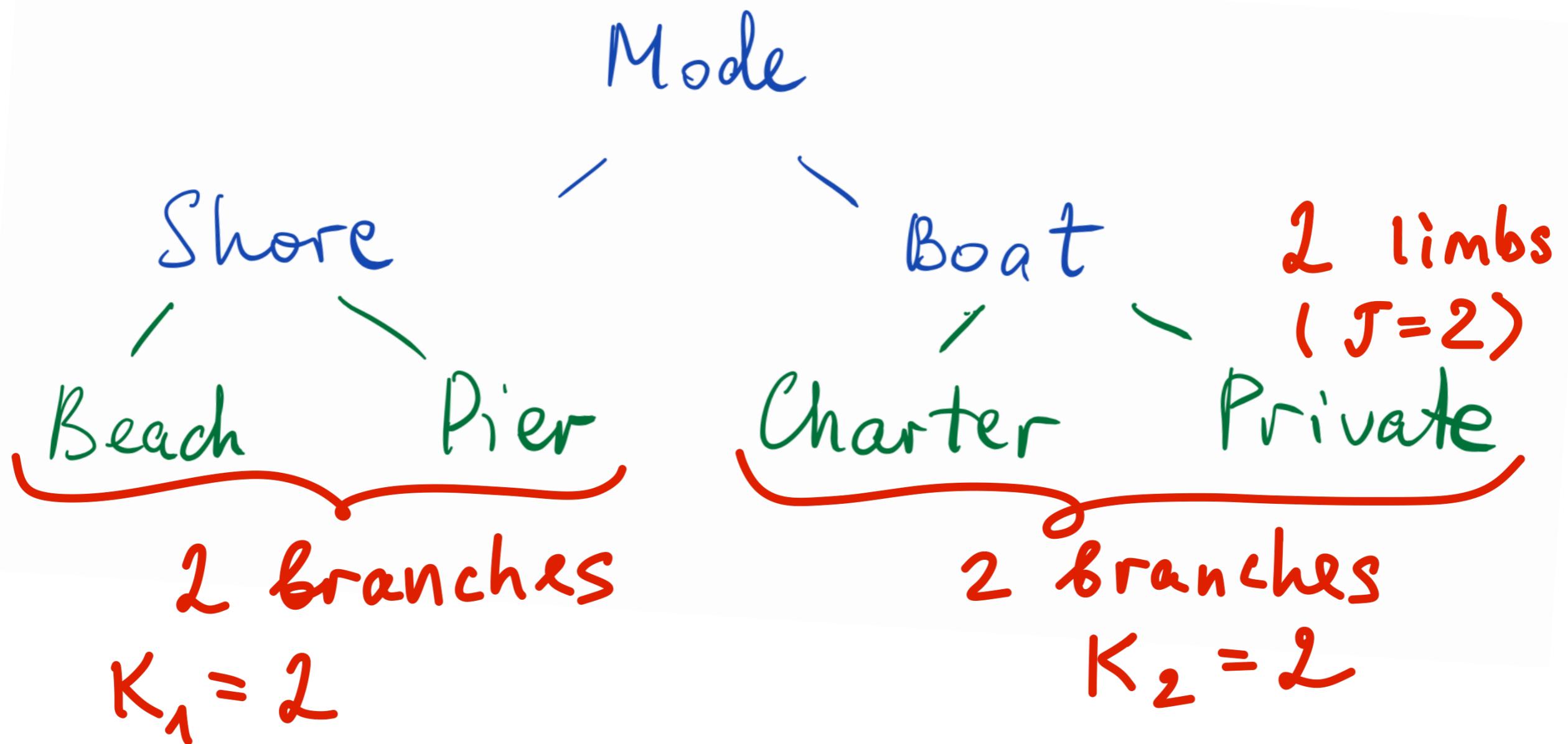


# Nested Logit

with application in Stata

# Model structure



# Model structure

## Random utility

$$U_{jk} = V_{jk} + \varepsilon_{jk}$$

In our example

$$j = 1, 2, \dots, J$$

$$j = 1, 2$$

$$k = 1, 2, \dots, K_j$$

$$k = 1, 2 \quad (j=1)$$

$$1, 2 \quad (j=2)$$

# Model structure

$$P_{jk} = P_j \times P_k | j$$

Example

$$P_{\text{shore, beach}} = P_{\text{shore}} \times P_{\text{beach} | \text{shore}}$$

## Distributional assumption

Generalized extreme value distr.

$$F(\varepsilon) = \exp[-G(e^{-\varepsilon_{11}}, \dots, e^{-\varepsilon_{1k_1}}; \dots, \dots; e^{-\varepsilon_{j1}}, \dots, e^{-\varepsilon_{jk_j}})]$$

$$G(y) = G(y_{11}, \dots, y_{1k_1}; \dots; y_{j1}, \dots, y_{jk_j})$$

# Distributional assumption

$$G(Y) = \sum_{j=1}^J \left( \sum_{k=1}^{K_j} y_{jk} \frac{1}{p_j} \right)^{p_j}$$

Scale parameters

$$p_j = \sqrt{1 - \text{Cor}(\varepsilon_{jk}, \varepsilon_{je})}$$

# Dissimilarity parameter

$$\tau_j = \frac{1}{\rho_j}$$

Recall:  $\rho_j = \sqrt{1 - \text{Cor}(\varepsilon_{jk}, \varepsilon_{jl})}$

If IIA holds,  $\rho_j = 1$

$$\Rightarrow \tau_j = 1$$

# The regression

$$y_{jk} = \begin{cases} 1 & \text{if } jk \text{ chosen} \\ 0 & \text{otherwise} \end{cases}$$

$$V_{jk} = \underbrace{z_j' \alpha}_{\text{varies over limbs only}} + \underbrace{x_{jk}' \beta_j}_{\text{varies over limbs and branches}}$$

varies over  
limbs only

$\alpha, \beta_j$ : regression parameters

# The probabilities

$$P_{jk} = P_j \times P_{k|j}$$
$$= \frac{\exp(z'_j \alpha + P_j I_j)}{\sum_{m=1}^J \exp(z'_m \alpha + P_m I_m)} \times \frac{\exp(x'_{jk} \beta_j / P_j)}{\sum_{l=1}^{K_j} \exp(x'_{je} \beta_j / P_j)}$$

$$I_j = \ln \left( \sum_{l=1}^{K_j} \exp(x'_{je} \beta_j) / P_j \right)$$

inclusive value or log-sum

# Estimation in Stata

Step 1: Generate the limb  
categorical variable

nlogitgen <newaltvar> = //  
<altvar>(label: alt1 | alt2 | ...)  
...

Example

nlogitgen type = (shore: pier|beach //  
boat: charter|private)

# Estimation in Stata

```
nlogit <depvar> <indepvars> ///
|| <altvar>: [byaltvarlist] ///
|| <altvar>: [byaltvarlist]
```

See **help nlogit** for more information