

APPENDIX 16.2: COMPUTER CODE FOR THE EXAMPLE APPLICATION

Printed below is the computer code used for multilevel MI in the data analysis example.

*** Description of the 'leadership' data set:

#

GRPID: indicator for work groups

JOBSAT: job satisfaction (Level 1)

NEGLEAD: ratings on negative leadership style (Level 1)

WLOAD: workload (Level 1, "low" vs. "high")

COHES: group cohesion (Level 2)

Multiple imputation is performed with an "empty" joint model using jomo. The

model of interest is fit using lme4, and the mitml package is used for pooling

tests and parameters.

library(lme4)

library(mitml)

set up random number generator

set.seed(1234)

load data

data(leadership)

*** Imputation phase:

#

set up "empty" model

fml <- list(NEGLEAD + JOBSAT + WLOAD ~ 1
+ (1|GRPID), # Level 1 model
COHES ~ 1) # Level 2 model

impute

imp <- jomoImpute(leadership, formula=fml,
n.burn=5000, n.iter=500, m=100)

assess convergence

summary(imp) # convergence criteria ("Rhat")

plot(imp) # diagnostic plots

create list of completed data sets

implist <- mitmlComplete(imp, print="all")

*** Analysis phase:

#

apply group-mean centering

```
implist <- within(implist,{
  G.NEGLEAD <- clusterMeans(NEGLEAD,GRPID)
  I.NEGLEAD <- NEGLEAD - G.NEGLEAD
})
```

fit model of interest and pool parameter estimates

```
fit <- with(implist, lmer(JOBSAT ~ I.NEGLEAD +
  G.NEGLEAD + WLOAD + COHES + (1|GRPID)))
testEstimates(fit, var.comp=TRUE)
```

test for random slope of leadership style (using D3)

```
fit2 <- with(implist, lmer(JOBSAT ~ I.NEGLEAD +
  G.NEGLEAD + WLOAD + COHES +
  (1+I.NEGLEAD|GRPID)))
anova(fit, fit2)
```

test for contextual effect of leadership style
(using D1)

```
context <- "G.NEGLEAD - I.NEGLEAD"
testConstraints(fit, constraint=context)
```

Printed below is the *Mplus* syntax that was used for ML estimation of the model of interest.

DATA:

file = leadership.dat;

VARIABLE:

names = GRPID JOBSAT COHES NEGLEAD
WLOAD;

usevariables = JOBSAT COHES NEGLEAD WLOAD
NEGLEADM;

within = NEGLEAD;

between = COHES NEGLEADM;

cluster = GRPID;

missing = all (-99);

DEFINE:

NEGLEADM = cluster_mean (NEGLEAD);

! calculate group means from the observed data
center NEGLEAD (groupmean); ! group-mean
centering

ANALYSIS:

type = twolevel;

estimator = ml;

MODEL:

%within%

JOB SAT on NEGLEAD

WLOAD (1); ! restrict effect of workload to be
equal at both levels

NEGLEAD with WLOAD; ! explanatory variables
as endogenous, allow covariances

%between%

JOB SAT on NEGLEADM COHES

WLOAD (1); ! restrict effect of workload to be
equal at both levels

NEGLEADM with COHES; ! explanatory
variables as endogenous, allow covariances

NEGLEADM with WLOAD;

COHES with WLOAD;