The result is shown as follows:

par	AB	RMS	par	AB	RMS
μ_1	0.033	0.079	λ_{21}	0.036	0.245
μ_2	0.043	0.094	λ_{31}	0.192	0.214
μ_3	0.006	0.085	λ_{52}	0.004	0.023
μ_4	0.054	0.032	λ_{62}	0.032	0.149
μ_5	0.010	0.040	λ_{72}	0.102	0.179
μ_6	0.001	0.145	λ_{93}	0.010	0.086
μ_7	0.078	0.096	b	0.095	0.163
μ_8	0.039	0.056	γ_1	0.017	0.038
μ_9	0.028	0.029	γ_2	0.075	0.112

par	AB	RMS	par	AB	RMS
$\psi_{\epsilon 4}$	0.034	0.121	ψ_δ	0.024	0.059
$\psi_{\epsilon 5}$	0.006	0.059	ϕ_{11}	0.034	0.130
$\psi_{\epsilon 6}$	0.038	0.096	ϕ_{22}	0.027	0.106
$\psi_{\epsilon 7}$	0.077	0.040	ϕ_{12}	0.020	0.113

2. a. Let $y_i^* = (y_{i1}^*, y_{i2}^*, \dots, y_{i5}^*)^T$ be the latent continuous random vector corresponds to the dichotomous random vector $(z_{i1}, z_{i2}, \dots, z_{i5})^T$. ~~For~~ Denote $y_i = (y_{i1}, y_{i2}, y_{i3}, \dots)^T$. ~~and denote~~ And for $k = 4, \dots, 7$. $y_{ik} \propto \exp\{y_{ik}v_{ik} - \log(1+e^{v_{ik}})\}$ with $b(v_{ik}) = \log(1+e^{v_{ik}})$ and $v_{ik} = \log\frac{p_{ik}}{1-p_{ik}}$.

Then the measurement equation is,

$$y_{ik}^{*(g)} = \mu_k^{*(g)} + \Lambda_k^{*T(g)} w_i^{(g)} + \varepsilon_i^{(g)}, \quad k = 1,2,3,4,5$$

$$y_{ik}^{(g)} = \mu_k^{(g)} + \Lambda_k^{T(g)} w_i^{(g)} + \varepsilon_i^{(g)}, \quad k = 1,2,3$$

$$y_{ik}^{(g)} = \mu_k^{(g)} + \Lambda_k^{T} w_i^{(g)}, \quad k = 4, \dots, 7$$

And the structural equation is,

$$\eta_i^{(g)} = \Gamma^{(g)} \xi_i^{(g)} + \delta_i^{(g)}$$

To tackle the identification problem, we fix $\alpha_{m,1}^{(g)}$ and $\alpha_{m,b_m}^{(g)}$ are preassigned values. And we can select the first group as the reference group, and identify its ordered categorical variables by fixing both end thresholds as above. For any m, and $g \neq 1$, we ~~have~~ impose the restriction:

$$\alpha_{m,k}^{(g)} = \alpha_{m,k}^{(1)}, \quad k = 1, \dots, b_m$$

Also, we ~~should~~ can preassign some fixed value to some appropriate positions of $\Lambda_k^{*(g)}$, $\Lambda_k^{(g)}$, ~~like~~ for example, the (1,1) elements of $\Lambda_k^{*(g)}$ is 1.

b. ① Prior distribution for nonconstrained parameters in different groups are naturally assumed to be independent. So, in estimating the unconstrained parameters, we need to specify its own prior distribution, and the data in the corresponding group are used.

② For constrained parameters, only one prior distribution for these constrained parameters is ~~used~~ needed, and all the data in the groups should be combined in the estimation. Under this situation, we may not take a joint prior distribution for the factor loading matrix and the unique variance of the error measurement.

C. ~~To~~ In Bayesian analysis, testing invariance over the groups is equivalence to model comparison. Therefore, we can use Bayes factor or DIC for testing the invariance. Take Bayes factors as example.

$$B_{12} = \frac{p(X, Z \mid M_1)}{p(X, Z \mid M_2)}.$$

where (X, Z) is the observed data set. Let t be a path in $[0,1]$ to link M_1 and M_2, and $0 = t_{(0)} < t_{(1)} < \cdots < t_{(S)} < t_{(S+1)} = 1$ be fixed grids in $[0,1]$.

$$U(\theta, \alpha, Y, \Omega, X, Z, t) = d \log p(Y, \Omega, X, Z \mid \theta, \alpha, t)/dt$$

Then,

$$\log \hat{B}_{12} = \frac{1}{2} \sum_{s=0}^{S} (t_{(s+1)} - t_{(s)}) (\bar{U}_{(s+1)} + \bar{U}_{(s)}),$$

where $\bar{U}_{(s)} = \frac{1}{J} \sum_{j=1}^{J} U(\theta^{(j)}, \alpha^{(j)}, Y^{(j)}, X, Z, t_{(s)})$