Structural Equation Modeling

P.04 - Estimation Methods in SEM

03.11.2021

Lab Description

For this practical you will need the following packages:

- `lavaan`
- `semPlot`
- `psych`
- `ggplot2`

You can install and load these packages using the following code:

```r
# Install packages.
install.packages(c("lavaan", "semPlot", "psych", "ggplot2"))

# Load the packages.
library(lavaan)
library(semPlot)
library(psych)
library(ggplot2)
```

Exercise 1

Upon installing the `R` packages mentioned above perform the following:

b. Import the dataset `ELEMM1.csv` that is available in the folder for this practical on Canvas.

c. Inspect the *skewness* and *kurtosis* of `ITEM1` to `ITEM22` using the `psych` package. Do you see indications of severe deviations from normality?

d. Estimate the model in Figure 1 using the default Maximum Likelihood method.

e. Re-estimate the model, but now use the Satorra-Bentler estimator to estimate the *MFTS*. How does the scaling factors relate to the unscaled χ^2 value?

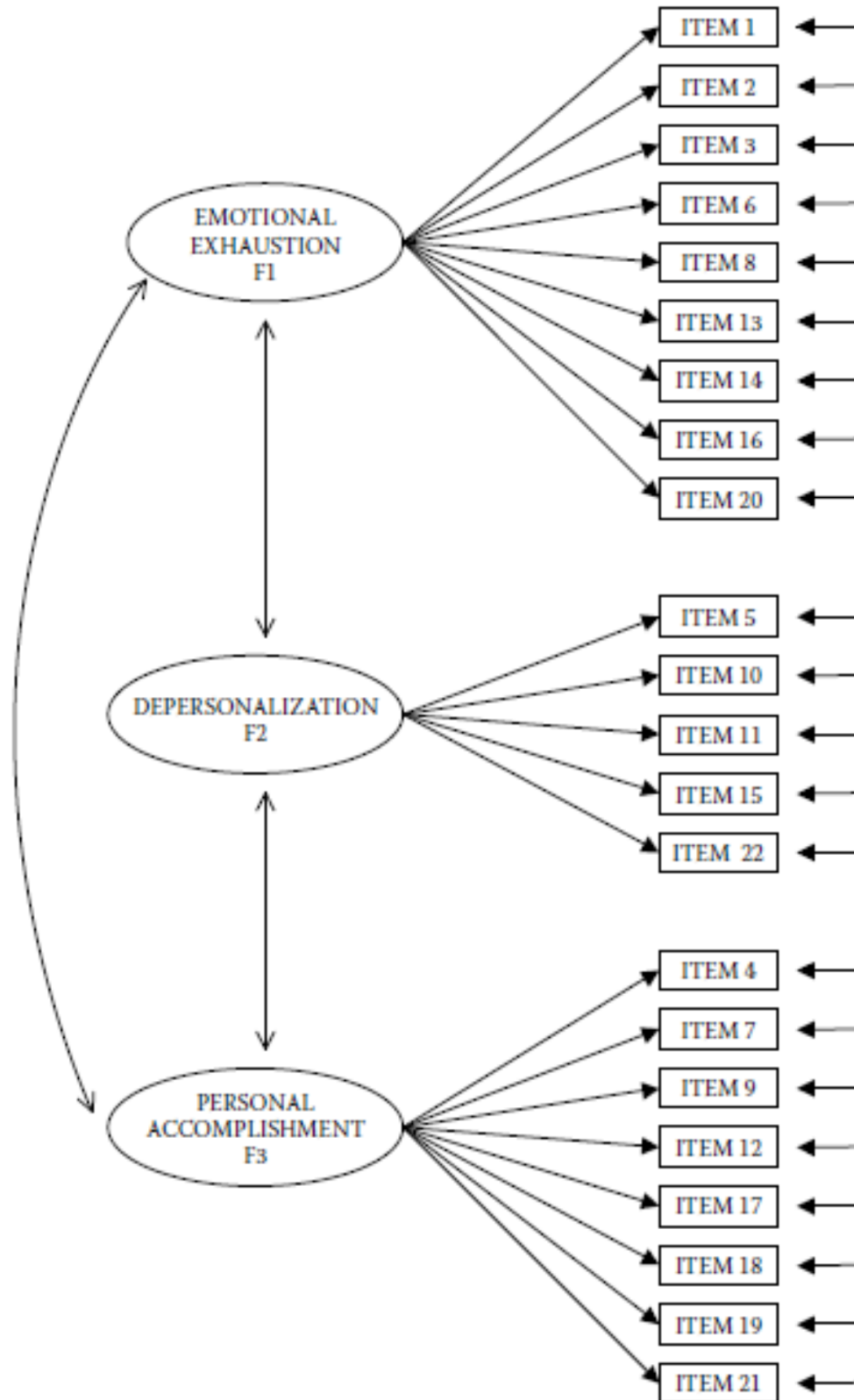f. Evaluate the fit of the model estimated in (e).

Figure 1: Hypothesized CFA model of factorial structure for the *Maslach Burnout Inventory* (MBI).

Exercise 2

a. Import the dataset `bdihk2c2.csv` that is available in the folder for this practical on Canvas.

b. Inspect the *skewness* and *kurtosis* of `BDI2_1` to `BDI2_20` using the `psych` package. Do you see indications of severe deviations from normality?

c. Develop histograms (using the `ggplot2` packages) for the variables. What do you learn from the inspection of these histograms?

  - *Tip: When working with R you will often encounter parts that you just don't know how to implement, so don't be ashamed to Google things (e.g., "how to create and histogram using ggplot2 in R").*

d. Estimate the model in Figure 2, but with the following addition constraints and model estimation specifications:

  1. Use `BDI2_3`, `BDI2_12`, and `BDI2_16` as marker variables.
  2. Constraint the variances of `F1`, `F2`, and `F3` to be equal.
  3. Fix the variance of `F4` to 1.
  4. Define the observed variables as ordered categorical variables.
  5. Use as estimator the *Mean and Variance Adjusted Weighted Least Squares* estimator (WLSMV).
  6. Evaluate the fit of this model.

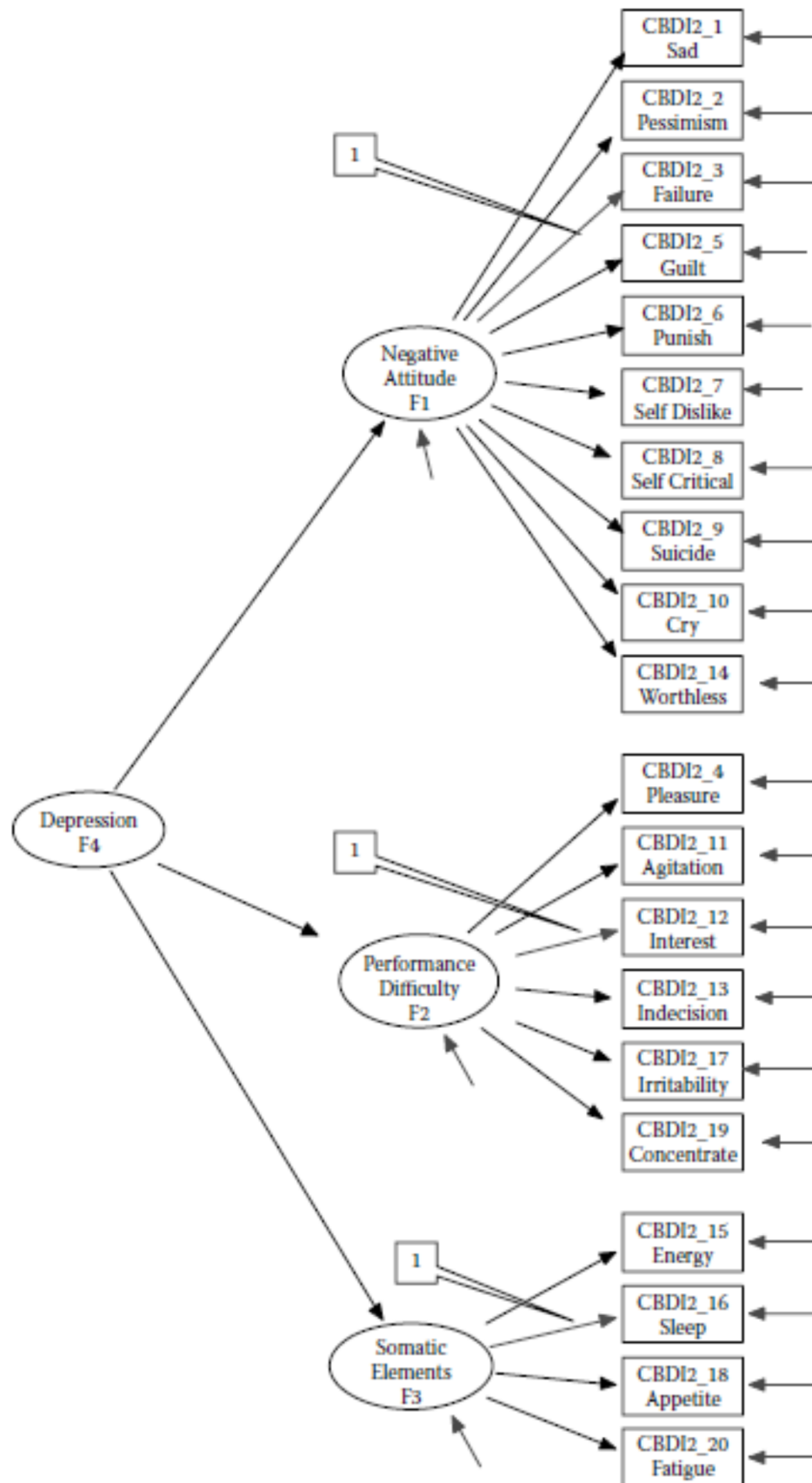*Note:* variables miss a `C` in the labeling, so `CBD` in picture is `BD` in the dataset.

Figure 2: Hypothesized second-order model of factorial structure for the Chinese version of the *Beck Depression Inventory II.*