REGRET ANALYIS AND BOUNDING

Prof. Miguel Bagajewicz

CHE 4273

MINIMAX REGRET ANALYSIS

Motivating Example

	s_1 High	s_2 Medium	s_3 Low	Average
A	19	14	-3	10
B	16	7	4	9
C	20	8	-4	8
D	10	6	5	7
Max	20(C)	14(A)	5(D)	10(A)

- Traditional way

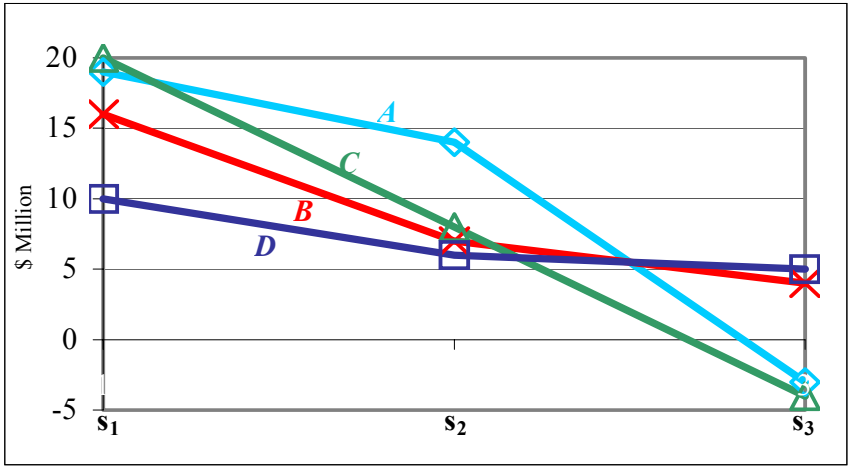
  Maximize Average…select A

- Optimistic decision maker

  MaxiMax … select C

- Pessimistic decision maker

  MaxiMmin … select D

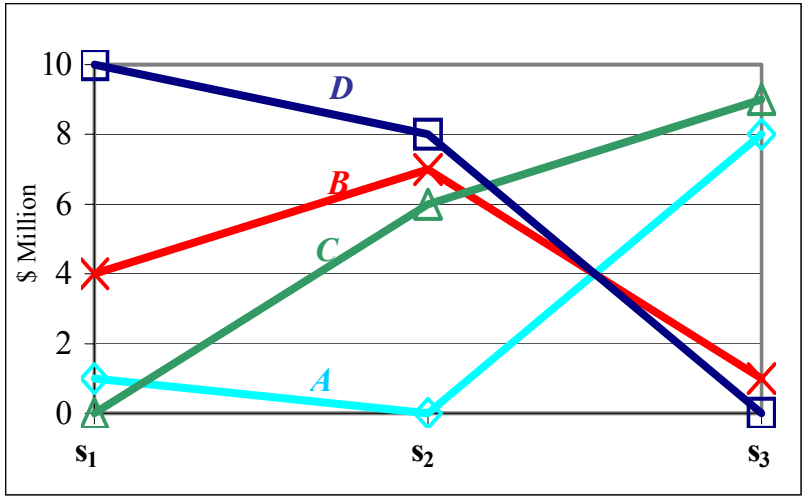


MINIMAX REGRET ANALYSIS

Motivating Example

- ***Calculate regret:***
  find maximum regret
- A … regret = 8 @ low market
- C … regret = 9 @ low market
- D … regret = 10 @ high market
- B … regret = 7 @ medium market
- ***MINIMAX → B***
- In general, gives ***conservative*** decision
  but not pessimistic.

	s_1 High	s_2 Medium	s_3 Low	Maximum Regret
A	1	0	8	8
B	4	7	1	7
C	0	6	9	9
D	10	8	0	10



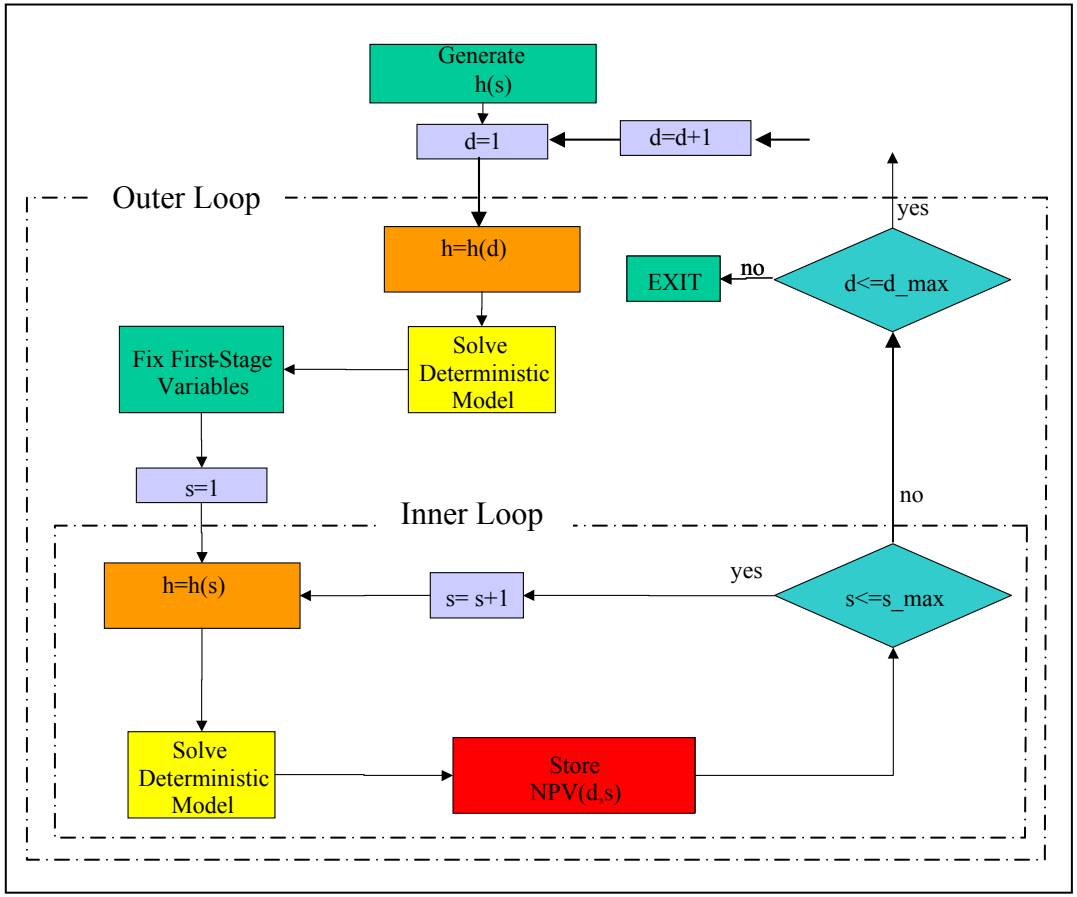
MINIMAX REGRET ANALYSIS

Two-Stage Stochastic Programming Using Regret Theory

NPV								
	s1	s2	s3	s4	s5	ENPV	Max	Min
d1	19.01	10.38	10.57	15.48	10.66	13.22	19.01	10.38
d2	11.15	14.47	8.87	20.54	10.58	13.12	20.54	8.87
d3	12.75	7.81	16.02	22.25	9.16	13.60	22.25	7.81
d4	5.41	9.91	12.63	32.02	8.08	13.61	32.02	5.41
d5	15.09	7.40	8.81	12.48	15.05	11.77	15.09	7.40
Max	19.01	14.47	16.02	32.02	15.05	13.61	32.02	10.38

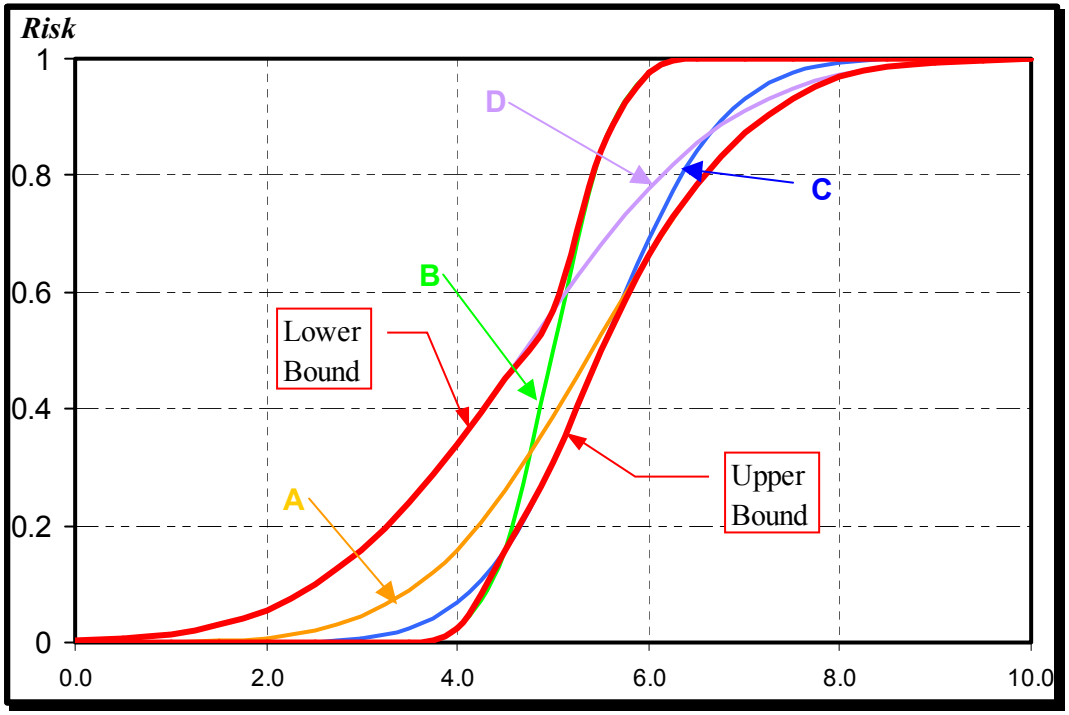
Regret						
	s1	s2	s3	s4	s5	Max
d1	0.00	4.09	5.45	16.54	4.39	16.54
d2	7.86	0.00	7.15	11.48	4.47	11.48
d3	6.26	6.66	0.00	9.77	5.89	9.77
d4	13.60	4.56	3.39	0.00	6.97	13.60
d5	3.92	7.07	7.21	19.54	0.00	19.54
					Min	9.77

SAMPLING ALGORITHM



This generates several solutions

UPPER AND LOWER BOUNDS

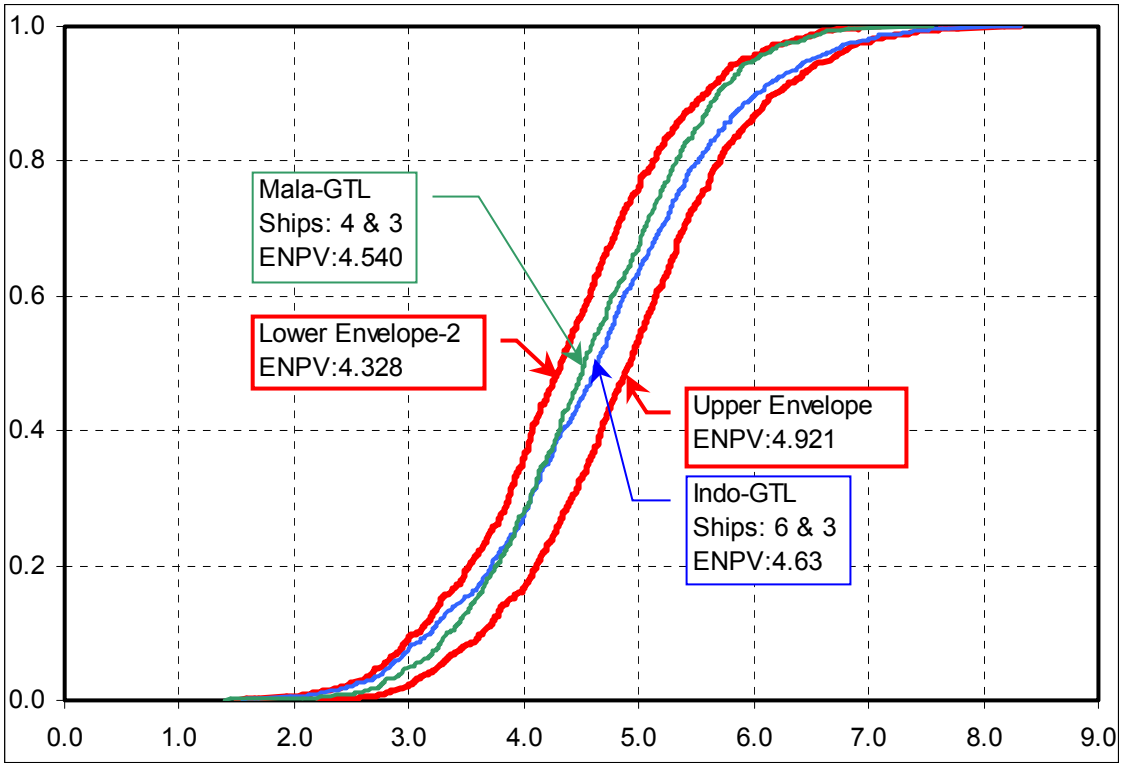


This is very useful because it allows nice decomposition,

That is, there is no need to solve the full stochastic problem

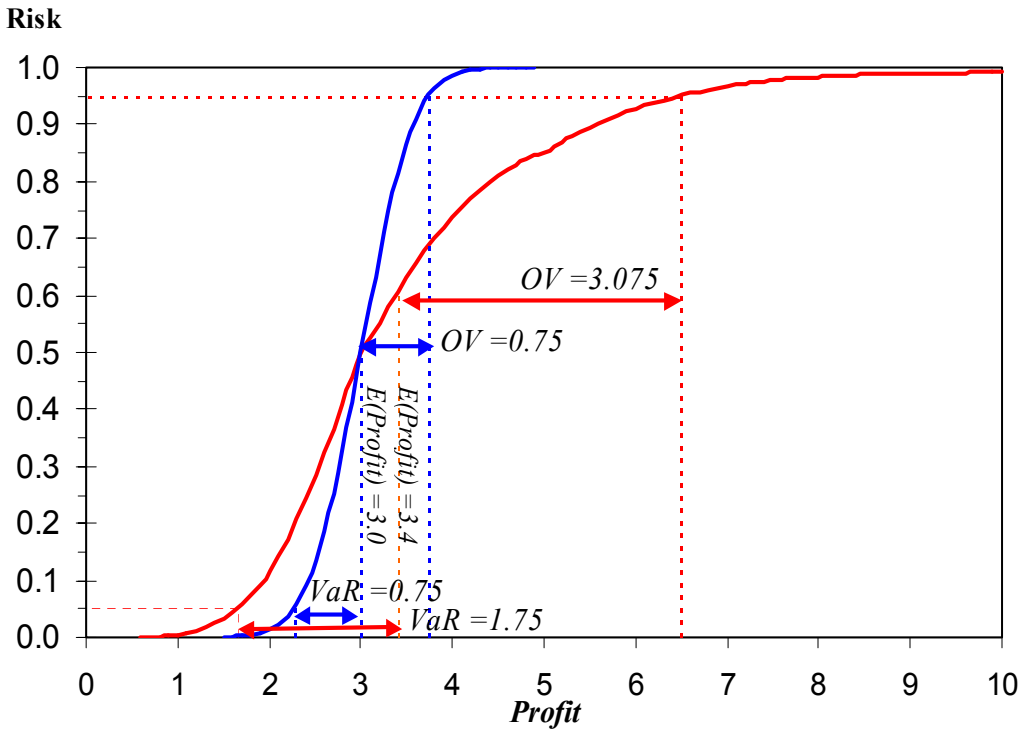
UPPER AND LOWER BOUNDS

Example: Gas Commercialization in Asia



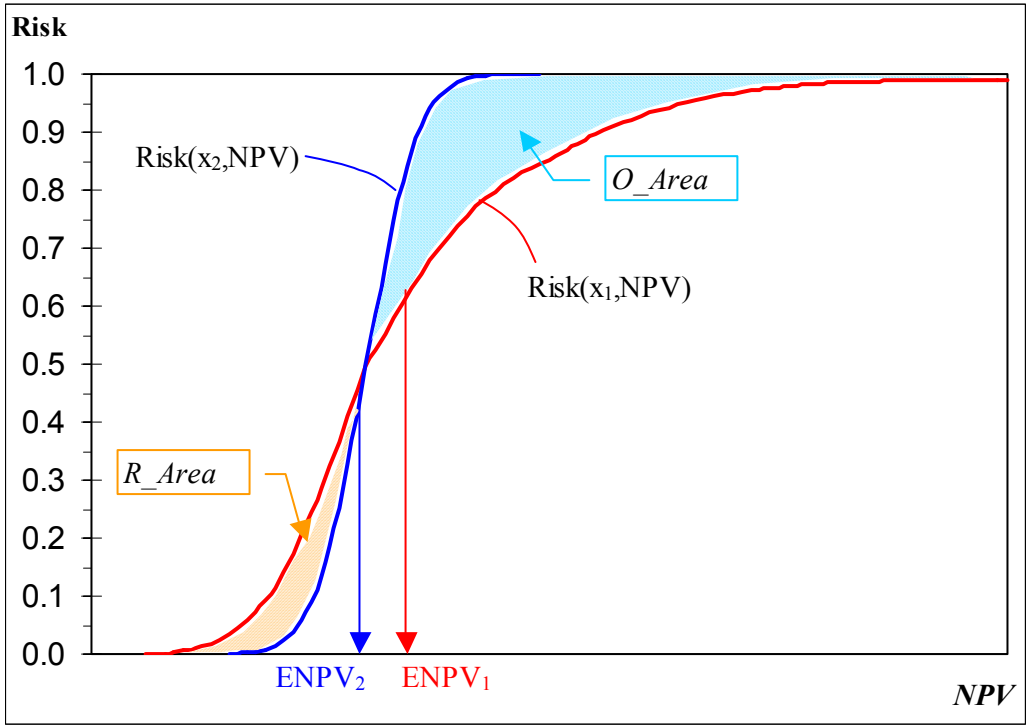
UPSIDE POTENTIAL

Point measure for the upside



AREA RATIO

Comparison measure

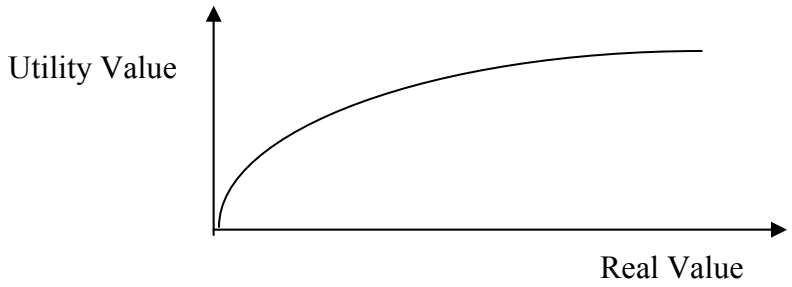


UTILITY THEORY

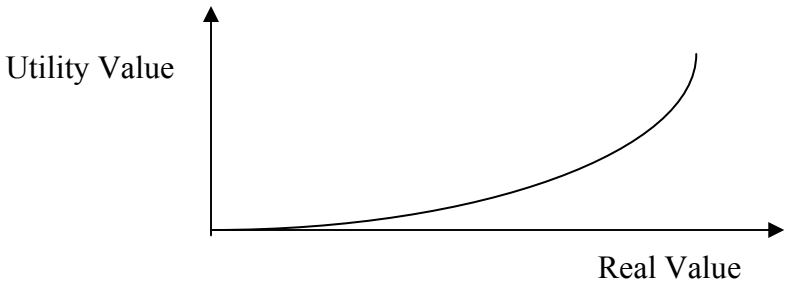
Utility Functions

Money does not always have the same value for a company

- A Risk Averse Decision Maker values more low profits than large ones



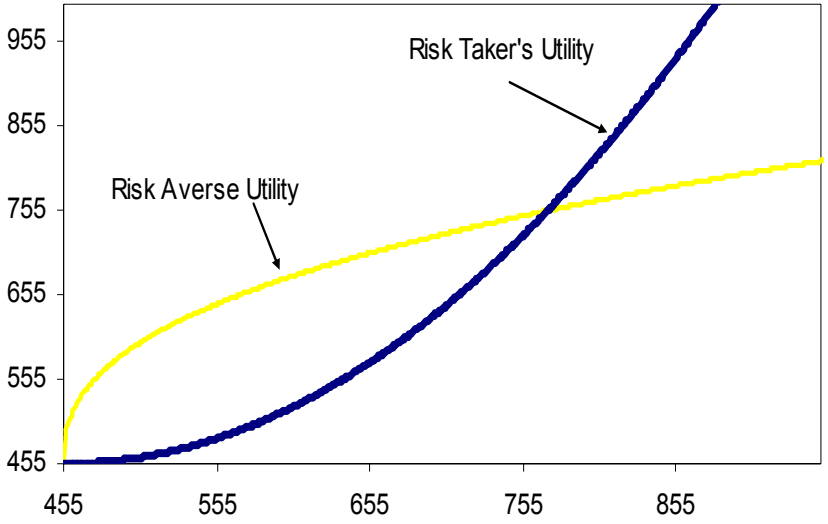
- A Risk Taker values more high profits

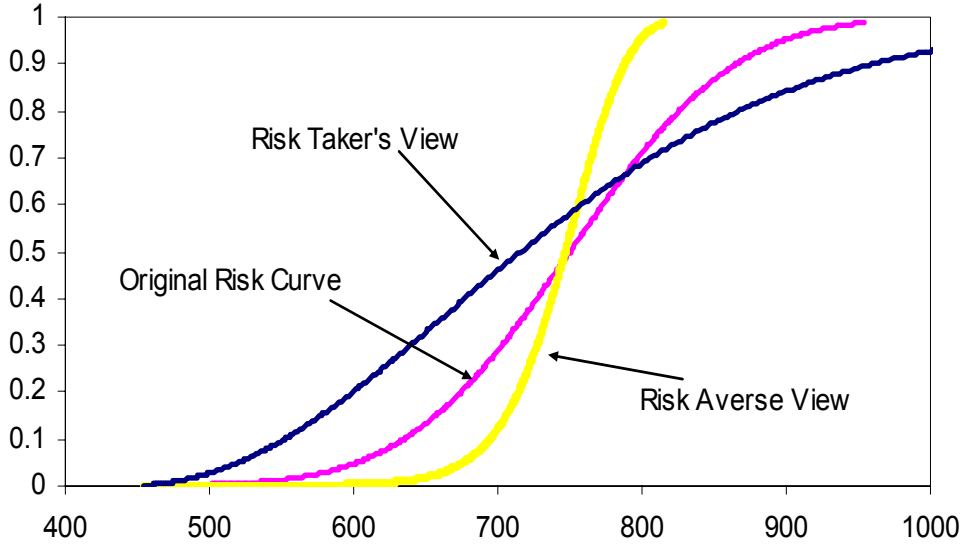


UTILITY THEORY

Use Utility Value instead of real profit for evaluation

Effect on Risk Curves





CONCLUSIONS

- **Regret Analysis can help in identifying good solutions (It can also fail)**
- **The sampling Algorithm is an important tool to identify upper bounds and good solutions.**
- **The upper potential is important to be considered.**

References

- Riggs J. L. *Economic Decision Models for Engineers and Managers.* McGraw Hill, NY, 1968
- Aseeri A. and M. Bagajewicz. *New Measures and Procedures to Manage Financial Risk with Applications to the Planning of Gas Commercialization in Asia*. Computers and Chemical Engineering