HW15

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5/28/2022

Please note that all code in this document is presented in a grey box and the output reflected below each box

- The below code allows lengthy lines of comments to display neatly within the grey box (wrapping it)

```r
knitr::opts_chunk$set(tidy.opts = list(width.cutoff = 60), tidy = TRUE)
```

1) Composite Path Models using PLS-PM

```r
# Importing data
sec <- read.csv("security_data_sem.csv", header = TRUE)
```

a) Create a PLS path model using SEMinR, with all the following characteristics:

i) Measurement model – all constructs are measured as composites:

- 1. Trust in website (TRUST): items TRST1 - TRST4
- 2. Perceived security of website (SEC): items PSEC1 - PSEC4
- 3. Reputation of website (REP): items PREP1 - PREP4
- 4. Investment in website (INV): items PINV1 - PINV3
- 5. Perception of privacy policies (POL): items PPSS1 - PPSS3
- 6. Familiarity with website (FAML): item FAML1
- 7. Interaction between REP and POL (use orthogonalized product terms)

```r
require(seminr)  # used for estimating structural equation models

# Measurement Model
sec_mm <- constructs(composite("TRUST", multi_items("TRST", 1:4)),
    composite("SEC", multi_items("PSEC", 1:4)), composite("REP",
        multi_items("PREP", 1:4)), composite("POL", multi_items("PPSS",
        1:3)), composite("FAML", single_item("FAML1")), composite("INV",
        multi_items("PINV", 1:3)), interaction_term("REP", "POL",
        orthogonal)  # Orthogonalized Interaction term
)
```

ii) Structural Model – paths between constructs as shown in this causal model:

REP + INV + POL + FAML + (REP*POL) to SEC to TRUST

```
# Structural Model
sec_sm <- relationships(paths(from = c("REP", "INV", "POL", "FAML",
    "REP*POL"), to = "SEC"), paths(from = "SEC", to = "TRUST"))
```

b) Show us the following results in table or figure formats:

i) Plot a figure of the estimated model:
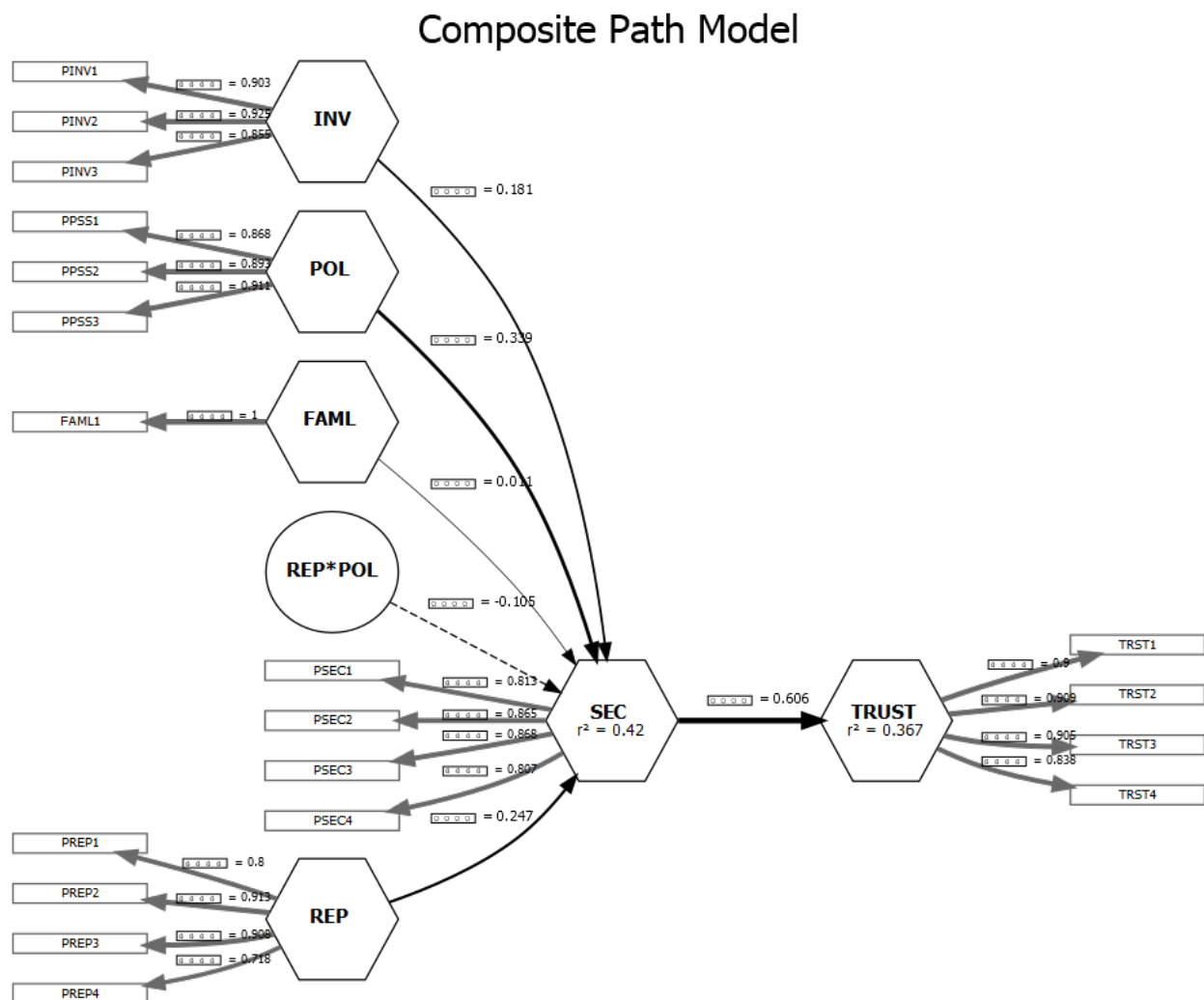
Estimated Model

Figure 1: Estimated Model

ii) Weights and loadings of composites:

```
# Weights
require(knitr)  # Used for creating tables with kable function
kable(sec_pls$outer_weights |>
    round(2), caption = "Weights of Composites", align = "c")  # Print table of weights
```

Table 1: Weights of Composites

	REP	INV	POL	FAML	REP*POL	SEC	TRUST
TRST1	0.00	0.00	0.00	0	0.00	0.00	0.28
TRST2	0.00	0.00	0.00	0	0.00	0.00	0.28
TRST3	0.00	0.00	0.00	0	0.00	0.00	0.29
TRST4	0.00	0.00	0.00	0	0.00	0.00	0.28
PSEC1	0.00	0.00	0.00	0	0.00	0.28	0.00
PSEC2	0.00	0.00	0.00	0	0.00	0.31	0.00
PSEC3	0.00	0.00	0.00	0	0.00	0.31	0.00
PSEC4	0.00	0.00	0.00	0	0.00	0.29	0.00
PREP1	0.22	0.00	0.00	0	0.00	0.00	0.00
PREP2	0.33	0.00	0.00	0	0.00	0.00	0.00
PREP3	0.35	0.00	0.00	0	0.00	0.00	0.00
PREP4	0.29	0.00	0.00	0	0.00	0.00	0.00
PPSS1	0.00	0.00	0.36	0	0.00	0.00	0.00
PPSS2	0.00	0.00	0.39	0	0.00	0.00	0.00
PPSS3	0.00	0.00	0.37	0	0.00	0.00	0.00
FAML1	0.00	0.00	0.00	1	0.00	0.00	0.00
PINV1	0.00	0.36	0.00	0	0.00	0.00	0.00
PINV2	0.00	0.40	0.00	0	0.00	0.00	0.00
PINV3	0.00	0.36	0.00	0	0.00	0.00	0.00
PREP1*PPSS1	0.00	0.00	0.00	0	0.24	0.00	0.00
PREP1*PPSS2	0.00	0.00	0.00	0	0.03	0.00	0.00
PREP1*PPSS3	0.00	0.00	0.00	0	0.02	0.00	0.00
PREP2*PPSS1	0.00	0.00	0.00	0	0.05	0.00	0.00
PREP2*PPSS2	0.00	0.00	0.00	0	-0.10	0.00	0.00
PREP2*PPSS3	0.00	0.00	0.00	0	-0.23	0.00	0.00
PREP3*PPSS1	0.00	0.00	0.00	0	-0.34	0.00	0.00
PREP3*PPSS2	0.00	0.00	0.00	0	0.09	0.00	0.00
PREP3*PPSS3	0.00	0.00	0.00	0	0.11	0.00	0.00
PREP4*PPSS1	0.00	0.00	0.00	0	0.44	0.00	0.00
PREP4*PPSS2	0.00	0.00	0.00	0	0.38	0.00	0.00
PREP4*PPSS3	0.00	0.00	0.00	0	0.27	0.00	0.00

```
# Loadings
kable(sec_pls$outer_loadings |>
    round(2), caption = "Loadings of Composites", align = "c")  # Print table of Loading's
```

Table 2: Loadings of Composites

	REP	INV	POL	FAML	REP*POL	SEC	TRUST
TRST1	0.00	0.00	0.00	0	0.00	0.00	0.90
TRST2	0.00	0.00	0.00	0	0.00	0.00	0.91
TRST3	0.00	0.00	0.00	0	0.00	0.00	0.90
TRST4	0.00	0.00	0.00	0	0.00	0.00	0.84
PSEC1	0.00	0.00	0.00	0	0.00	0.81	0.00
PSEC2	0.00	0.00	0.00	0	0.00	0.87	0.00
PSEC3	0.00	0.00	0.00	0	0.00	0.87	0.00
PSEC4	0.00	0.00	0.00	0	0.00	0.81	0.00
PREP1	0.80	0.00	0.00	0	0.00	0.00	0.00
PREP2	0.91	0.00	0.00	0	0.00	0.00	0.00
PREP3	0.91	0.00	0.00	0	0.00	0.00	0.00
PREP4	0.72	0.00	0.00	0	0.00	0.00	0.00
PPSS1	0.00	0.00	0.87	0	0.00	0.00	0.00
PPSS2	0.00	0.00	0.89	0	0.00	0.00	0.00
PPSS3	0.00	0.00	0.91	0	0.00	0.00	0.00
FAML1	0.00	0.00	0.00	1	0.00	0.00	0.00
PINV1	0.00	0.90	0.00	0	0.00	0.00	0.00
PINV2	0.00	0.92	0.00	0	0.00	0.00	0.00
PINV3	0.00	0.85	0.00	0	0.00	0.00	0.00
PREP1*PPSS1	0.00	0.00	0.00	0	0.58	0.00	0.00
PREP1*PPSS2	0.00	0.00	0.00	0	0.51	0.00	0.00
PREP1*PPSS3	0.00	0.00	0.00	0	0.51	0.00	0.00
PREP2*PPSS1	0.00	0.00	0.00	0	0.51	0.00	0.00
PREP2*PPSS2	0.00	0.00	0.00	0	0.42	0.00	0.00
PREP2*PPSS3	0.00	0.00	0.00	0	0.34	0.00	0.00
PREP3*PPSS1	0.00	0.00	0.00	0	0.24	0.00	0.00
PREP3*PPSS2	0.00	0.00	0.00	0	0.55	0.00	0.00
PREP3*PPSS3	0.00	0.00	0.00	0	0.47	0.00	0.00
PREP4*PPSS1	0.00	0.00	0.00	0	0.90	0.00	0.00
PREP4*PPSS2	0.00	0.00	0.00	0	0.84	0.00	0.00
PREP4*PPSS3	0.00	0.00	0.00	0	0.86	0.00	0.00

iii) Regression coefficients of paths between factors

```r
sec_sum <- summary(sec_pls)  # Variable for summary

# Coefficients
kable(sec_sum$paths |>
    round(2), caption = "Coefficients of Paths", align = "c")  # Print table of Coefficients
```

Table 3: Coefficients of Paths

	SEC	TRUST
R^2	0.42	0.37
AdjR^2	0.41	0.37
REP	0.25	NA
INV	0.18	NA

	SEC	TRUST
POL	0.34	NA
FAML	0.01	NA
REP*POL	-0.10	NA
SEC	NA	0.61

iv) Bootstrapped path coefficients: t-values, 95% CI

```
# Variables for Bootstrapped model & coefficients
boot_pls <- bootstrap_model(sec_pls, nboot = 1000)
boot_pls_sum <- summary(boot_pls)
boot_pls_sum$bootstrapped_paths[, 4:6]
```

```
##                    T Stat.      2.5% CI   97.5% CI
## REP  ->  SEC     4.3297173  0.13429009 0.3550873
## INV  ->  SEC     3.2043944  0.07335112 0.2945384
## POL  ->  SEC     6.3324306  0.22917828 0.4456917
## FAML  ->  SEC     0.1827396 -0.09703474 0.1283667
## REP*POL  ->  SEC -0.8271601 -0.19632041 0.1919901
## SEC  ->  TRUST  17.2429811  0.53803679 0.6747854
```

```
# Print table of Bootstrapped Path Coefficients: t-values,
# 95% CI
kable(boot_pls_sum$bootstrapped_paths[, c(1, 4:6)] |>
    round(2), caption = "Coefficients of Paths", align = "c")
```

Table 4: Coefficients of Paths

	Original Est.	T Stat.	2.5% CI	97.5% CI
REP -> SEC	0.25	4.33	0.13	0.36
INV -> SEC	0.18	3.20	0.07	0.29
POL -> SEC	0.34	6.33	0.23	0.45
FAML -> SEC	0.01	0.18	-0.10	0.13
REP*POL -> SEC	-0.10	-0.83	-0.20	0.19
SEC -> TRUST	0.61	17.24	0.54	0.67

2) Common-Factor Models using CB-SEM

a) Create a common factor model using SEMinR, with the following characteristics:

i) Respecifying all the constructs using the as.reflective() function

```
# Measurement Model
sec_cf_mm <- constructs(reflective("TRUST", multi_items("TRST",
    1:4)), reflective("SEC", multi_items("PSEC", 1:4)), reflective("REP",
```

```
    multi_items("PREP", 1:4)), reflective("POL", multi_items("PPSS",
    1:3)), reflective("FAML", single_item("FAML1")), reflective("INV",
    multi_items("PINV", 1:3)), interaction_term("REP", "POL",
    orthogonal)  # Orthogonalized Interaction term
)
```

ii) Use the same structural model as before

```
# Estimate model using CB-SEM
sec_cf_pls <- estimate_cbsem(data = sec, measurement_model = sec_cf_mm,
    structural_model = sec_sm)
```
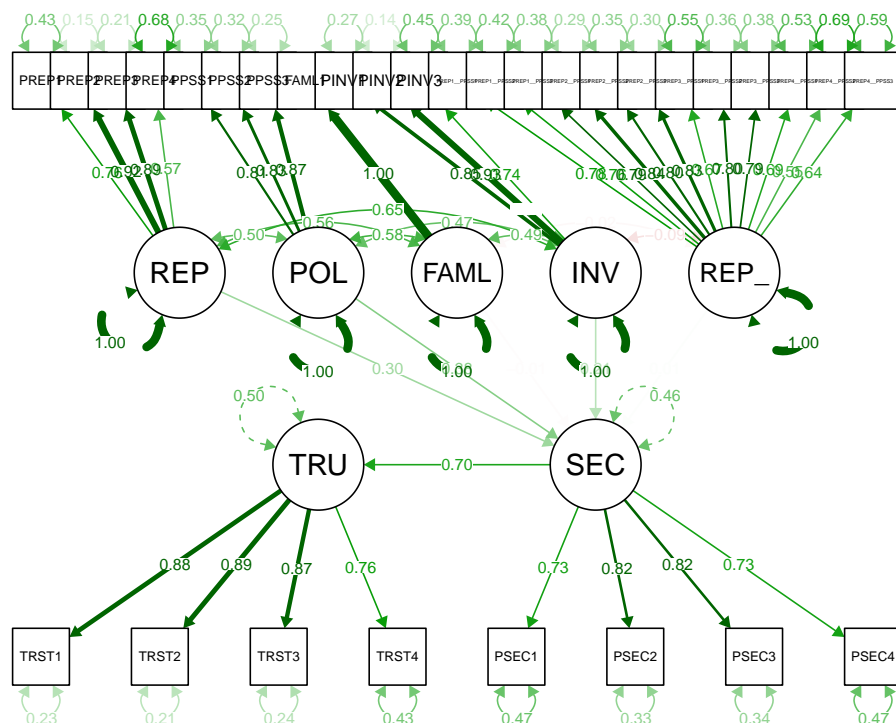
b) Show us the following results in table or figure formats

i) Plot a figure of the estimated model

```
require("semPlot")  # Used to plot CB-SEM model
plot(sec_cf_pls, title = "Common Factor Model")
```



```
## NULL
```

ii) Loadings of composites

```
sec_cf_sum <- summary(sec_cf_pls)  # Variable for summary

# Loadings of Composites
kable(sec_cf_sum$loadings$coefficients |>
    round(2), caption = "Loadings of Composites", align = "c")  # Print table of Loading's
```

Table 5: Loadings of Composites

	TRUST	SEC	REP	POL	FAML	INV
TRST1	0.88	NA	NA	NA	NA	NA
TRST2	0.89	NA	NA	NA	NA	NA
TRST3	0.87	NA	NA	NA	NA	NA
TRST4	0.76	NA	NA	NA	NA	NA
PSEC1	NA	0.73	NA	NA	NA	NA
PSEC2	NA	0.82	NA	NA	NA	NA
PSEC3	NA	0.82	NA	NA	NA	NA
PSEC4	NA	0.73	NA	NA	NA	NA
PREP1	NA	NA	0.76	NA	NA	NA
PREP2	NA	NA	0.92	NA	NA	NA
PREP3	NA	NA	0.89	NA	NA	NA
PREP4	NA	NA	0.57	NA	NA	NA
PPSS1	NA	NA	NA	0.81	NA	NA
PPSS2	NA	NA	NA	0.83	NA	NA
PPSS3	NA	NA	NA	0.87	NA	NA
FAML1	NA	NA	NA	NA	1	NA
PINV1	NA	NA	NA	NA	NA	0.85
PINV2	NA	NA	NA	NA	NA	0.93
PINV3	NA	NA	NA	NA	NA	0.74

iii) Regression coefficients of paths between factors, and their p-values

```
# Regression Coefficients
kable(sec_cf_sum$paths$coefficients[, 1:2] |>
    round(2), caption = "Coefficients of Paths", align = "c")  # Print table of Coefficients
```

Table 6: Coefficients of Paths

	SEC	TRUST
R^2	0.54	0.5
REP	0.30	NA
INV	0.21	NA
POL	0.38	NA
FAML	-0.01	NA
REP_x_POL	0.01	NA
SEC	NA	0.7

```r
# P-values
kable(sec_cf_sum$paths$pvalues |>
    round(8), caption = "p-values", align = "c")  # Print table of p-values
```

Table 7: p-values

	SEC	TRUST
REP	0.0000382	NA
INV	0.0035345	NA
POL	0.0000000	NA
FAML	0.8996836	NA
REP_x_POL	0.8516847	NA
SEC	NA	0