

STATISTICAL DECISION THEORY - I LINEAR MODELS AND DECISIONS

(LUCE & RAIFFA, FERUSON, MOOD, HOEL, RAO, ROBBINS)

Θ STATES OF NATURE (STATES BEING CONSIDERED)

A AVAILABLE ACTIONS

$L: \Theta \times A \rightarrow R$ LOSS FUNCTION ($R = \text{COSTS, MAY BE } < 0$)

GAME $\langle \Theta, A, L \rangle$ DECISION MAKING UNDER UNCERTAINTY - CHOICES OF ACTIONS

E RANDOM VECTORS WITH DISTRIBUTIONS DEPENDENT ON $\theta \in \Theta$ (STATE OF NATURE)

EACH RANDOM VECTOR CORRESPONDS TO A DATA COLLECTION STRATEGY

$x_j \in E \Rightarrow x_j: \mathcal{X}_j \rightarrow [0, 1] \Rightarrow \sum_{\mathcal{X}_j} x_j = 1$ WITH \mathcal{X}_j THE SPACE OF POSSIBLE OUTCOMES OF THE j th DATA COLLECTION STRATEGY

$D = \{d_{ij} \mid d_{ij}: \mathcal{X}_j \rightarrow A\}$ A SET OF DECISION RULES

$R(\theta, d_{ij}, x_j) = E_{\theta}[L(\theta, d_{ij}(x_j))]$ RISK FUNCTION - EXPECTED VALUE, ASSUMING $\theta \in \Theta$, OF LOSS FOR d_{ij}, x_j

EMPIRICAL GAME $\langle \Theta, \langle E, D \rangle, R \rangle$ DECISION MAKING UNDER UNCERTAINTY AT A HIGHER LEVEL
- CHOICES AMONG DATA COLLECTION STRATEGY AND DECISION RULE PAIRS

SPACE OF DATA COLLECTION STRATEGIES GENERALLY DIFFICULT TO SPECIFY AND TO FORMALLY INCLUDE IN DECISION RULES - USUALLY DETERMINED MORE SUBJECTIVELY BY 'SEPARABLE' CRITERIA OF INFORMATION AND COST (AND TRADITION) (DESIGN, SAMPLE SIZE, ETC.) (EXCEPTION: SEQUENTIAL SAMPLING)

THEREFORE, x_j IS FIXED 'EXTERNALLY' (SUBJECTIVELY) AND:

$D = \{d_i \mid d_i: \mathcal{X} \rightarrow A\}$

$R(\theta, d_i) = E_{\theta}[L(\theta, d_i(x))]$

STATISTICAL GAME $\langle \Theta, D, R \rangle$ DECISION MAKING UNDER UNCERTAINTY
- CHOICES AMONG DECISION RULES