

DSC5211C QUANTITATIVE RISK MANAGEMENT

SESSION 7

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Stochastic Dynamic Programming Infinite Horizon

A firm is speculating in oil.

1. They hold inventories of oil which they increase or sell depending on market prices. Market prices can have three states, normal (40 \$/bbl), disrupted (\$75) and very disrupted (125\$/bbl).
2. The transition probabilities between the different states are given in the following table.

	N	D	VD
N	0.8	0.1	0.1
D	0.3	0.5	0.2
VD	0.0	0.3	0.7

3. The holding costs are about 0.02 \$/month/barrel.
4. The maximum level of inventory is 1000 Kbbl and the firm buys and sells inventory in discrete batches of 100 Kbbl.
5. Each period corresponds to one month. The discount factor is 99.5% per month.
6. Due to capacity restrictions, at any given month, the speculator can sell or buy at the most 200 Kbbl.

You were asked to define the optimal inventory policy to maximize the firm's profits.

- a) Represent the problem analytically.
- b) Formulate the linear programming problem and solve it in GAMS.
 - i) Identify the optimal policy.
 - ii) Compute the expected profit.
 - iii) Interpret your results.

c) How would the optimal policy change if:

i) The discount factor was 90%?

ii) There was no restriction on the maximum trading per month, i.e., point 6 is not required?

iii) the transition matrix was:

	N	D	VD
N	0.9	0.1	0.0
D	0.4	0.5	0.1
VD	0.0	0.2	0.8

d) Which parameters are more important for the speculator success? Justify your answer.