

Chi Square Difference Testing in Mplus with MLR and WLSM (but not WLSMV)

(for non-normal interval-level or continuous data)

- Use the Excel calculator for different tests with these two estimators, *Chi Square Difference Testing with Mplus's MLR and WLSM Estimators* (Bowen, 2021).
- For an application article, see [Bryant and Satorra \(2011\)](#).
- If using WLSMV, see resource, *Chi Square Difference Testing in Mplus with WLSMV Estimation* (Bowen, 2021)

The following is verbatim text from the Mplus website; retrieved Feb 2, 2014

<http://www.statmodel.com/chidiff.shtml>

Difference Testing Using Chi-Square

Following are the steps needed to compute a chi-square difference test in Mplus using the MLM (Satorra-Bentler), MLR, and WLSM chi-square. DIFFTEST should be used for MLMV and WLSMV. The nested model is the more restrictive model with more degrees of freedom than the comparison model.

1. Compute the difference test scaling correction cd , where $d0$ is the degrees of freedom in the nested model, $c0$ is the scaling correction factor for the nested model, $d1$ is the degrees of freedom in the comparison model, and $c1$ is the scaling correction factor for the comparison model. Be sure to use the correction factor given in the output for the H0 model.

$$cd = (d0 * c0 - d1 * c1) / (d0 - d1)$$

2. Compute the Satorra-Bentler scaled chi-square difference test TRd as follows:

$$TRd = (T0 * c0 - T1 * c1) / cd$$

where $T0$ and $T1$ are the MLM, MLR, or WLSM chi-square values for the nested and comparison model, respectively. For MLM and MLR the products $T0 * c0$ and $T1 * c1$ are the same as the corresponding ML chi-square values.

Difference Testing Using the Loglikelihood

Following are the steps needed to compute a chi-square difference test based on loglikelihood values and scaling correction factors obtained with the MLR estimator.

1. Estimate the nested and comparison models using MLR. The printout gives loglikelihood values L0 and L1 for the H0 and H1 models, respectively, as well as scaling correction factors c0 and c1 for the H0 and H1 models, respectively. For example,

$$L0 = -2,606, c0 = 1.450 \text{ with } 39 \text{ parameters } (p0 = 39)$$

$$L1 = -2,583, c1 = 1.546 \text{ with } 47 \text{ parameters } (p1 = 47)$$

2. Compute the difference test scaling correction where p0 is the number of parameters in the nested model and p1 is the number of parameters in the comparison model.

$$\begin{aligned} cd &= (p0 * c0 - p1 * c1) / (p0 - p1) \\ &= (39 * 1.450 - 47 * 1.546) / (39 - 47) = 2.014 \end{aligned}$$

3. Compute the chi-square difference test (TRd) as follows:

$$\begin{aligned} TRd &= -2 * (L0 - L1) / cd \\ &= -2 * (-2606 + 2583) / 2.014 = 22.840 \end{aligned}$$

Computing the Strictly Positive Satorra-Bentler Chi-Square Difference Test

The robust chi-square difference test can sometimes produce a negative value. An alternative approach that avoids this is given in:

Satorra, A., & Bentler, P.M. (2010). Ensuring positiveness of the scaled difference chi-square test statistic. *Psychometrika*, 75, 243-248.