.005
-48.250	3877.323
-48.041	∞