Appendix A

Mplus syntax for parallel, tau-equivalent, and congeneric models

TITLE:

Parallel model

DATA:

FILE IS myData.csv;

VARIABLE:

NAMES ARE X1-X6;

MODEL:

TASKGOAL BY X1\* X2-X6 (lambda);

TASKGOAL@1;

X1-X6 (theta);

OUTPUT:

STDYX;

TITLE:

Tau-equivalent model

DATA:

FILE IS myData.csv;

VARIABLE:

NAMES ARE X1-X6;

MODEL:

TASKGOAL BY X1\* X2-X6 (lambda);

TASKGOAL@1;

X1-X6;

OUTPUT:

STDYX;

TITLE:

Congeneric model

DATA:

FILE IS myData.csv;

VARIABLE:

NAMES ARE X1-X6;

MODEL:

TASKGOAL BY X1\* X2-X6;

TASKGOAL@1;

X1-X6;

OUTPUT:

STDYX;

Appendix B

Mplus syntax for estimating *ω* within the congeneric model

TITLE:

Congeneric model, with omega estimate

DATA:

FILE IS myData.csv;

VARIABLE:

NAMES ARE X1-X6;

ANALYSIS:

BOOTSTRAP IS 5000;

MODEL:

TASKGOAL BY X1\* (L1)

X2 (L2)

X3 (L3)

X4 (L4)

X5 (L5)

X6 (L6);

TASKGOAL@1;

X1 (TH1);

X2 (TH2);

X3 (TH3);

X4 (TH4);

X5 (TH5);

X6 (TH6);

MODEL CONSTRAINT:

NEW(sumL sumth omega);

L1 > 0;

L2 > 0;

L3 > 0;

L4 > 0;

L5 > 0;

L6 > 0;

sumL = L1 + L2 + L3 + L4 + L5 + L6;

sumTH = TH1 + TH2 + TH3 + TH4 + TH5 + TH6;

omega = ((sumL)^2)/(((sumL)^2)+sumTH);

OUTPUT:

STDYX; CINT(bcbootstrap);

Appendix C

R Code for Omega Analyses

######################################################  
# Omega Analyses in Different R Packages  
######################################################  
  
  
#~~~~~~~~~~~~~~ R package "MBESS" ~~~~~~~~~~~~~~~~~~#  
  
# Kelley (2017)   
  
library(MBESS)  
  
# interval.type = "ml" indicates that the method used to find confidence interval is ml.  
# Other methods are available depending on the needs of the study.  
  
ci.reliability(data = myData, type = "omega", interval.type = "ml", conf.level = 0.95)

## $est  
## [1] 0.8144169  
##   
## $se  
## [1] 0.01702632  
##   
## $ci.lower  
## [1] 0.781046  
##   
## $ci.upper  
## [1] 0.8477879  
##   
## $conf.level  
## [1] 0.95  
##   
## $type  
## [1] "omega"  
##   
## $interval.type  
## [1] "maximum likelihood (wald ci)"

# coefficient alpha  
ci.reliability(data = myData, type = "alpha", interval.type = "ml", conf.level = 0.95)

## $est  
## [1] 0.7861023  
##   
## $se  
## [1] 0.01715837  
##   
## $ci.lower  
## [1] 0.7524725  
##   
## $ci.upper  
## [1] 0.8197321  
##   
## $conf.level  
## [1] 0.95  
##   
## $type  
## [1] "alpha"  
##   
## $interval.type  
## [1] "maximum likelihood (wald ci)"

#~~~~~~~~~~~~~~ R package "semTools" ~~~~~~~~~~~~~~~~~~#  
  
# Pornprasertmanit, Miller, Schoemann, & Rosseel (2013)  
  
# Three omega estimates are available in this package.  
# In addition to the conventional coefficient omega reported in the following,   
# an omega estimate that accounted for correlated measurement errors  
# and the hierarchical omega can also be calculated.  
# Details can be found in the package manual.  
  
library(lavaan)

## This is lavaan 0.5-20

## lavaan is BETA software! Please report any bugs.

##   
## Attaching package: 'lavaan'

## The following object is masked from 'package:MBESS':  
##   
## cor2cov

model <- 'f =~ x1 + x2 + x3 + x4 + x5 + x6'  
fit <- cfa(model, data = myData)  
  
library(semTools)

##

## ###############################################################################

## This is semTools 0.4-11

## All users of R (or SEM) are invited to submit functions or ideas for functions.

## ###############################################################################

##   
## Attaching package: 'semTools'

## The following object is masked from 'package:MBESS':  
##   
## ci.reliability

reliability(fit)[2, 1]

## [1] 0.814417

# coefficient alpha  
reliability(fit)[1, 1]

## [1] 0.7861023

#~~~~~~~~~~~~~~ R package "coefficientalpha" ~~~~~~~~~~~~~~~~~~#  
  
# Zhang & Yuan (2015)  
  
# This R package provides robust estimates of alpha and omega   
# as well as the corresponding confidence intervals  
# to deal with both outlying observations and missing data.  
  
library(coefficientalpha)

## Loading required package: rsem

## Loading required package: MASS

# Varphi refers to the downweighting rate (for the outlying observations);  
# by setting varphi at 0, the conventional non-robust omega is calculated.  
summary(omega(myData, varphi = 0, se = TRUE))

## Test of homogeneity  
## The robust F statistic is 0.93   
## with a p-value 0.4995   
##   
## The omega is 0.8144169 with the standard error 0.01661408.  
## The estimated omega is   
## omega 0.814  
## se 0.017  
## p-value (omega>0) 0.000  
## Confidence interval 0.782 0.847  
##   
##   
## Test of homogeneity  
## The robust F statistic is 0.93   
## with a p-value 0.4995   
## Note. The robust test failed to reject the assumption of homogeneity.

# coefficient alpha  
summary(alpha(myData, varphi = 0, se = TRUE))

## Test of tau-equavilence  
## The robust F statistic is 11.717   
## with a p-value 0   
## \*\*The F test rejected tau-equavilence\*\*  
##   
## The alpha is 0.7861023 with the standard error 0.01744227.  
## The estimated alpha is   
## alpha 0.786  
## se 0.017  
## p-value (alpha>0) 0.000  
## Confidence interval 0.752 0.820  
##   
##   
## Test of tau-equivalence   
## The robust F statistic is 11.717   
## with a p-value 0   
## Note. The robust test rejected the tau-equivalence assumption.