

Factor Analysis

July 4, 2023

Table of contents

T13	4
EFA	4
CFA	4
T14	6
EFA	6
CFA	6
T15	8
EFA	8
CFA	8

```

library(tidyverse)
library(scales)
library(glue)

library(psych)
library(lavaan)

library(parameters)
library(performance)
library(flextable)

print_EFA_table <- function(efa) {
  EFA_partab <- model_parameters(efa)

  EFA_partab |>
    mutate(
      across(where(is.numeric), number_format(0.01))
    ) |>
    flextable() |> autofit() |>
    color(i = which(abs(EFA_partab$PA1) <= 0.4), j = 2, color = "grey90") |>
    color(i = which(abs(EFA_partab$PA2) <= 0.4), j = 3, color = "grey90") |>
    color(i = which(abs(EFA_partab$PA1) > 0.71), j = 2, color = "red") |>
    color(i = which(abs(EFA_partab$PA2) > 0.71), j = 3, color = "red") |>
    footnote(
      j = 2:3, part = "header", ref_symbols = c("*"),
      value = as_paragraph("Grey: |loadings| < 0.4; Red: |loadings| > 0.71")
    )
}

print_CFA_table <- function(cfa) {
  CFA_metrics <- model_performance(cfa, metrics = c("CFI", "GFI")) |>
    mutate(
      across(where(is.numeric), number_format(0.01))
    ) |>
    pivot_longer(everything()) |>
    glue_data("{name} = {value}") |>
    glue_collapse(sep = "; ")

  CFA_tab <- model_parameters(cfa, component = "loading", standardize = TRUE) |>
    rename(Factor = To, Item = From) |>

```

```

    select(-Operator)

format(CFA_tab)[[1]] |>
  flextable() |> autofit() |>
  merge_v(j = 1) |>
  theme_booktabs() |>
  hline(i = 4) |>
  footnote(j = 1, part = "header", ref_symbols = c("*"), value = as_paragraph(CFA_metric))
}

# Tidy data
W131415 <- haven::read_sav("data-raw/W131415.sav")

labels <- c("Happy", "Excited", "Entheus", "Curious",
            "Anx", "Tense", "Angry", "Sad", "Desparate")

# Happy is loaded from both
mod <- "
  POSITIVE =~ Happy + Excited + Entheus + Curious
  NEGATIVE =~ Anx + Tense + Angry + Sad + Desparate + Happy

  POSITIVE ~~ NEGATIVE
"

```

T13

```
W13 <- W131415 |>
  select(happy13, excited13, entheus13, curious13,
         anx13, tense13, angry13, sad13, desparate13) |>
  set_names(nm = labels)
```

EFA

```
EFA13 <- fa(W13, nfactors = 2,
            fm = "pa", rotate = "varimax", cor = "cov")

print_EFA_table(EFA13)
```

Variable	PA1 [*]	PA2 [*]	Complexity	Uniqueness
Happy	-0.47	0.63	1.86	0.51
Excited	0.04	0.87	1.00	0.48
Entheus	-0.21	0.85	1.12	0.38
Curious	0.11	0.61	1.06	1.14
Anx	0.76	-0.01	1.00	0.47
Tense	0.86	0.00	1.00	0.45
Angry	0.77	0.03	1.00	0.72
Sad	0.76	-0.15	1.08	0.57
Desparate	0.88	-0.13	1.04	0.53

* Grey: |loadings| < 0.4; Red: |loadings| > 0.71

CFA

```
CFA13 <- cfa(mod, data = W13)

print_CFA_table(CFA13)
```

Factor [*]	Item	Coefficient	SE	CI	z	p
POSITIVE	Happy	0.59	0.03	[0.53, 0.64]	20.83	< .001
	Excited	0.72	0.03	[0.67, 0.77]	28.33	< .001
	Enthus	0.85	0.02	[0.81, 0.90]	38.08	< .001
	Curious	0.45	0.03	[0.38, 0.52]	12.99	< .001
NEGATIVE	Anx	0.76	0.02	[0.72, 0.80]	37.69	< .001
	Tense	0.80	0.02	[0.76, 0.83]	43.63	< .001
	Angry	0.66	0.03	[0.61, 0.71]	26.28	< .001
	Sad	0.70	0.02	[0.66, 0.75]	30.75	< .001
	Desperate	0.76	0.02	[0.72, 0.80]	37.91	< .001
	Happy	-0.36	0.03	[-0.42, -0.30]	-11.96	< .001

^{*} CFI = 0.94; GFI = 0.94

T14

```
W14 <- W131415 |>
  select(W14Happy, W14Excited, W14Entheus, W14Curious,
         W14Anx, W14Tense, W14angry, W14Sad, W14Desperate) |>
  set_names(nm = labels)
```

EFA

```
EFA14 <- fa(W14, nfactors = 2,
            fm = "pa", rotate = "varimax", cor = "cov")

print_EFA_table(EFA14)
```

Variable	PA1 [*]	PA2 [*]	Complexity	Uniqueness
Happy	-0.47	0.66	1.81	0.50
Excited	0.00	0.82	1.00	0.54
Entheus	-0.22	0.89	1.12	0.40
Curious	0.09	0.67	1.04	1.11
Anx	0.78	-0.07	1.02	0.65
Tense	0.87	0.01	1.00	0.54
Angry	0.77	0.01	1.00	0.73
Sad	0.81	-0.10	1.03	0.45
Desperate	0.88	-0.22	1.13	0.65

* Grey: |loadings| < 0.4; Red: |loadings| > 0.71

CFA

```
CFA14 <- cfa(mod, data = W14)

print_CFA_table(CFA14)
```

Factor [*]	Item	Coefficient	SE	CI	z	p
POSITIVE	Happy	0.59	0.03	[0.54, 0.65]	20.39	< .001
	Excited	0.69	0.03	[0.64, 0.75]	26.13	< .001
	Enthus	0.86	0.02	[0.82, 0.91]	38.32	< .001
	Curious	0.48	0.03	[0.41, 0.55]	13.74	< .001
NEGATIVE	Anx	0.69	0.02	[0.64, 0.74]	28.30	< .001
	Tense	0.74	0.02	[0.70, 0.78]	33.46	< .001
	Angry	0.67	0.03	[0.62, 0.72]	26.05	< .001
	Sad	0.77	0.02	[0.73, 0.81]	37.95	< .001
	Desperate	0.76	0.02	[0.71, 0.80]	35.55	< .001
	Happy	-0.36	0.03	[-0.42, -0.29]	-11.27	< .001

^{*} CFI = 0.93; GFI = 0.94

T15

```
W15 <- W131415 |>
  select(W15Happy, W15Excited, W15Enteus, W15Curious,
         W15Anx, W15Tense, W15Angry, W15Sad, W15Desperate) |>
  set_names(nm = labels)
```

EFA

```
EFA15 <- fa(W15, nfactors = 2,
            fm = "pa", rotate = "varimax", cor = "cov")

print_EFA_table(EFA15)
```

Variable	PA1 [*]	PA2 [*]	Complexity	Uniqueness
Happy	-0.56	0.66	1.94	0.48
Excited	0.05	0.79	1.01	0.54
Entheus	-0.24	0.77	1.19	0.54
Curious	0.12	0.56	1.10	1.15
Anx	1.06	-0.02	1.00	0.58
Tense	1.09	-0.01	1.00	0.50
Angry	1.03	-0.01	1.00	0.77
Sad	0.94	-0.08	1.01	0.70
Desperate	1.15	-0.13	1.03	0.66

* Grey: |loadings| < 0.4; Red: |loadings| > 0.71

CFA

```
CFA15 <- cfa(mod, data = W15)

print_CFA_table(CFA15)
```

Factor [*]	Item	Coefficient	SE	CI	z	p
POSITIVE	Happy	0.63	0.03	[0.56, 0.70]	18.30	< .001
	Excited	0.61	0.04	[0.54, 0.68]	16.89	< .001
	Entheus	0.81	0.03	[0.75, 0.87]	25.52	< .001
	Curious	0.37	0.05	[0.28, 0.46]	8.23	< .001
NEGATIVE	Anx	0.82	0.02	[0.79, 0.86]	45.50	< .001
	Tense	0.85	0.02	[0.81, 0.88]	51.33	< .001
	Angry	0.75	0.02	[0.71, 0.80]	33.34	< .001
	Sad	0.74	0.02	[0.70, 0.79]	32.28	< .001
	Desperate	0.81	0.02	[0.78, 0.85]	43.91	< .001
	Happy	-0.40	0.04	[-0.46, -0.33]	-11.24	< .001

^{*} CFI = 0.95; GFI = 0.94