How to Select Prior Variance in Bayesian Approximate Measurement Invariance?

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Abstract: Measurement invariance (MI) is a pre-requisite for comparing factor means across groups under the framework of latent variables. But in traditional multi-group factor analysis, strict invariant constraints are imposed on measurement parameters across groups. However, due to the complexity of modeling multi-group data, these strict constraints are unrealistic in real data analysis and can easily lead to poor model fitting. In fact, scalar invariance is almost unachievable in practice.

The Bayesian approximate MI proposed by Muthén and Asparouhov(2013) compensates for this limitation to some extent by providing a zero-mean, small-variance prior for the differences in measurement parameters. It allows for small differences between groups and avoids the problems caused by strict restrictions in classical method, such as poor model fitting, awkward model modifications and inflated Type I error rate.

However, two main problems in this method have hindered its application. Firstly, model evaluation remains underdeveloped. Secondly, there is no guideline for the selection of prior variance (e.g., De Bondt & Van Petegem, 2015; Fong, 2014). To address the latter problem and set a foundation for further research, four priors with different variance were provided to recover the latent mean difference under different conditions using one-factor models. The conditions of the Monte Carlo simulation study include: model size, number of groups, ratio of group size to model size and noninvariant size. Recommendations were provided based on the results to help researchers get unbiased and effective estimates in an approximate MI analysis, and a real data set was analyzed to demonstrate the validity and practical usefulness of this guideline.

Moreover, future studies should develop guideline for fitting criteria because our simulation study has found that model is still well-fitting when the estimates are biased. In addition, based on the results of simulation study, future studies are also suggested to estimate the noninvariant size of datasets and then choose the prior.

Keywords: Bayesian, approximate measurement invariance, prior