



Lecture 25. Risk and expected net present value

FOR 2022. Financial Analysis for Natural Resources.



School of Forest Resources



Risk and uncertainty

- Describes our knowledge about the future
 - Certainty – we know exactly what future outcomes will be
 - Uncertainty – we know the range of outcomes, but we don't know the likelihood of each outcome.
 - Risk – we know the future states of nature and the likelihood of each.

● ● ● | Risk

s_i = future state i , ($i = 1 \dots n$)

p_i = probability of future state i

Each p_i $0.0 \leq p_i \leq 1.0$ and

$$\sum_{i=1}^n p_i = 1.0$$

● ● ● | Expected value

- Expected value is simply the sum of all possible outcomes' values (s_i) multiplied by their likelihood (p_i):

$$Ev = \sum_{i=1}^n p_i s_i$$



Example of expected value

n	s_i	p_i	$s_i \times p_i$
1	100	0.35	35
2	60	0.20	12
3	20	0.15	3
4	220	0.10	22
5	140	0.20	28
Ev =			100



Cash flow table with probabilities

Year(s)	Activity	Cash flows under risk		
		$p_1 = 0.2$	$p_2 = 0.5$	$p_3 = 0.3$
0	Establish	(\$200)	(\$200)	(\$200)
1-35	Taxes	(\$1)	(\$2)	(\$5)
15	Thin 1	\$50	\$100	\$150
20	Thin 2	\$125	\$200	\$300
25	Thin 3	\$500	\$700	\$1000
35	Regen	\$2500	\$3500	\$5000



Solving for expected net present value

	Prob.	0.2	0.5	0.3	0.2	0.5	0.3
Year(s)	Activity	Cash Flow	Cash Flow	Cash Flow	8%	8%	8%
0	Establish	\$ (200)	\$ (200)	\$ (200)	\$ (200)	\$ (200)	\$ (200)
1-35	Taxes	\$ (1)	\$ (2)	\$ (5)	\$ (12)	\$ (23)	\$ (58)
15	Thin 1	\$ 50	\$ 100	\$ 150	\$ 16	\$ 32	\$ 47
20	Thin 2	\$ 125	\$ 200	\$ 300	\$ 27	\$ 43	\$ 64
25	Thin 3	\$ 500	\$ 700	\$ 1,000	\$ 73	\$ 102	\$ 146
35	Regen	\$ 2,000	\$ 3,500	\$ 5,000	\$ 135	\$ 237	\$ 338
				npv =	\$ 39	\$ 190	\$ 338
				E(npv)	\$204.14		

$$E(npv) = 0.2 \times \$39 + 0.5 \times \$190 + 0.3 \times \$338 \\ = \$204.14$$

NTLS



Expected value

- Similar to sensitivity analysis
- Incorporates knowledge about the likelihood of certain events or future states of nature
- Suggests an outcome that is most likely under a broad set of circumstances or trials.



Next lecture...

Review for final