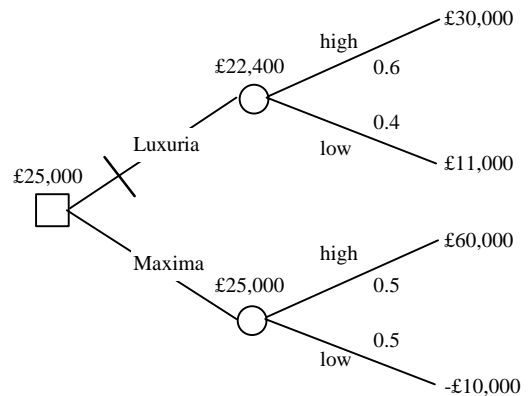


Risk Profiles

A business woman who is organising an exhibition in a provincial town has to choose between two venues: the Luxuria Hotel and the Maxima Centre. To simplify her problem, she decides to estimate her potential profit at these locations on the basis of two scenarios: high attendance and low attendance at the exhibition.

If she chooses the Luxuria Hotel, she reckons that she has a 60% chance of achieving a high attendance and hence a profit of £30,000 (after taking into account the costs of advertising, hiring the venue, etc.). There is, however, a 40% chance that attendance will be low, in which case her profit will be just £11,000. If she chooses the Maxima Centre, she reckons she has a 50% chance of high attendance, leading to a profit of £60,000, and a 50% chance of low attendance leading to a loss of £10,000.

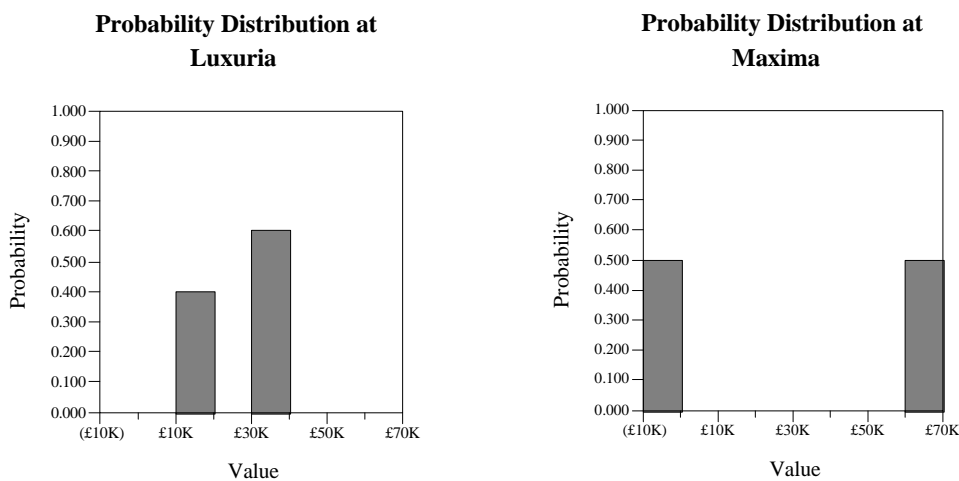


The business woman's expected profit is £22,400 if she chooses the Luxuria Hotel and £25,000 if she chooses the Maxima Centre. By the EMV criterion she should choose the Maxima Centre.

However, choosing the Maxima Centre is the riskier option. Although it offers high rewards if things go well, it is possible to make a loss if things go badly. The alternative action, choosing the Luxuria Hotel leads to a guaranteed profit, and many (if not most) people would opt for this option.

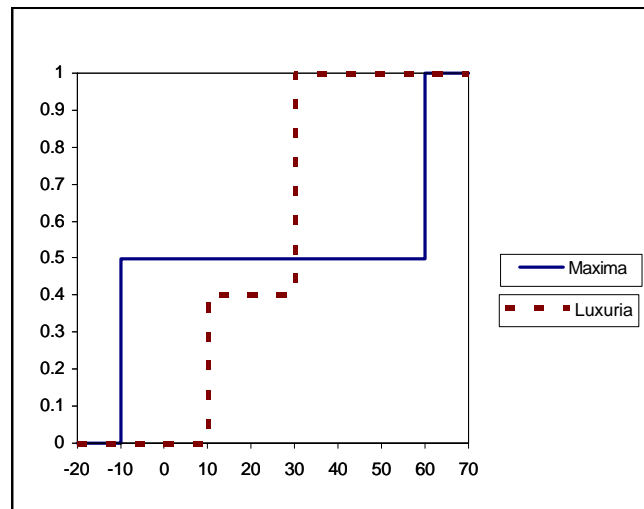
The problem with the EMV criterion is that it does not make the risks of the different possible outcomes explicit. Furthermore, the expected values, which are used for comparing different strategies, are rarely actual outcome values. In this case, for example, the profit would never be £22,400 or £25,000. When the decision problem can justifiably be regarded as one of a sequence of many identical problems, then choosing the outcome with the best expected value would lead to the greatest overall payoff (taken over the whole sequence). But when the problem is a "one-off" one is on shakier ground with EMV.

One can show the risk associated with a particular strategy in graphical form, using a probability distribution graph, or risk profile. This is a column chart which displays the dispersion of possible outcomes and the probabilities associated with those outcomes. In a tree with several outcomes the extent to which the bars are clustered or dispersed around the mean would provide a graphical indicator of the risk of the decision.



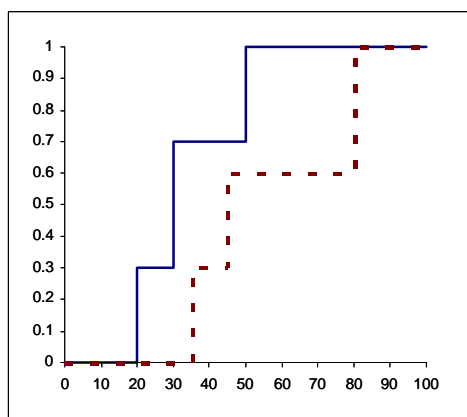
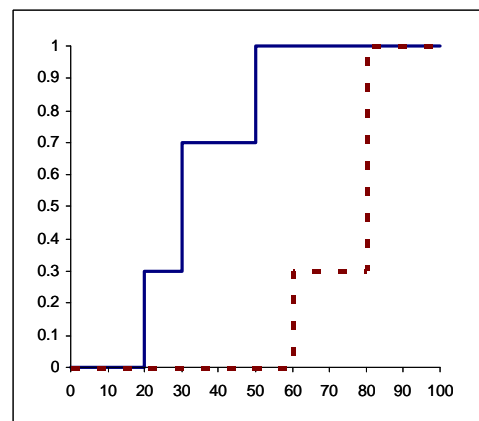
These risk profiles show clearly how much riskier the Maxima choice is.

A risk profile bar graph can also be displayed cumulatively. Rather than using discrete bars to indicate the probability of an outcome within a specific range of values, the cumulative graph shows a continuous series of bars. The top of each bar indicates the probability of an outcome at or below a particular value. It is possible to display several cumulative distributions together on a single graph, as shown for our example.



Such comparative cumulative risk profiles are particularly useful in showing when one strategy dominates another.

Deterministic dominance occurs when one strategy always offers a better outcome than the alternative. Not only does it have a higher expected value, but its worst outcome (if there is any uncertainty) is preferable (or at least equal) to the best outcome of the alternative. In a comparative cumulative risk profile graph, the entire plot of the dominating alternative will either lie to the right of the line representing the other strategy, or its worst outcome will be equal to the best outcome of the alternative.

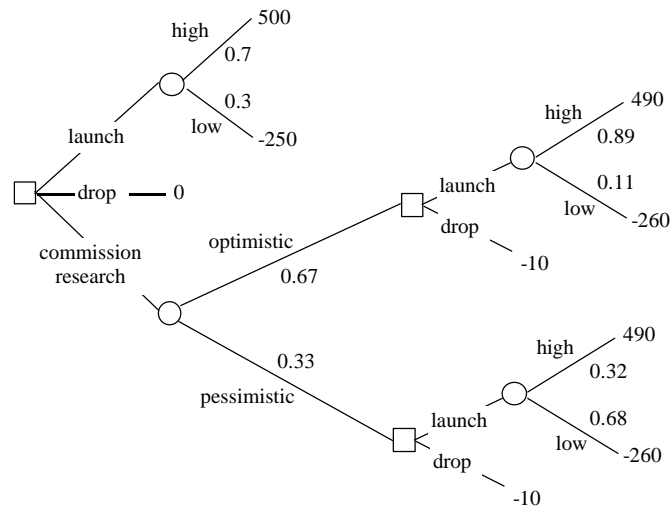


Stochastic (or probabilistic) dominance involves more complex rules of interpretation. Stochastic dominance can be inferred if the line describing the dominating strategy is never to the left of the alternative's line and is to the right and / or below the alternative's in at least one location. The cause of stochastic dominance can often be seen in the dominating strategy as better probabilities, payoffs, or a combination of both.

In situations where there is no clear dominance, the lines of the strategies being compared will cross at one or more points in the graph, as in the Luxuria / Maxima example. In such situations it becomes much harder to make strong statements about which strategy is better. In general, if one strategy has a much higher expected value, there may be a good argument to choose it. If the expected values are very similar, one must decide whether to choose the strategy with less risk or the strategy that offers the possibility of greater upside outcomes.

Yet, when it is possible to demonstrate dominance, you have a far less blunt instrument for eliminating inferior strategies than by simply comparing expected monetary values.

Let us take another look at the venture analysis example, in which the cost of marketing research information was £10,000, but its value turned out to be only £3,500. This time we'll draw the decision tree with the cost of the marketing research information taken into account in the payoff values at the leaves of the tree, but with all expected value calculations omitted:



From the tree, we can identify a set of distinct strategies, (some sensible - others silly):

1. Launch immediately
2. Drop immediately
3. Commission research, then launch, regardless of research result
4. Commission research, then drop, regardless of research result
5. Commission research, launch if optimistic research result, drop if pessimistic research result
6. Commission research, launch if pessimistic research result, drop if optimistic research result

We can work out the risks for the different strategies:

1. *Launch immediately:*

Payoff	Risk
500	0.7
-250	0.3

2. *Drop immediately:*

Payoff	Risk
0	1.0

3. *Commission research, then launch, regardless of research result:*

Payoff	Risk
490	$0.67 \cdot 0.89 + 0.33 \cdot 0.32 = 0.7$
-260	$0.67 \cdot 0.11 + 0.33 \cdot 0.68 = 0.3$

4. *Commission research, then drop, regardless of research result:*

Payoff	Risk
-10	$0.67 + 0.33 = 1.0$

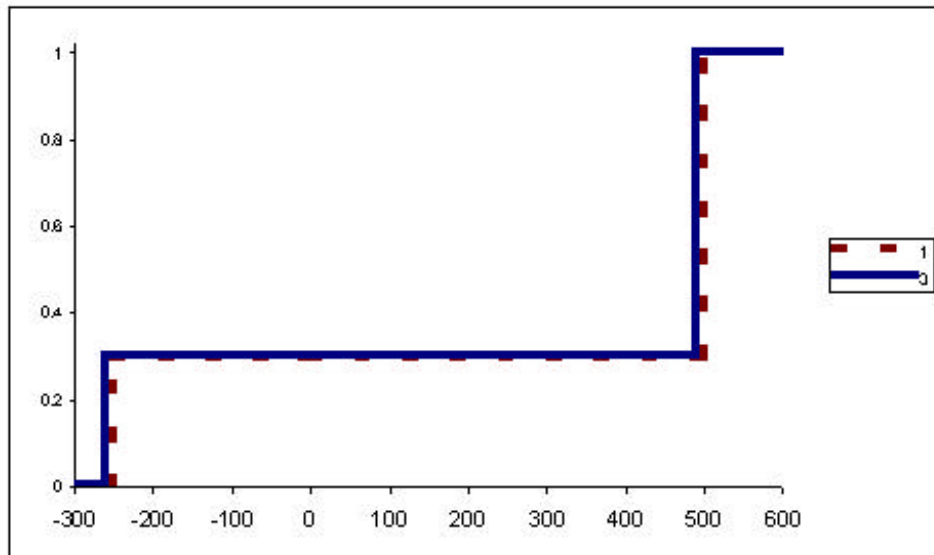
5. *Commission research, launch if optimistic research result, drop if pessimistic research result:*

Payoff	Risk
490	$0.67 \cdot 0.89 = 0.595$
-10	0.330
-260	$0.67 \cdot 0.11 = 0.075$

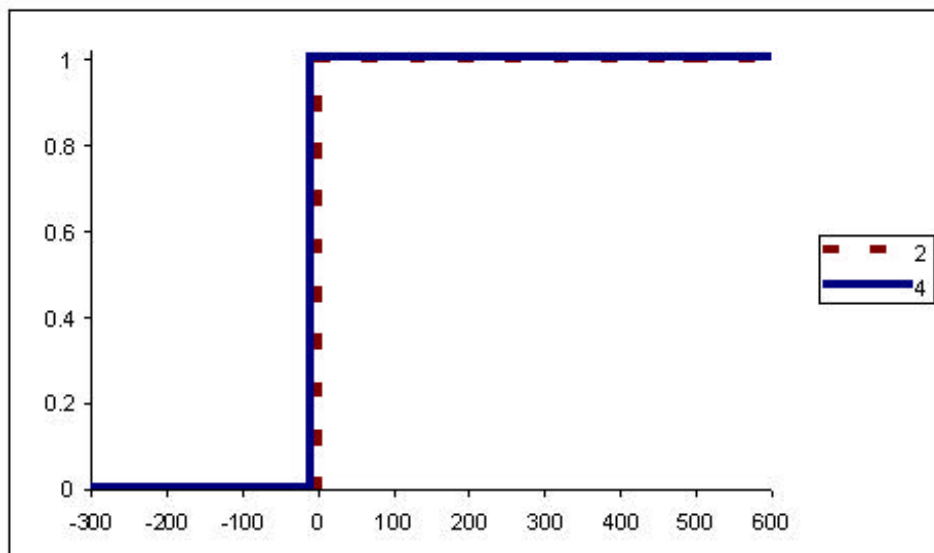
6. Commission research, launch if pessimistic research result, drop if optimistic research result:

Payoff	Risk
490	$0.33 \cdot 0.32 = 0.105$
-10	0.670
-260	$0.33 \cdot 0.68 = 0.225$

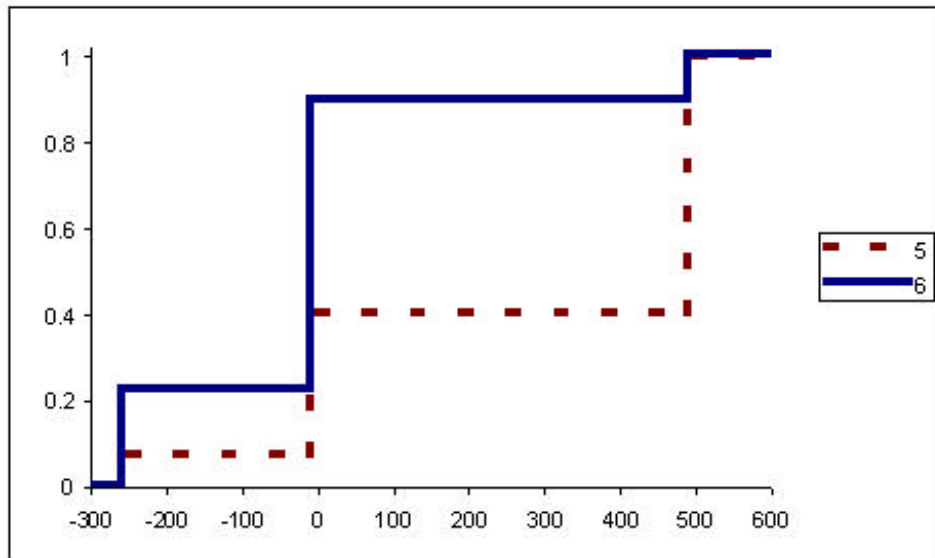
Comparing strategy 1 with strategy 3, we see that strategy 1 stochastically dominates strategy 3 (just):



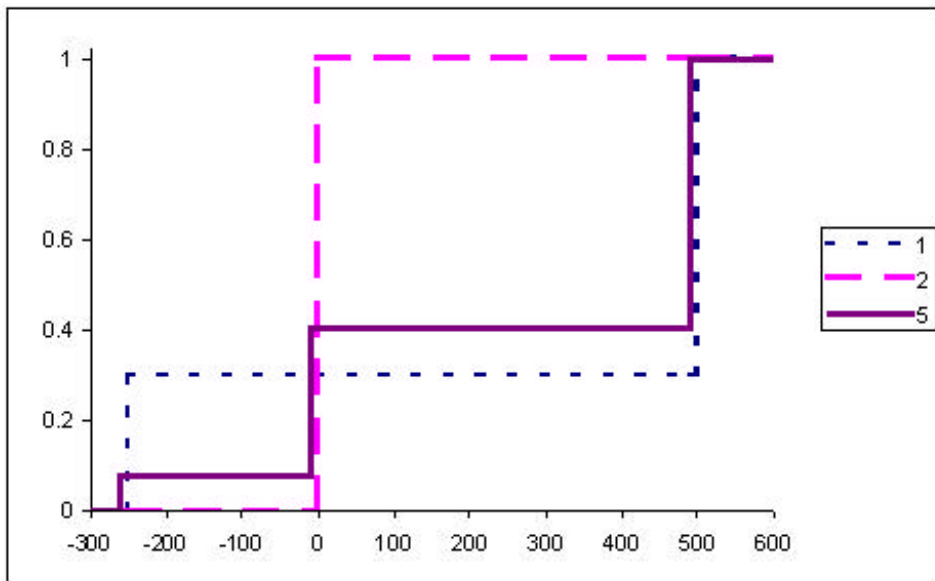
Comparing strategy 2 with strategy 4, we see that strategy 2 deterministically dominates strategy 4 (just):



Comparing strategy 5 with strategy 6, we see that strategy 5 stochastically dominates strategy 6:



So, we can eliminate strategies 3, 4 and 6 and need only compare the other three:



From this comparative cumulative risk profile chart, we can see that strategy 2 is the safest, strategy 1 the riskiest and strategy 5 the one that seems to offer the best combination of reward yet only moderate risks.

Notice that this choice runs counter to the conclusion reached when using the EMV criterion, in which strategy 1 is the preferred choice, with an EMV of £275K, compared to £268.5K for strategy 5 and £0K for strategy 2.