

Structural Equation Modeling

P.04 - Estimation Methods in SEM

November 01, 2022

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:

```
# 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:

- Import the dataset `ELEMM1.csv` that is available in the folder for this practical on Canvas.
- Inspect the *skewness* and *kurtosis* of `ITEM1` to `ITEM22` using the `psych` package. Do you see indications of severe deviations from normality?
- Estimate the model in Figure 1 using the default Maximum Likelihood method.
- 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?
- Evaluate the fit of the model estimated in (e).

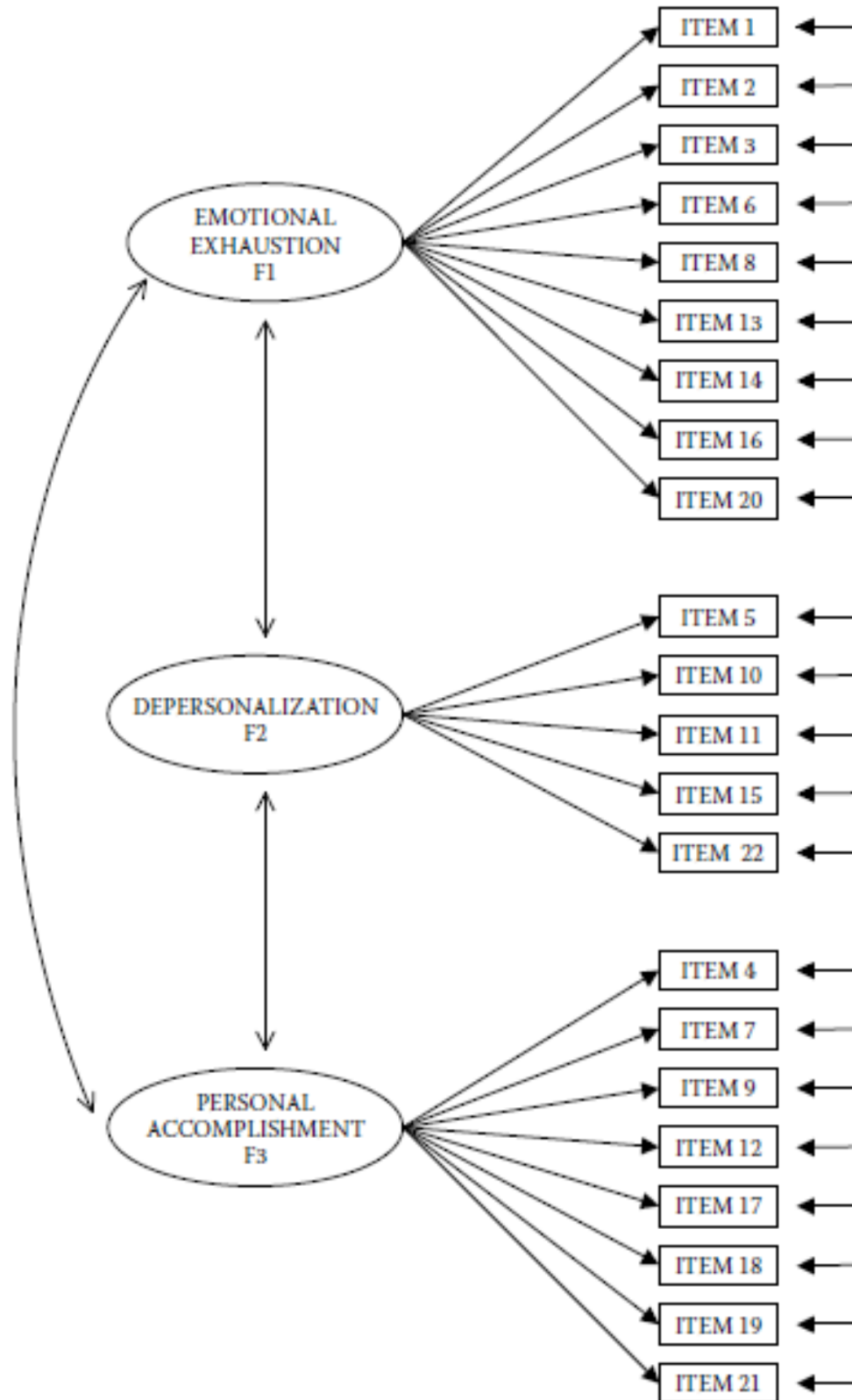


Figure 1: Hypothesized CFA model of factorial structure for the *Maslach Burnout Inventory* (MBI).

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` package) for the variables BDI2_1 and BDI2_20. 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 additional constraints and model estimation specifications:
 1. Use BDI2_3, BDI2_12, and BDI2_16 as marker variables.
 2. Constrain 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.

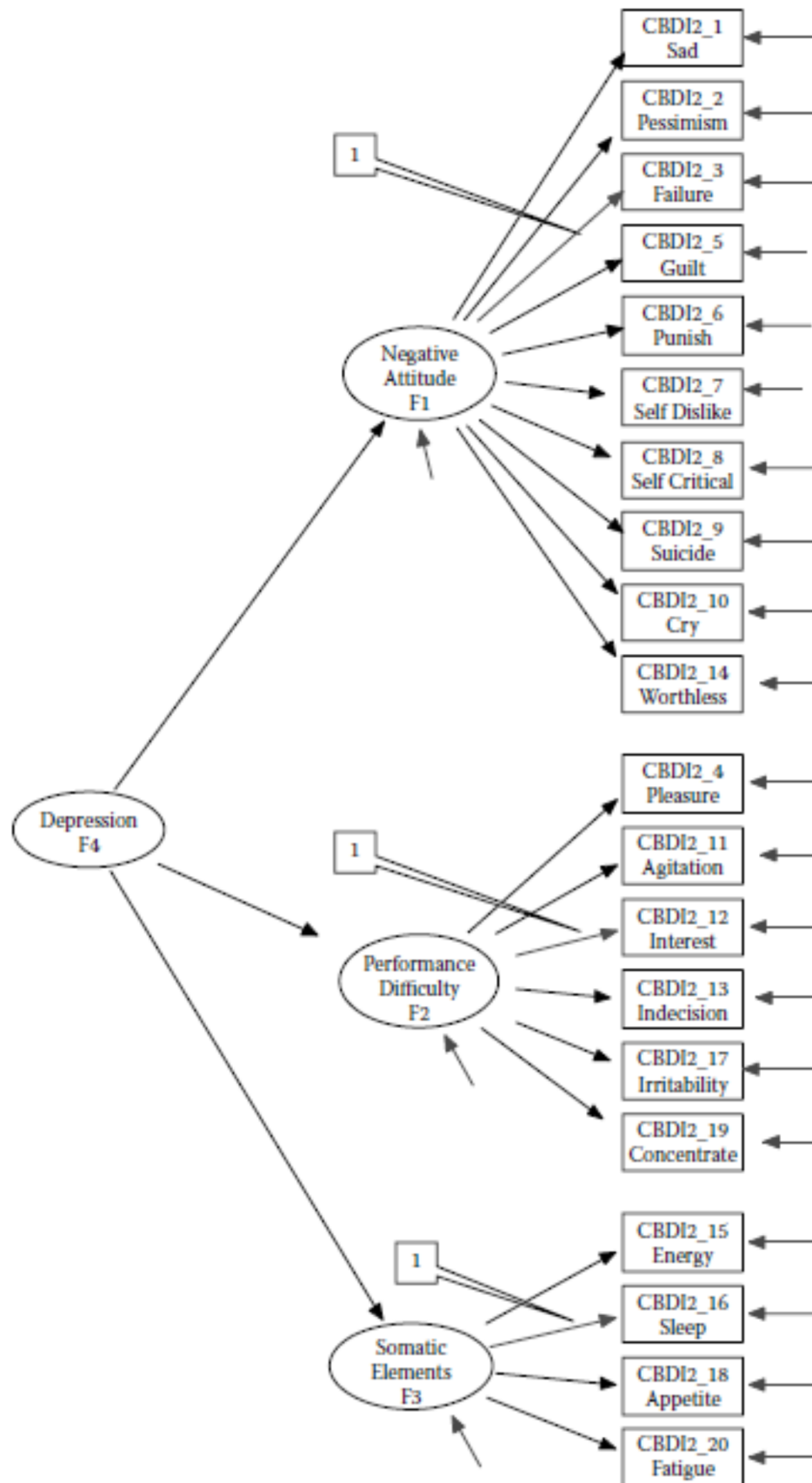


Figure 2: Hypothesized second-order model of factorial structure for the Chinese version of the *Beck Depression Inventory II*.