Scenario & Sensitivity Analysis

AEC 851 – Agribusiness Operations Management
Spring, 2006
Scenario analysis & Decision trees

- Identify decision alternatives ($A_i$)
- Evaluate possible states of nature ($S_j$)
- Estimate possible payoffs ($m_{ij}$) to each alternative under each state of nature
- Estimate probabilities of each state ($Pr[S_j]$)
- Calculate
  - Payoff matrix
  - Regrets matrix
  - Risk-weighted payoff matrix
Hay Contract Decision Tree (500 ton contract)

Hay Decision

Contract 0

Contract 500

Contract 1000

low, low  17%  $3,404
low, medium  6%  $992
low, high  11%  $1,411
medium, low  25%  $8,481
medium, medium  8%  $2,571
medium, high  17%  $4,117
high, low  8%  $4,869
high, medium  3%  $1,538
high, high  6%  $2,733

low, low  17%  $20,425
low, medium  6%  $17,850
low, high  11%  $12,700
medium, low  25%  $33,925
medium, medium  8%  $30,850
medium, high  17%  $24,700
high, low  8%  $58,425
high, medium  3%  $55,350
high, high  6%  $49,200
Decision Rules w/o Probabilities

• Payoffs basis (direct gains)
  – Minimax (best if worst case occurs)
  – Maximax (best if best case occurs)

• Regret basis (opportunity costs)
  – Minimax Regret (least bad of wrong decisions)
Decision Rules w/ Probabilities I

• Simplest rules
  – Max expected value
  – Max in most likely state
  – Min variance

• Safety-first
  – Min \( \Pr(m) \leq \text{cut-off} \)
    • E.g.: Minimize probability of payoff \( \leq \$25,000 \)
Decision Rules w/ Probabilities II

- Risk efficiency: Comparing distributions
  - Does one strategy out-perform other in all states of nature?
    - First-degree stochastic dominance (FSD)
    - Does one have higher mean / lower var.? 
      - Mean-variance (E-V) efficiency
- “Expected Utility” – Weighting expected returns by variance
  - EU = E(A) - δVar(A)
Hay price probabilities:
Individual (PDF) – Cumulative (CDF)
## Joint Probabilities
(Horse Hay case)

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<tr>
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<th>Low price</th>
<th>Med price</th>
<th>High price</th>
<th>RETURN STATES:</th>
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<tbody>
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<td>Low return</td>
<td>.17</td>
<td>.25</td>
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<td>Med return</td>
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