Dynamic SEM on ESM Data

Structural Equation Modeling Course Project - KU Leuven

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```r
# selecting items and reading data ------------------------------------------------

items <- list(
  discrimination = c("dscrrce",
                     "dscrntn",
                     "dscrrlg",
                     "dscrlng",
                     "dscretn",
                     "dscrage",
                     "dscrgnd",
                     "dscrsex",
                     "dscrdsb",
                     "dscroth"
                     ),

  trust_social = c("ppltrst",
                   "pplfair",
                   "pplhlp"
                   ),

  trust_political = c("trstprl",
                      "trstlgl",
                      "trstplc",
                      "trstplt",
                      "trstprt"
                      ),

  hope_political = c("psppsgva",
                     "actrolga",
                     "psppipla",
                     "cptppola"),

  interest_political = "polintr"

)

items_ordered <- items$hope_political %>% unlist() %>% as.character()

data <- read.csv("https://github.com/psyguy/sem-course-project/raw/master/data/ess2016_selected.csv")

# cleaning/recoding the data ---------------------------------------------

d <- data
# removing invalid/missing data
d[d>10] <- NA
```

```
## Warning in Ops.factor(left, right): '>' not meaningful for factors

d$polintr[d$polintr>4] <- NA
d[,20:23][d[,20:23]>5] <- NA
# reverse-coding polint
d$polintr <- (d$polintr-5) %>% abs()

dscrscore <- d %>% select(contains("dscr")) %>% rowSums()

d <- d %>% cbind(dscrscore)

d <- d %>% filter(cntry == "BE") %>%  na.omit()

# making model syntaxes -------------------------------------------------

m.5 <- "
# 1. latent variable definitions
  hope_political =~ NA*psppsgva + actrolga + psppipla + cptppola
  trust_social =~ NA*ppltrst + pplfair + pplhlp
  trust_political =~ NA*trstprl + trstlgl + trstplc + trstplt + trstprt
  optimism_political =~ NA*psppsgva + actrolga + psppipla + cptppola +
                        trstprl + trstlgl + trstplc + trstplt + trstprt
# 2. regressions
  hope_political + trust_political ~ polintr
  hope_political + trust_social + trust_political ~ dscrscore
# 3. (co)variances
  hope_political ~~ 1*hope_political
  trust_social ~~ 1*trust_social
  trust_political ~~ 1*trust_political
  # optimism_general ~~ 1*optimism_general
  optimism_political ~~ 1*optimism_political

  hope_political ~~ trust_social + trust_political
  trust_social ~~ trust_political
# 4. intercepts

  psppsgva + actrolga + psppipla + cptppola ~ 1
  ppltrst + pplfair + pplhlp ~ 1
  trstprl + trstlgl + trstplc + trstplt + trstprt ~ 1
"

# fitting and plotting model -------------------------------------------------

f <- lavaan(m.5, d,
            ordered = c(items_ordered, as.character(unlist(items$discrimination))),
            std.lv = TRUE,
            auto.var=TRUE)

# f %>% summary(standardized=TRUE)


semPaths(f,
         title = FALSE,
         curvePivot = TRUE,
```
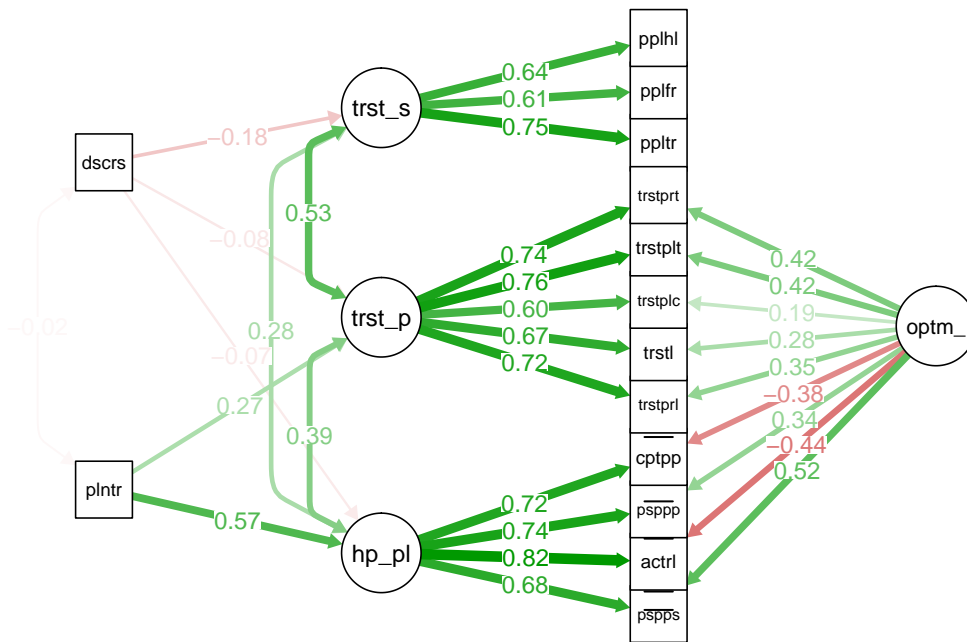
```
        what = "std",
        rotation = 2,
        layout = "tree2",
        optimizeLatRes = TRUE,
        intercepts = FALSE,
        edge.label.cex = 0.95,
        exoVar=FALSE,
        sizeMan=5,
        sizeLat=7,
        nCharNodes=5,
        residuals=FALSE,
        fixedStyle=1,
        freeStyle=1,
        curvePivot = FALSE)
```



```
o <- "

Parameter Estimates:

  Information                                 Expected
  Information saturated (h1) model         Unstructured
  Standard Errors                           Robust.sem

Latent Variables:
                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
```

```
  hope_political =~
    psppsgva              0.588    0.026   22.591    0.000      0.537    0.639
    actrolga              0.767    0.024   31.405    0.000      0.719    0.815
    psppipla              0.660    0.021   31.081    0.000      0.618    0.702
    cptppola              0.658    0.025   26.822    0.000      0.610    0.706
  trust_social =~
    ppltrst               1.554    0.063   24.822    0.000      1.432    1.677
    pplfair               1.113    0.048   22.979    0.000      1.018    1.207
    pplhlp                1.253    0.057   21.963    0.000      1.141    1.365
  trust_political =~
    trstprl               1.484    0.052   28.337    0.000      1.381    1.586
    trstlgl               1.480    0.058   25.582    0.000      1.366    1.593
    trstplc               1.170    0.048   24.126    0.000      1.075    1.265
    trstplt               1.572    0.053   29.687    0.000      1.468    1.676
    trstprt               1.507    0.056   27.018    0.000      1.397    1.616
  optimism_political =~
    psppsgva              0.583    0.033   17.557    0.000      0.518    0.648
    actrolga             -0.472    0.046  -10.354    0.000     -0.561   -0.382
    psppipla              0.401    0.034   11.728    0.000      0.334    0.468
    cptppola             -0.403    0.038  -10.588    0.000     -0.478   -0.328
    trstprl               0.794    0.058   13.674    0.000      0.680    0.907
    trstlgl               0.652    0.063   10.378    0.000      0.529    0.775
    trstplc               0.399    0.053    7.507    0.000      0.295    0.503
    trstplt               0.933    0.059   15.805    0.000      0.817    1.049
    trstprt               0.921    0.061   15.154    0.000      0.802    1.040

Regressions:
                       Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
  hope_political ~
    polintr               0.775    0.032   24.093    0.000      0.712    0.838
  trust_political ~
    polintr               0.327    0.031   10.705    0.000      0.267    0.387
  hope_political ~
    dscrrce               0.128    0.210    0.610    0.542     -0.283    0.539
    dscrntn              -0.599    0.162   -3.710    0.000     -0.916   -0.283
    dscrrlg              -0.468    0.178   -2.627    0.009     -0.817   -0.119
    dscrlng               0.079    0.270    0.293    0.769     -0.450    0.608
    dscretn               0.578    0.420    1.378    0.168     -0.244    1.401
    dscrage              -0.445    0.525   -0.849    0.396     -1.474    0.583
    dscrgnd               1.052    0.442    2.379    0.017      0.185    1.918
    dscrsex               0.281    0.302    0.929    0.353     -0.312    0.874
    dscrdsb              -0.303    0.402   -0.752    0.452     -1.091    0.486
    dscroth              -0.061    0.194   -0.314    0.753     -0.441    0.319
  trust_social ~
    dscrrce              -0.331    0.203   -1.635    0.102     -0.729    0.066
    dscrntn              -0.683    0.169   -4.043    0.000     -1.014   -0.352
    dscrrlg              -0.434    0.185   -2.347    0.019     -0.797   -0.072
    dscrlng              -0.198    0.309   -0.640    0.522     -0.803    0.408
    dscretn              -0.061    0.371   -0.164    0.870     -0.788    0.666
    dscrage              -0.601    0.350   -1.718    0.086     -1.287    0.085
    dscrgnd               0.557    0.419    1.327    0.184     -0.265    1.379
    dscrsex               0.131    0.329    0.398    0.691     -0.514    0.776
    dscrdsb              -0.336    0.432   -0.778    0.437     -1.182    0.510
```

```
    dscroth              -0.285    0.197   -1.446    0.148   -0.672     0.101
  trust_political ~
    dscrrce               0.417    0.199    2.097    0.036    0.027     0.806
    dscrntn               0.458    0.161    2.850    0.004    0.143     0.773
    dscrrlg              -0.521    0.160   -3.263    0.001   -0.834    -0.208
    dscrlng               0.634    0.235    2.697    0.007    0.173     1.094
    dscretn              -0.600    0.300   -2.000    0.045   -1.187    -0.012
    dscrage              -0.786    0.393   -2.001    0.045   -1.556    -0.016
    dscrgnd               0.491    0.386    1.271    0.204   -0.266     1.247
    dscrsex              -0.423    0.244   -1.735    0.083   -0.900     0.055
    dscrdsb              -0.602    0.472   -1.275    0.202   -1.528     0.324
    dscroth              -0.263    0.194   -1.355    0.175   -0.643     0.117
  optimism_political ~
    dscrrce              -0.183    0.212   -0.864    0.387   -0.599     0.232
    dscrntn              -0.601    0.198   -3.040    0.002   -0.988    -0.213
    dscrrlg               0.195    0.186    1.045    0.296   -0.170     0.560
    dscrlng              -0.721    0.269   -2.682    0.007   -1.247    -0.194
    dscretn              -0.415    0.308   -1.346    0.178   -1.019     0.189
    dscrage              -0.236    0.610   -0.386    0.700   -1.432     0.961
    dscrgnd              -0.880    0.354   -2.489    0.013   -1.574    -0.187
    dscrsex              -0.338    0.422   -0.803    0.422   -1.165     0.488
    dscrdsb              -0.147    0.383   -0.384    0.701   -0.897     0.603
    dscroth              -0.637    0.237   -2.686    0.007   -1.102    -0.172

Covariances:
                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
 .hope_political ~~
   .trust_social      0.259    0.030    8.676    0.000    0.201     0.318
   .trust_politicl    0.387    0.031   12.361    0.000    0.325     0.448
 .trust_social ~~
   .trust_politicl    0.546    0.027   20.383    0.000    0.493     0.598

Intercepts:
                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
   .psppsgva          0.000    0.077    0.000    1.000   -0.152     0.152
   .actrolga          0.000    0.080    0.000    1.000   -0.156     0.156
   .psppipla          0.000    0.077    0.000    1.000   -0.150     0.150
   .cptppola          0.000    0.077    0.000    1.000   -0.151     0.151
   .ppltrst           4.258    0.138   30.845    0.000    3.987     4.528
   .pplfair           5.247    0.124   42.467    0.000    5.005     5.489
   .pplhlp            4.216    0.133   31.671    0.000    3.955     4.477
   .trstprl           3.430    0.135   25.312    0.000    3.164     3.695
   .trstlgl           4.396    0.148   29.637    0.000    4.105     4.687
   .trstplc           5.683    0.132   42.943    0.000    5.423     5.942
   .trstplt           2.842    0.137   20.813    0.000    2.574     3.110
   .trstprt           2.866    0.136   21.021    0.000    2.599     3.133
   .hope_political    0.000                               0.000     0.000
   .trust_social      0.000                               0.000     0.000
   .trust_politicl    0.000                               0.000     0.000
   .optimism_pltcl    0.000                               0.000     0.000

Thresholds:
                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
```

```
    psppsgva|t1        0.171                                     0.171    0.171
    psppsgva|t2        1.253                                     1.253    1.253
    psppsgva|t3        2.622                                     2.622    2.622
    psppsgva|t4        3.366                                     3.366    3.366
    actrolga|t1        1.287                                     1.287    1.287
    actrolga|t2        2.317                                     2.317    2.317
    actrolga|t3        3.473                                     3.473    3.473
    actrolga|t4        4.253                                     4.253    4.253
    psppipla|t1        0.345                                     0.345    0.345
    psppipla|t2        1.549                                     1.549    1.549
    psppipla|t3        2.735                                     2.735    2.735
    psppipla|t4        4.198                                     4.198    4.198
    cptppola|t1        1.017                                     1.017    1.017
    cptppola|t2        2.017                                     2.017    2.017
    cptppola|t3        3.148                                     3.148    3.148
    cptppola|t4        4.052                                     4.052    4.052

Variances:
                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
    .hope_political    1.000                                     1.000    1.000
    .trust_social      1.000                                     1.000    1.000
    .trust_politicl    1.000                                     1.000    1.000
    .optimism_pltcl    1.000                                     1.000    1.000
    .psppsgva          0.314                                     0.314    0.314
    .actrolga          0.189                                     0.189    0.189
    .psppipla          0.404                                     0.404    0.404
    .cptppola          0.405                                     0.405    0.405
    .ppltrst           1.964    0.135   14.544    0.000   1.699    2.229
    .pplfair           2.106    0.093   22.547    0.000   1.923    2.290
    .pplhlp            2.361    0.111   21.204    0.000   2.142    2.579
    .trstprl           1.765    0.066   26.689    0.000   1.635    1.894
    .trstlgl           2.481    0.097   25.687    0.000   2.292    2.670
    .trstplc           2.472    0.087   28.298    0.000   2.301    2.643
    .trstplt           1.158    0.066   17.524    0.000   1.028    1.287
    .trstprt           1.350    0.071   19.120    0.000   1.212    1.488

Scales y*:
                   Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
    psppsgva           1.000                                     1.000    1.000
    actrolga           1.000                                     1.000    1.000
    psppipla           1.000                                     1.000    1.000
    cptppola           1.000                                     1.000    1.000

"
# o %>% print()
o %>% cat()
```

```
##
##
## Parameter Estimates:
##
##   Information                                 Expected
##   Information saturated (h1) model          Unstructured
```

```
##   Standard Errors                        Robust.sem
##
## Latent Variables:
##                    Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##   hope_political =~
##     psppsgva         0.588    0.026    22.591    0.000    0.537    0.639
##     actrolga         0.767    0.024    31.405    0.000    0.719    0.815
##     psppipla         0.660    0.021    31.081    0.000    0.618    0.702
##     cptppola         0.658    0.025    26.822    0.000    0.610    0.706
##   trust_social =~
##     ppltrst          1.554    0.063    24.822    0.000    1.432    1.677
##     pplfair          1.113    0.048    22.979    0.000    1.018    1.207
##     pplhlp           1.253    0.057    21.963    0.000    1.141    1.365
##   trust_political =~
##     trstprl          1.484    0.052    28.337    0.000    1.381    1.586
##     trstlgl          1.480    0.058    25.582    0.000    1.366    1.593
##     trstplc          1.170    0.048    24.126    0.000    1.075    1.265
##     trstplt          1.572    0.053    29.687    0.000    1.468    1.676
##     trstprt          1.507    0.056    27.018    0.000    1.397    1.616
##   optimism_political =~
##     psppsgva         0.583    0.033    17.557    0.000    0.518    0.648
##     actrolga        -0.472    0.046   -10.354    0.000   -0.561   -0.382
##     psppipla         0.401    0.034    11.728    0.000    0.334    0.468
##     cptppola        -0.403    0.038   -10.588    0.000   -0.478   -0.328
##     trstprl          0.794    0.058    13.674    0.000    0.680    0.907
##     trstlgl          0.652    0.063    10.378    0.000    0.529    0.775
##     trstplc          0.399    0.053     7.507    0.000    0.295    0.503
##     trstplt          0.933    0.059    15.805    0.000    0.817    1.049
##     trstprt          0.921    0.061    15.154    0.000    0.802    1.040
##
## Regressions:
##                    Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##   hope_political ~
##     polintr          0.775    0.032    24.093    0.000    0.712    0.838
##   trust_political ~
##     polintr          0.327    0.031    10.705    0.000    0.267    0.387
##   hope_political ~
##     dscrrce          0.128    0.210     0.610    0.542   -0.283    0.539
##     dscrntn         -0.599    0.162    -3.710    0.000   -0.916   -0.283
##     dscrrlg         -0.468    0.178    -2.627    0.009   -0.817   -0.119
##     dscrlng          0.079    0.270     0.293    0.769   -0.450    0.608
##     dscretn          0.578    0.420     1.378    0.168   -0.244    1.401
##     dscrage         -0.445    0.525    -0.849    0.396   -1.474    0.583
##     dscrgnd          1.052    0.442     2.379    0.017    0.185    1.918
##     dscrsex          0.281    0.302     0.929    0.353   -0.312    0.874
##     dscrdsb         -0.303    0.402    -0.752    0.452   -1.091    0.486
##     dscroth         -0.061    0.194    -0.314    0.753   -0.441    0.319
##   trust_social ~
##     dscrrce         -0.331    0.203    -1.635    0.102   -0.729    0.066
##     dscrntn         -0.683    0.169    -4.043    0.000   -1.014   -0.352
##     dscrrlg         -0.434    0.185    -2.347    0.019   -0.797   -0.072
##     dscrlng         -0.198    0.309    -0.640    0.522   -0.803    0.408
##     dscretn         -0.061    0.371    -0.164    0.870   -0.788    0.666
##     dscrage         -0.601    0.350    -1.718    0.086   -1.287    0.085
```

```
##      dscrgnd              0.557    0.419    1.327    0.184    -0.265    1.379
##      dscrsex              0.131    0.329    0.398    0.691    -0.514    0.776
##      dscrdsb             -0.336    0.432   -0.778    0.437    -1.182    0.510
##      dscroth             -0.285    0.197   -1.446    0.148    -0.672    0.101
##    trust_political ~
##      dscrrce              0.417    0.199    2.097    0.036     0.027    0.806
##      dscrntn              0.458    0.161    2.850    0.004     0.143    0.773
##      dscrrlg             -0.521    0.160   -3.263    0.001    -0.834   -0.208
##      dscrlng              0.634    0.235    2.697    0.007     0.173    1.094
##      dscretn             -0.600    0.300   -2.000    0.045    -1.187   -0.012
##      dscrage             -0.786    0.393   -2.001    0.045    -1.556   -0.016
##      dscrgnd              0.491    0.386    1.271    0.204    -0.266    1.247
##      dscrsex             -0.423    0.244   -1.735    0.083    -0.900    0.055
##      dscrdsb             -0.602    0.472   -1.275    0.202    -1.528    0.324
##      dscroth             -0.263    0.194   -1.355    0.175    -0.643    0.117
##    optimism_political ~
##      dscrrce             -0.183    0.212   -0.864    0.387    -0.599    0.232
##      dscrntn             -0.601    0.198   -3.040    0.002    -0.988   -0.213
##      dscrrlg              0.195    0.186    1.045    0.296    -0.170    0.560
##      dscrlng             -0.721    0.269   -2.682    0.007    -1.247   -0.194
##      dscretn             -0.415    0.308   -1.346    0.178    -1.019    0.189
##      dscrage             -0.236    0.610   -0.386    0.700    -1.432    0.961
##      dscrgnd             -0.880    0.354   -2.489    0.013    -1.574   -0.187
##      dscrsex             -0.338    0.422   -0.803    0.422    -1.165    0.488
##      dscrdsb             -0.147    0.383   -0.384    0.701    -0.897    0.603
##      dscroth             -0.637    0.237   -2.686    0.007    -1.102   -0.172
##
## Covariances:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##   .hope_political ~~
##     .trust_social     0.259    0.030    8.676    0.000     0.201    0.318
##     .trust_politicl   0.387    0.031   12.361    0.000     0.325    0.448
##   .trust_social ~~
##     .trust_politicl   0.546    0.027   20.383    0.000     0.493    0.598
##
## Intercepts:
##                    Estimate  Std.Err  z-value  P(>|z|) ci.lower ci.upper
##     .psppsgva         0.000    0.077    0.000    1.000    -0.152    0.152
##     .actrolga         0.000    0.080    0.000    1.000    -0.156    0.156
##     .psppipla         0.000    0.077    0.000    1.000    -0.150    0.150
##     .cptppola         0.000    0.077    0.000    1.000    -0.151    0.151
##     .ppltrst          4.258    0.138   30.845    0.000     3.987    4.528
##     .pplfair          5.247    0.124   42.467    0.000     5.005    5.489
##     .pplhlp           4.216    0.133   31.671    0.000     3.955    4.477
##     .trstprl          3.430    0.135   25.312    0.000     3.164    3.695
##     .trstlgl          4.396    0.148   29.637    0.000     4.105    4.687
##     .trstplc          5.683    0.132   42.943    0.000     5.423    5.942
##     .trstplt          2.842    0.137   20.813    0.000     2.574    3.110
##     .trstprt          2.866    0.136   21.021    0.000     2.599    3.133
##     .hope_political   0.000                               0.000    0.000
##     .trust_social     0.000                               0.000    0.000
##     .trust_politicl   0.000                               0.000    0.000
##     .optimism_pltcl   0.000                               0.000    0.000
##
```

```
## Thresholds:
##                 Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##      psppsgva|t1   0.171                                0.171     0.171
##      psppsgva|t2   1.253                                1.253     1.253
##      psppsgva|t3   2.622                                2.622     2.622
##      psppsgva|t4   3.366                                3.366     3.366
##      actrolga|t1   1.287                                1.287     1.287
##      actrolga|t2   2.317                                2.317     2.317
##      actrolga|t3   3.473                                3.473     3.473
##      actrolga|t4   4.253                                4.253     4.253
##      psppipla|t1   0.345                                0.345     0.345
##      psppipla|t2   1.549                                1.549     1.549
##      psppipla|t3   2.735                                2.735     2.735
##      psppipla|t4   4.198                                4.198     4.198
##      cptppola|t1   1.017                                1.017     1.017
##      cptppola|t2   2.017                                2.017     2.017
##      cptppola|t3   3.148                                3.148     3.148
##      cptppola|t4   4.052                                4.052     4.052
##
## Variances:
##                 Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##    .hope_political  1.000                               1.000     1.000
##    .trust_social    1.000                               1.000     1.000
##    .trust_politicl  1.000                               1.000     1.000
##    .optimism_pltcl  1.000                               1.000     1.000
##    .psppsgva        0.314                               0.314     0.314
##    .actrolga        0.189                               0.189     0.189
##    .psppipla        0.404                               0.404     0.404
##    .cptppola        0.405                               0.405     0.405
##    .ppltrst         1.964    0.135   14.544    0.000     1.699     2.229
##    .pplfair         2.106    0.093   22.547    0.000     1.923     2.290
##    .pplhlp          2.361    0.111   21.204    0.000     2.142     2.579
##    .trstprl         1.765    0.066   26.689    0.000     1.635     1.894
##    .trstlgl         2.481    0.097   25.687    0.000     2.292     2.670
##    .trstplc         2.472    0.087   28.298    0.000     2.301     2.643
##    .trstplt         1.158    0.066   17.524    0.000     1.028     1.287
##    .trstprt         1.350    0.071   19.120    0.000     1.212     1.488
##
## Scales y*:
##                 Estimate  Std.Err  z-value  P(>|z|)  ci.lower  ci.upper
##      psppsgva      1.000                               1.000     1.000
##      actrolga      1.000                               1.000     1.000
##      psppipla      1.000                               1.000     1.000
##      cptppola      1.000                               1.000     1.000
```

```
# semTable(f,
#          columns = c("estse", "p"),
#          fits = c("chisq", "rmsea"),
#          file = file.path(tempdir, "fit1.t1.html"),
#          # varLabels = c("x1" = "hello"),
#          type = "html",
#          print.results = TRUE)
```