BACS - HW (Week 16)

We will create a model like the one we saw in class, with several important differences. We will have several new constructs and include a single-item construct.

Question 1) Composite Path Models using PLS-PM.

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 (see the documentation of SEMinR for making single item constructs)**
      7. **Interaction between REP and POL (use orthogonalized product terms)**

```
#Installing package.
>install.packages("seminr")
>library(seminr)

#Creating measurement model.
> secdata <- read.csv("security_data_sem.csv")
> secdata_mm <- constructs(
+   composite("TRUST", multi_items("TRST", 1:4)),
+   composite("SEC", multi_items("PSEC", 1:4)),
+   composite("REP", multi_items("PREP", 1:4)),
+   composite("INV", multi_items("PINV", 1:3)),
+   composite("POL", multi_items("PPSS", 1:3)),
+   composite("FAML", single_item("FAML1")),
+   interaction_term(iv="REP", moderator="POL", method=orthogonal)
+ )
```

ii. **Structural Model – paths between constructs as shown in this causal model: REP + INV + POL + FAML + (REP×POL) → SEC → TRUST**

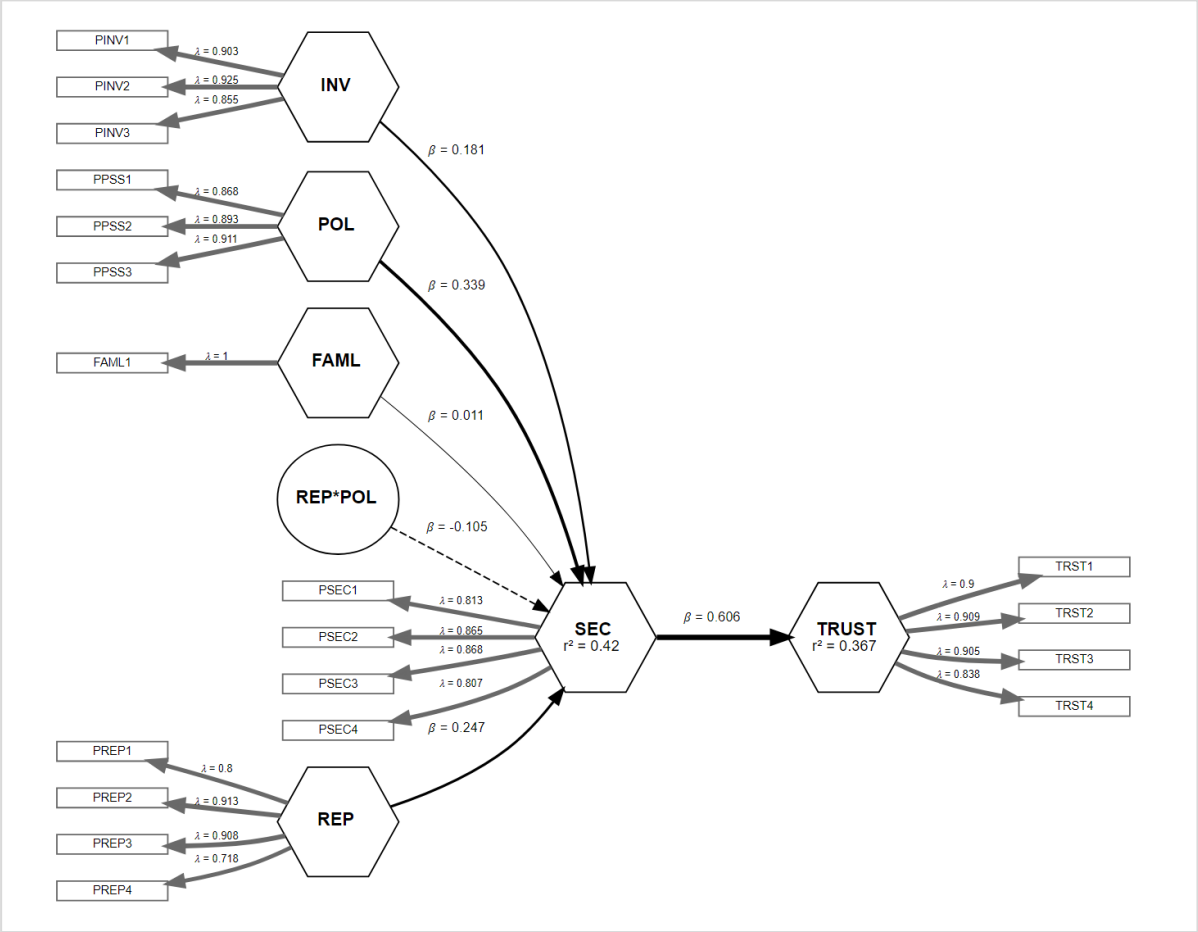
```
#Creating structural model.
> secdata_sm <- relationships(
+   paths(from = c("REP", "INV", "POL", "FAML", "REP*POL"), to = "SEC"),
+   paths(from = "SEC", to = "TRUST")
+ )

#Obtaining a PLS path model.
> secdata_pls <- estimate_pls(
+   data = secdata,
+   measurement_model = secdata_mm,
+   structural_model = secdata_sm
+ )

> summary(secdata_pls)
```

```
Results from  package seminr (2.1.0)

Path Coefficients:
           SEC TRUST
R^2      0.420 0.367
AdjR^2   0.412 0.365
REP      0.247     .
INV      0.181     .
POL      0.339     .
FAML     0.011     .
REP*POL -0.105     .
SEC          . 0.606

Reliability:
        alpha  rhoC   AVE  rhoA
REP     0.857 0.904 0.704 0.882
INV     0.875 0.923 0.801 0.879
POL     0.870 0.920 0.794 0.872
FAML    1.000 1.000 1.000 1.000
REP*POL 0.938 0.853 0.352 1.000
SEC     0.859 0.905 0.704 0.862
TRUST   0.911 0.937 0.789 0.911

Alpha, rhoC, and rhoA should exceed 0.7 while AVE should exceed 0.5
```

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

i. Plot a figure of the estimated model.

```
#Plotting the estimated model.
> plot(secdata_pls)
```



ii. Weights and loadings of composites.

#Storing summary in a report variable.

```
>secdata_report <- summary(secdata_pls)
```

#Obtaining weights.

```
> secdata_report$weights
```

	REP	INV	POL	FAML	REP*POL	SEC	TRUST
TRST1	0.000	0.000	0.000	0.000	0.000	0.000	0.282
TRST2	0.000	0.000	0.000	0.000	0.000	0.000	0.280
TRST3	0.000	0.000	0.000	0.000	0.000	0.000	0.286
TRST4	0.000	0.000	0.000	0.000	0.000	0.000	0.278
PSEC1	0.000	0.000	0.000	0.000	0.000	0.277	0.000
PSEC2	0.000	0.000	0.000	0.000	0.000	0.315	0.000
PSEC3	0.000	0.000	0.000	0.000	0.000	0.307	0.000
PSEC4	0.000	0.000	0.000	0.000	0.000	0.292	0.000
PREP1	0.215	0.000	0.000	0.000	0.000	0.000	0.000
PREP2	0.334	0.000	0.000	0.000	0.000	0.000	0.000
PREP3	0.349	0.000	0.000	0.000	0.000	0.000	0.000
PREP4	0.287	0.000	0.000	0.000	0.000	0.000	0.000
PINV1	0.000	0.363	0.000	0.000	0.000	0.000	0.000
PINV2	0.000	0.395	0.000	0.000	0.000	0.000	0.000
PINV3	0.000	0.358	0.000	0.000	0.000	0.000	0.000
PPSS1	0.000	0.000	0.360	0.000	0.000	0.000	0.000
PPSS2	0.000	0.000	0.395	0.000	0.000	0.000	0.000
PPSS3	0.000	0.000	0.367	0.000	0.000	0.000	0.000
FAML1	0.000	0.000	0.000	1.000	0.000	0.000	0.000
PREP1*PPSS1	0.000	0.000	0.000	0.000	0.239	0.000	0.000
PREP1*PPSS2	0.000	0.000	0.000	0.000	0.031	0.000	0.000
PREP1*PPSS3	0.000	0.000	0.000	0.000	0.021	0.000	0.000
PREP2*PPSS1	0.000	0.000	0.000	0.000	0.046	0.000	0.000
PREP2*PPSS2	0.000	0.000	0.000	0.000	-0.104	0.000	0.000
PREP2*PPSS3	0.000	0.000	0.000	0.000	-0.228	0.000	0.000
PREP3*PPSS1	0.000	0.000	0.000	0.000	-0.341	0.000	0.000
PREP3*PPSS2	0.000	0.000	0.000	0.000	0.095	0.000	0.000
PREP3*PPSS3	0.000	0.000	0.000	0.000	0.108	0.000	0.000
PREP4*PPSS1	0.000	0.000	0.000	0.000	0.443	0.000	0.000
PREP4*PPSS2	0.000	0.000	0.000	0.000	0.382	0.000	0.000
PREP4*PPSS3	0.000	0.000	0.000	0.000	0.271	0.000	0.000

#Obtaining loadings of composites.

```
> secdata_report$loadings
```

	REP	INV	POL	FAML	REP*POL	SEC	TRUST
TRST1	0.000	0.000	0.000	0.000	-0.000	0.000	0.900
TRST2	0.000	0.000	0.000	0.000	-0.000	0.000	0.909
TRST3	0.000	0.000	0.000	0.000	-0.000	0.000	0.905
TRST4	0.000	0.000	0.000	0.000	-0.000	0.000	0.838
PSEC1	0.000	0.000	0.000	0.000	-0.000	0.813	0.000
PSEC2	0.000	0.000	0.000	0.000	-0.000	0.865	0.000
PSEC3	0.000	0.000	0.000	0.000	-0.000	0.868	0.000
PSEC4	0.000	0.000	0.000	0.000	-0.000	0.807	0.000
PREP1	0.800	0.000	0.000	0.000	0.000	0.000	0.000
PREP2	0.913	0.000	0.000	0.000	0.000	0.000	0.000
PREP3	0.908	0.000	0.000	0.000	0.000	0.000	0.000
PREP4	0.718	0.000	0.000	0.000	0.000	0.000	0.000
PINV1	0.000	0.903	0.000	0.000	-0.000	0.000	0.000
PINV2	0.000	0.925	0.000	0.000	-0.000	0.000	0.000
PINV3	0.000	0.855	0.000	0.000	-0.000	0.000	0.000
PPSS1	0.000	0.000	0.868	0.000	0.000	0.000	0.000
PPSS2	0.000	0.000	0.893	0.000	0.000	0.000	0.000
PPSS3	0.000	0.000	0.911	0.000	0.000	0.000	0.000
FAML1	0.000	0.000	0.000	1.000	-0.000	0.000	0.000
PREP1*PPSS1	-0.000	-0.000	-0.000	-0.000	0.581	-0.000	-0.000
PREP1*PPSS2	-0.000	-0.000	0.000	-0.000	0.510	-0.000	-0.000
PREP1*PPSS3	-0.000	-0.000	-0.000	-0.000	0.506	-0.000	-0.000
PREP2*PPSS1	-0.000	-0.000	-0.000	-0.000	0.509	-0.000	-0.000
PREP2*PPSS2	-0.000	-0.000	0.000	-0.000	0.421	0.000	0.000
PREP2*PPSS3	-0.000	-0.000	-0.000	0.000	0.336	0.000	0.000
PREP3*PPSS1	-0.000	-0.000	-0.000	0.000	0.236	0.000	0.000
PREP3*PPSS2	-0.000	-0.000	0.000	-0.000	0.555	-0.000	-0.000
PREP3*PPSS3	-0.000	-0.000	-0.000	0.000	0.466	-0.000	-0.000
PREP4*PPSS1	0.000	-0.000	0.000	0.000	0.900	-0.000	-0.000
PREP4*PPSS2	-0.000	-0.000	-0.000	-0.000	0.836	-0.000	0.000
PREP4*PPSS3	0.000	-0.000	0.000	0.000	0.859	-0.000	0.000

iii. **Regression coefficients of paths between factors.**

```
#Obtaining regression coefficients of paths.
> secdata_report$paths
```

```
             SEC TRUST
R^2        0.420 0.367
AdjR^2     0.412 0.365
REP        0.247     .
INV        0.181     .
POL        0.339     .
FAML       0.011     .
REP*POL   -0.105     .
SEC            . 0.606
```

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

```
#Bootstrapping the PLS path model.
>boot_pls <- bootstrap_model(secdata_pls, nboot = 1000)

#Displaying bootstrapped structural paths coefficients.
>summary(boot_pls)
```

```
Results from Bootstrap resamples:  1000

Bootstrapped Structural Paths:
                  Original Est. Bootstrap Mean Bootstrap SD T Stat. 2.5% CI 97.5% CI
REP  ->  SEC             0.247          0.245        0.060   4.131   0.118    0.355
INV  ->  SEC             0.181          0.186        0.056   3.221   0.072    0.297
POL  ->  SEC             0.339          0.343        0.056   6.085   0.227    0.447
FAML  ->  SEC            0.011          0.010        0.059   0.179  -0.104    0.131
REP*POL  ->  SEC        -0.105         -0.024        0.124  -0.847  -0.191    0.193
SEC  ->  TRUST           0.606          0.611        0.036  16.605   0.537    0.680
```

Question 2) Common-Factor Models using CB-SEM.

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

i. **Either respecify all the constructs as being `reflective()`, or use the `as.reflective()` function to convert your earlier measurement model to being entirely reflective.**

```
#Creating a reflective measurement model.
> secdata_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("INV", multi_items("PINV", 1:3)),
+   reflective("POL", multi_items("PPSS", 1:3)),
+   reflective("FAML", single_item("FAML1")),
+   interaction_term(iv="REP", moderator="POL", method=orthogonal)
+ )
```

ii. **Use the same structural model as before (you can just reuse it again!).**

#Creating a Common Factor Model.

```
> sec_cf_pls <- estimate_cbsem(
+   data = secdata,
+   measurement_model = secdata_cf_mm,
+   structural_model = secdata_sm
+ )
>summary(sec_cf_pls)
```

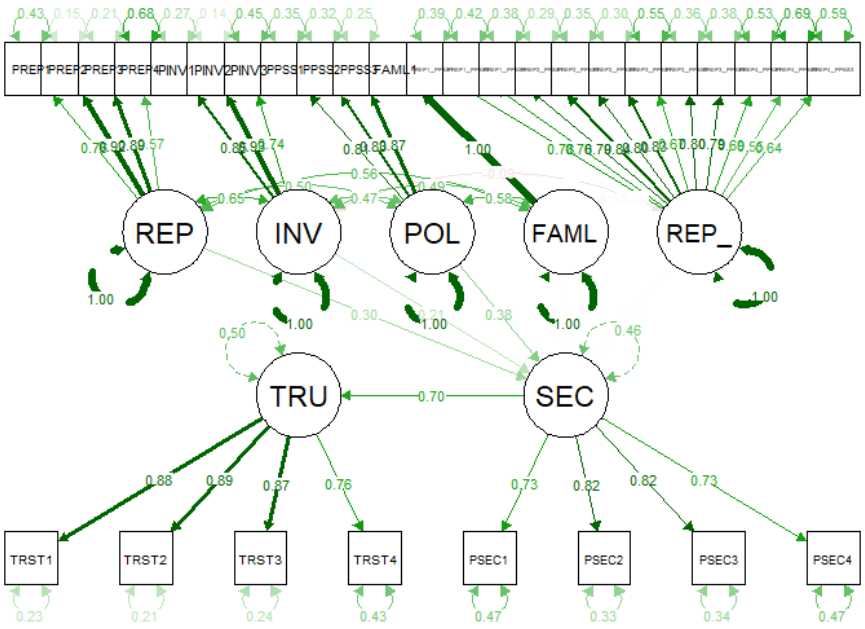
```
Results from  package seminr (2.1.0)
Estimation used  package seminr (2.1.0)

Fit metrics:
      npar       fmin       pnfi       logl        aic        bic     ntotal       bic2        rmr
    77.000      3.529      0.663 -17296.241  34746.482  35054.781    405.000  34810.451      0.116
      srmr       crmr        gfi       agfi       pgfi        mfi       ecvi
     0.063      0.065      0.742      0.694      0.627      0.049      7.439

                    metric   scaled robust
cfi                  0.764    0.772  0.799
tli                  0.738    0.747  0.777
nnfi                 0.738    0.747  0.777
rni                  0.764    0.772  0.799
rmsea                0.120    0.072  0.107
rmsea.ci.lower       0.116    0.069  0.100
rmsea.ci.upper       0.124    0.075  0.114
rmsea.pvalue         0.000    0.000      .
chisq             2858.871 1303.538      .
df                 419.000  419.000      .
pvalue               0.000    0.000      .
baseline.chisq   10812.133 4340.588      .
baseline.df        465.000  465.000      .
baseline.pvalue      0.000    0.000      .
rfi                  0.707    0.667      .
nfi                  0.736    0.700      .
ifi                  0.765    0.774      .
```

```
Reliability:
      rhoC  AVE
TRUST 0.91 0.72
SEC   0.86 0.60
REP   0.87 0.63
INV   0.88 0.71
POL   0.87 0.70
FAML  1.00 1.00

Path Coefficients:
             SEC TRUST
R^2         0.54  0.50
REP         0.30     .
INV         0.21     .
POL         0.38     .
FAML       -0.01     .
REP_x_POL   0.01     .
SEC            .  0.70
```

b. Show us the following results in table or figure formats.

i. Plot a figure of the estimated model (it will look different from your PLS model!).

```
#Plotting the estimated model.
> plot(sec_cf_pls)
```



ii. Loadings of composites.

```
#Storing summary in a report variable.
>sec_cf_pls_report<-summary(sec_cf_pls)

#Obtaining loadings of composites.
> sec_cf_pls_report$loadings
```

	TRUST	SEC	REP	INV	POL	FAML
TRST1	0.8800240	NA	NA	NA	NA	NA
TRST2	0.8886342	NA	NA	NA	NA	NA
TRST3	0.8690644	NA	NA	NA	NA	NA
TRST4	0.7575988	NA	NA	NA	NA	NA
PSEC1	NA	0.7308766	NA	NA	NA	NA
PSEC2	NA	0.8173481	NA	NA	NA	NA
PSEC3	NA	0.8151708	NA	NA	NA	NA
PSEC4	NA	0.7260444	NA	NA	NA	NA
PREP1	NA	NA	0.7551328	NA	NA	NA
PREP2	NA	NA	0.9199208	NA	NA	NA
PREP3	NA	NA	0.8871362	NA	NA	NA
PREP4	NA	NA	0.5650059	NA	NA	NA
PINV1	NA	NA	NA	0.8520004	NA	NA
PINV2	NA	NA	NA	0.9257476	NA	NA
PINV3	NA	NA	NA	0.7388750	NA	NA
PPSS1	NA	NA	NA	NA	0.8051533	NA
PPSS2	NA	NA	NA	NA	0.8272576	NA
PPSS3	NA	NA	NA	NA	0.8674335	NA
FAML1	NA	NA	NA	NA	NA	1

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

```
#Obtaining coefficients of paths and p-values.
>sec_cf_pls_report$paths
```

```
$coefficients
                     SEC      TRUST
R^2          0.540381651 0.4951084
REP          0.299536782         NA
INV          0.214253245         NA
POL          0.376401499         NA
FAML        -0.008837653         NA
REP_x_POL    0.008355287         NA
SEC                   NA 0.7036394

$pvalues
                     SEC TRUST
REP        3.817182e-05    NA
INV        3.534482e-03    NA
POL        4.380975e-09    NA
FAML       8.996836e-01    NA
REP_x_POL  8.516847e-01    NA
SEC                   NA     0
```