

## Simple (CBT + PMT)

$$f(\tilde{z}^0, \tilde{y}', \tau(\tilde{z}^0) | \tilde{\omega}, \tilde{\alpha}', \tilde{\theta}) = f(\tau(\tilde{z}^0) | \tilde{z}^0) \times f(\tilde{z}^0 | \tilde{\alpha}, \tilde{\theta}, \tilde{\omega}) \times f(\tilde{y}' | \tilde{\alpha}, \tilde{\theta})$$

latent score of "testing" sample corresponding to CBT

↑

latent score of "training" sample

↑

PMT response from "training" sample

$$= \prod_i \mathbb{I}(\tau(\tilde{z}_i^0) = \text{rank}(\tilde{z}_i^0))$$

$$\times \prod_i N(\tilde{z}_i^0 | \tilde{\alpha} + \tilde{x}_i^0 \tilde{\theta}, \tilde{\omega}_i^{-1})$$

$$\times \prod_i N(\tilde{y}_i' | \tilde{\alpha} + \tilde{x}_i' \tilde{\theta}, \tilde{\omega}_i^{-1})$$

$$p(\omega) = \begin{cases} 0.5 & \text{if } \omega = 0.5 \text{ (unreliable)} \\ 0.5 & \text{if } \omega = 1 \text{ (reliable)} \end{cases}$$

## J-rankers + PMT

$$f(\tilde{z}, \tilde{y}, \tau | \tilde{\omega}, \tilde{\alpha}, \tilde{\theta}) = f(\tau | \tilde{z}) \times f(\tilde{z} | \tilde{\alpha}, \tilde{\theta}, \tilde{\omega}) \times f(\tilde{y} | \tilde{\alpha}, \tilde{\theta})$$

$$= \prod_j \mathbb{I}(\tau(\tilde{z}_j) = \text{rank}(\tilde{z}_j)) \leftarrow \text{CBT, geography, etc.}$$

$$\times \prod_j \prod_i N(\tilde{z}_{ij} | \tilde{\alpha}_i + \tilde{x}_i^0 \tilde{\theta}, \tilde{\omega}_j^{-1}) \leftarrow \text{latent scores corresponding to}$$

$$\times \prod_i N(\tilde{y}_i | \tilde{\alpha} + \tilde{x}_i' \tilde{\theta}, \tilde{\omega}_{j+1}^{-1}) \leftarrow \text{"training" PMT response}$$