

CFA with Continuation in R

Load library

```
library(lavaan)
```

```
## This is lavaan 0.6-9  
## lavaan is FREE software! Please report any bugs.
```

Load dataset

Note that we don't use all variables in this data set. To model what we did in Mplus (where we selected the variables that we will use in the analysis), we added syntax for creating a new data frame for the CFA.

You don't need to do this in R though; you can simply specify the variable names in the model section and lavaan will use those variables for the estimation.

```
cont85 <- read.table("continuation85.dat")  
  
colnames(cont85) <- c(  
  'id',  
  'tfscs1',  
  'tfscs2',  
  'tfscs3',  
  'tfscs4',  
  'tfscs5',  
  'tfscs6',  
  'tfscs7',  
  'tfscs8',  
  'tfscs9',  
  'tfscs10',  
  'tfscs11',  
  'tfscs12',  
  'tfscs13',  
  'tfscs14',  
  'tfscs15',  
  'tfscs16',  
  'tfscs17',  
  'tfscs18',  
  'tfscs19',  
  'tfscs20',  
  'tfscs21',  
  'tfscs22',  
  'tfscs23',
```

```

'tfscs24',
'tfscs25',
'tfscs26',
'tfscs27',
'tfscs28',
'tfscs29',
'tfscs30',
'tfscs31',
'tfscs32',
'tfscs33',
'tfscs34'
)

cfa_data <- cont85[,c(2, 4:5, 7, 10:13, 15:19, 22:25, 28:29, 32, 34)]

```

Model specification

```

cfa_model <-
'
#Inhibition factor
inhib =~ 1*tfscs1 + tfscs10 + tfscs15 +
          tfscs17 + tfscs22 + tfscs23 + tfscs33
#initiation factor
init =~ 1*tfscs6 + tfscs11 + tfscs12 +
        tfscs18 + tfscs21 + tfscs24 + tfscs27
#continuation factor
cont =~ 1*tfscs3 + tfscs4 + tfscs9 + tfscs14 +
        tfscs16 + tfscs28 + tfscs31'

```

Fitting the model

```

cfa_fit <- cfa(model = cfa_model,
               data = cfa_data,
               missing = "fiml",
               estimator = "ml",
               #se = "boot", # you can request bootstrapped CIs
               #bootstrap = 500, # the more samples, the longer it takes
               control = list(iter.max = 1000)
               )

```

Output

Model summary

```

summary(cfa_fit,
        standardized = TRUE,
        rsquare = TRUE,
        fit.measures = TRUE,
        modindices = TRUE)

## lavaan 0.6-9 ended normally after 41 iterations
##
##      Estimator                      ML
##      Optimization method          NLMINB
##      Number of model parameters      66
##
##      Number of observations          204
##      Number of missing patterns      1
##
## Model Test User Model:
##
##      Test statistic                 394.071
##      Degrees of freedom              186
##      P-value (Chi-square)            0.000
##
## Model Test Baseline Model:
##
##      Test statistic                 2370.045
##      Degrees of freedom              210
##      P-value                         0.000
##
## User Model versus Baseline Model:
##
##      Comparative Fit Index (CFI)      0.904
##      Tucker-Lewis Index (TLI)         0.891
##
## Loglikelihood and Information Criteria:
##
##      Loglikelihood user model (H0)      -5172.290
##      Loglikelihood unrestricted model (H1) -4975.255
##
##      Akaike (AIC)                     10476.580
##      Bayesian (BIC)                     10695.576
##      Sample-size adjusted Bayesian (BIC) 10486.468
##
## Root Mean Square Error of Approximation:
##
##      RMSEA                             0.074
##      90 Percent confidence interval - lower 0.064
##      90 Percent confidence interval - upper 0.084
##      P-value RMSEA <= 0.05              0.000
##
## Standardized Root Mean Square Residual:
##
##      SRMR                             0.056
##
## Parameter Estimates:

```

```

##
## Standard errors
## Information
## Observed information based on
## Standard
## Observed
## Hessian
##
## Latent Variables:
## Estimate Std.Err z-value P(>|z|) Std.lv Std.all
##
## inhib =~
## tfscs1 1.000 0.615 0.689
## tfscs10 1.043 0.118 8.851 0.000 0.641 0.678
## tfscs15 0.928 0.119 7.801 0.000 0.570 0.599
## tfscs17 1.409 0.144 9.806 0.000 0.866 0.768
## tfscs22 1.003 0.134 7.491 0.000 0.616 0.575
## tfscs23 1.111 0.115 9.678 0.000 0.683 0.748
## tfscs33 0.927 0.125 7.416 0.000 0.569 0.567
##
## init =~
## tfscs6 1.000 0.983 0.814
## tfscs11 0.745 0.073 10.174 0.000 0.732 0.664
## tfscs12 0.865 0.070 12.303 0.000 0.850 0.761
## tfscs18 0.989 0.073 13.608 0.000 0.972 0.828
## tfscs21 0.832 0.067 12.394 0.000 0.818 0.776
## tfscs24 0.803 0.070 11.551 0.000 0.790 0.733
## tfscs27 0.870 0.072 12.093 0.000 0.856 0.758
##
## cont =~
## tfscs3 1.000 0.585 0.544
## tfscs4 0.959 0.139 6.875 0.000 0.561 0.654
## tfscs9 1.173 0.160 7.316 0.000 0.686 0.725
## tfscs14 1.044 0.152 6.874 0.000 0.611 0.649
## tfscs16 1.065 0.166 6.419 0.000 0.622 0.582
## tfscs28 1.154 0.157 7.350 0.000 0.674 0.725
## tfscs31 0.879 0.139 6.303 0.000 0.514 0.559
##
## Covariances:
## Estimate Std.Err z-value P(>|z|) Std.lv Std.all
##
## inhib ~~
## init 0.468 0.071 6.616 0.000 0.775 0.775
## cont 0.321 0.057 5.640 0.000 0.893 0.893
##
## init ~~
## cont 0.477 0.081 5.853 0.000 0.829 0.829
##
## Intercepts:
## Estimate Std.Err z-value P(>|z|) Std.lv Std.all
##
## .tfscs1 3.549 0.062 56.794 0.000 3.549 3.976
## .tfscs10 3.559 0.066 53.771 0.000 3.559 3.765
## .tfscs15 3.701 0.067 55.545 0.000 3.701 3.889
## .tfscs17 3.309 0.079 41.898 0.000 3.309 2.933
## .tfscs22 3.235 0.075 43.081 0.000 3.235 3.016
## .tfscs23 3.623 0.064 56.689 0.000 3.623 3.969
## .tfscs33 3.309 0.070 47.082 0.000 3.309 3.296
## .tfscs6 3.206 0.085 37.926 0.000 3.206 2.655
## .tfscs11 2.902 0.077 37.589 0.000 2.902 2.632
## .tfscs12 3.167 0.078 40.507 0.000 3.167 2.836
## .tfscs18 3.333 0.082 40.541 0.000 3.333 2.838
## .tfscs21 3.275 0.074 44.373 0.000 3.275 3.107

```

##	.tfscs24	3.358	0.075	44.507	0.000	3.358	3.116
##	.tfscs27	3.382	0.079	42.777	0.000	3.382	2.995
##	.tfscs3	3.304	0.075	43.952	0.000	3.304	3.077
##	.tfscs4	3.627	0.060	60.484	0.000	3.627	4.235
##	.tfscs9	3.784	0.066	57.144	0.000	3.784	4.001
##	.tfscs14	3.461	0.066	52.522	0.000	3.461	3.677
##	.tfscs16	3.093	0.075	41.318	0.000	3.093	2.893
##	.tfscs28	3.451	0.065	52.989	0.000	3.451	3.710
##	.tfscs31	3.706	0.064	57.585	0.000	3.706	4.032
##	inhib	0.000				0.000	0.000
##	init	0.000				0.000	0.000
##	cont	0.000				0.000	0.000

##

Variances:

##		Estimate	Std.Err	z-value	P(> z)	Std.lv	Std.all
##	.tfscs1	0.419	0.047	8.989	0.000	0.419	0.526
##	.tfscs10	0.482	0.054	8.986	0.000	0.482	0.540
##	.tfscs15	0.580	0.062	9.403	0.000	0.580	0.641
##	.tfscs17	0.522	0.064	8.206	0.000	0.522	0.410
##	.tfscs22	0.771	0.081	9.458	0.000	0.771	0.670
##	.tfscs23	0.367	0.043	8.501	0.000	0.367	0.441
##	.tfscs33	0.683	0.072	9.492	0.000	0.683	0.678
##	.tfscs6	0.491	0.059	8.382	0.000	0.491	0.337
##	.tfscs11	0.680	0.072	9.428	0.000	0.680	0.559
##	.tfscs12	0.524	0.059	8.864	0.000	0.524	0.420
##	.tfscs18	0.434	0.053	8.185	0.000	0.434	0.315
##	.tfscs21	0.443	0.051	8.704	0.000	0.443	0.398
##	.tfscs24	0.537	0.060	9.026	0.000	0.537	0.463
##	.tfscs27	0.543	0.061	8.912	0.000	0.543	0.426
##	.tfscs3	0.811	0.085	9.588	0.000	0.811	0.704
##	.tfscs4	0.419	0.046	9.049	0.000	0.419	0.572
##	.tfscs9	0.424	0.050	8.501	0.000	0.424	0.474
##	.tfscs14	0.513	0.056	9.208	0.000	0.513	0.579
##	.tfscs16	0.756	0.080	9.395	0.000	0.756	0.661
##	.tfscs28	0.410	0.047	8.671	0.000	0.410	0.474
##	.tfscs31	0.581	0.061	9.533	0.000	0.581	0.688
##	inhib	0.378	0.070	5.367	0.000	1.000	1.000
##	init	0.967	0.140	6.916	0.000	1.000	1.000
##	cont	0.342	0.085	4.004	0.000	1.000	1.000

##

R-Square:

##	Estimate	
##	tfscs1	0.474
##	tfscs10	0.460
##	tfscs15	0.359
##	tfscs17	0.590
##	tfscs22	0.330
##	tfscs23	0.559
##	tfscs33	0.322
##	tfscs6	0.663
##	tfscs11	0.441
##	tfscs12	0.580
##	tfscs18	0.685
##	tfscs21	0.602

```
##      tfscs24          0.537
##      tfscs27          0.574
##      tfscs3           0.296
##      tfscs4           0.428
##      tfscs9           0.526
##      tfscs14          0.421
##      tfscs16          0.339
##      tfscs28          0.526
##      tfscs31          0.312
```

```
##
```

```
## Modification Indices:
```

```
##
```

##	lhs	op	rhs	mi	epc	sepc.lv	sepc.all	sepc.nox
## 73	inhib	=~	tfscs6	0.453	-0.120	-0.074	-0.061	-0.061
## 74	inhib	=~	tfscs11	0.094	-0.059	-0.036	-0.033	-0.033
## 75	inhib	=~	tfscs12	1.153	-0.190	-0.117	-0.105	-0.105
## 76	inhib	=~	tfscs18	1.169	0.185	0.114	0.097	0.097
## 77	inhib	=~	tfscs21	0.056	0.039	0.024	0.023	0.023
## 78	inhib	=~	tfscs24	0.193	-0.077	-0.048	-0.044	-0.044
## 79	inhib	=~	tfscs27	0.958	0.176	0.108	0.096	0.096
## 80	inhib	=~	tfscs3	0.194	0.170	0.104	0.097	0.097
## 81	inhib	=~	tfscs4	0.031	-0.051	-0.032	-0.037	-0.037
## 82	inhib	=~	tfscs9	2.104	-0.457	-0.281	-0.297	-0.297
## 83	inhib	=~	tfscs14	1.204	0.355	0.218	0.232	0.232
## 84	inhib	=~	tfscs16	1.650	0.486	0.299	0.279	0.279
## 85	inhib	=~	tfscs28	4.388	-0.649	-0.399	-0.429	-0.429
## 86	inhib	=~	tfscs31	4.181	0.672	0.413	0.449	0.449
## 87	init	=~	tfscs1	0.916	-0.095	-0.093	-0.104	-0.104
## 88	init	=~	tfscs10	2.017	-0.150	-0.148	-0.156	-0.156
## 89	init	=~	tfscs15	2.023	-0.159	-0.156	-0.164	-0.164
## 90	init	=~	tfscs17	27.568	0.626	0.615	0.545	0.545
## 91	init	=~	tfscs22	0.176	-0.054	-0.053	-0.049	-0.049
## 92	init	=~	tfscs23	2.417	-0.152	-0.149	-0.163	-0.163
## 93	init	=~	tfscs33	0.524	-0.087	-0.085	-0.085	-0.085
## 94	init	=~	tfscs3	4.179	0.320	0.314	0.293	0.293
## 95	init	=~	tfscs4	6.703	-0.306	-0.301	-0.351	-0.351
## 96	init	=~	tfscs9	4.014	-0.252	-0.248	-0.262	-0.262
## 97	init	=~	tfscs14	1.028	-0.132	-0.130	-0.138	-0.138
## 98	init	=~	tfscs16	18.183	0.653	0.642	0.600	0.600
## 99	init	=~	tfscs28	1.544	0.154	0.151	0.163	0.163
## 100	init	=~	tfscs31	0.968	-0.131	-0.129	-0.140	-0.140
## 101	cont	=~	tfscs1	0.039	0.062	0.036	0.041	0.041
## 102	cont	=~	tfscs10	0.157	-0.132	-0.077	-0.082	-0.082
## 103	cont	=~	tfscs15	0.098	0.109	0.064	0.067	0.067
## 104	cont	=~	tfscs17	4.455	0.813	0.476	0.422	0.422
## 105	cont	=~	tfscs22	7.202	-1.067	-0.624	-0.582	-0.582
## 106	cont	=~	tfscs23	0.002	-0.013	-0.008	-0.008	-0.008
## 107	cont	=~	tfscs33	0.171	-0.154	-0.090	-0.090	-0.090
## 108	cont	=~	tfscs6	0.985	-0.224	-0.131	-0.109	-0.109
## 109	cont	=~	tfscs11	0.012	0.027	0.016	0.014	0.014
## 110	cont	=~	tfscs12	4.405	-0.468	-0.273	-0.245	-0.245
## 111	cont	=~	tfscs18	0.016	0.028	0.016	0.014	0.014
## 112	cont	=~	tfscs21	4.304	0.429	0.251	0.238	0.238
## 113	cont	=~	tfscs24	2.224	0.331	0.194	0.180	0.180

## 114	cont	==	tfscs27	0.304	-0.125	-0.073	-0.065	-0.065
## 115	tfscs1	~~	tfscs10	1.567	0.045	0.045	0.100	0.100
## 116	tfscs1	~~	tfscs15	1.606	-0.049	-0.049	-0.099	-0.099
## 117	tfscs1	~~	tfscs17	0.023	0.006	0.006	0.013	0.013
## 118	tfscs1	~~	tfscs22	1.076	-0.046	-0.046	-0.080	-0.080
## 119	tfscs1	~~	tfscs23	1.001	0.033	0.033	0.084	0.084
## 120	tfscs1	~~	tfscs33	0.745	-0.036	-0.036	-0.067	-0.067
## 121	tfscs1	~~	tfscs6	0.053	0.008	0.008	0.018	0.018
## 122	tfscs1	~~	tfscs11	4.027	-0.081	-0.081	-0.153	-0.153
## 123	tfscs1	~~	tfscs12	0.536	0.027	0.027	0.057	0.057
## 124	tfscs1	~~	tfscs18	2.621	-0.056	-0.056	-0.131	-0.131
## 125	tfscs1	~~	tfscs21	0.010	0.003	0.003	0.008	0.008
## 126	tfscs1	~~	tfscs24	2.035	0.052	0.052	0.110	0.110
## 127	tfscs1	~~	tfscs27	0.153	-0.015	-0.015	-0.030	-0.030
## 128	tfscs1	~~	tfscs3	7.668	0.122	0.122	0.209	0.209
## 129	tfscs1	~~	tfscs4	0.303	0.018	0.018	0.042	0.042
## 130	tfscs1	~~	tfscs9	3.541	0.063	0.063	0.149	0.149
## 131	tfscs1	~~	tfscs14	4.634	-0.077	-0.077	-0.166	-0.166
## 132	tfscs1	~~	tfscs16	2.594	-0.069	-0.069	-0.122	-0.122
## 133	tfscs1	~~	tfscs28	0.084	-0.009	-0.009	-0.023	-0.023
## 134	tfscs1	~~	tfscs31	0.502	0.026	0.026	0.054	0.054
## 135	tfscs10	~~	tfscs15	0.258	0.021	0.021	0.039	0.039
## 136	tfscs10	~~	tfscs17	2.048	-0.061	-0.061	-0.121	-0.121
## 137	tfscs10	~~	tfscs22	4.376	0.098	0.098	0.161	0.161
## 138	tfscs10	~~	tfscs23	6.868	-0.092	-0.092	-0.218	-0.218
## 139	tfscs10	~~	tfscs33	9.746	0.138	0.138	0.240	0.240
## 140	tfscs10	~~	tfscs6	0.375	-0.024	-0.024	-0.049	-0.049
## 141	tfscs10	~~	tfscs11	0.170	-0.018	-0.018	-0.031	-0.031
## 142	tfscs10	~~	tfscs12	1.264	-0.044	-0.044	-0.087	-0.087
## 143	tfscs10	~~	tfscs18	3.110	-0.065	-0.065	-0.142	-0.142
## 144	tfscs10	~~	tfscs21	1.632	0.046	0.046	0.100	0.100
## 145	tfscs10	~~	tfscs24	1.207	-0.043	-0.043	-0.085	-0.085
## 146	tfscs10	~~	tfscs27	4.654	0.086	0.086	0.167	0.167
## 147	tfscs10	~~	tfscs3	2.196	-0.070	-0.070	-0.112	-0.112
## 148	tfscs10	~~	tfscs4	5.591	0.082	0.082	0.182	0.182
## 149	tfscs10	~~	tfscs9	1.572	0.045	0.045	0.099	0.099
## 150	tfscs10	~~	tfscs14	0.375	0.023	0.023	0.047	0.047
## 151	tfscs10	~~	tfscs16	2.029	-0.065	-0.065	-0.108	-0.108
## 152	tfscs10	~~	tfscs28	3.530	-0.066	-0.066	-0.148	-0.148
## 153	tfscs10	~~	tfscs31	2.153	0.059	0.059	0.111	0.111
## 154	tfscs15	~~	tfscs17	1.064	-0.046	-0.046	-0.084	-0.084
## 155	tfscs15	~~	tfscs22	0.942	0.049	0.049	0.073	0.073
## 156	tfscs15	~~	tfscs23	0.929	0.036	0.036	0.078	0.078
## 157	tfscs15	~~	tfscs33	0.094	0.014	0.014	0.023	0.023
## 158	tfscs15	~~	tfscs6	9.543	-0.129	-0.129	-0.242	-0.242
## 159	tfscs15	~~	tfscs11	0.590	0.036	0.036	0.057	0.057
## 160	tfscs15	~~	tfscs12	0.515	-0.030	-0.030	-0.055	-0.055
## 161	tfscs15	~~	tfscs18	0.063	-0.010	-0.010	-0.020	-0.020
## 162	tfscs15	~~	tfscs21	0.004	-0.003	-0.003	-0.005	-0.005
## 163	tfscs15	~~	tfscs24	0.011	0.004	0.004	0.008	0.008
## 164	tfscs15	~~	tfscs27	3.045	0.075	0.075	0.133	0.133
## 165	tfscs15	~~	tfscs3	2.823	-0.085	-0.085	-0.124	-0.124
## 166	tfscs15	~~	tfscs4	0.014	0.004	0.004	0.009	0.009
## 167	tfscs15	~~	tfscs9	0.001	-0.001	-0.001	-0.003	-0.003

## 168	tfscs15	~~	tfscs14	5.218	0.094	0.094	0.172	0.172
## 169	tfscs15	~~	tfscs16	0.212	0.023	0.023	0.034	0.034
## 170	tfscs15	~~	tfscs28	0.490	0.026	0.026	0.054	0.054
## 171	tfscs15	~~	tfscs31	0.136	0.016	0.016	0.027	0.027
## 172	tfscs17	~~	tfscs22	0.226	-0.024	-0.024	-0.039	-0.039
## 173	tfscs17	~~	tfscs23	0.057	0.009	0.009	0.021	0.021
## 174	tfscs17	~~	tfscs33	5.987	-0.118	-0.118	-0.198	-0.198
## 175	tfscs17	~~	tfscs6	7.722	0.117	0.117	0.230	0.230
## 176	tfscs17	~~	tfscs11	0.242	-0.023	-0.023	-0.039	-0.039
## 177	tfscs17	~~	tfscs12	5.821	0.102	0.102	0.194	0.194
## 178	tfscs17	~~	tfscs18	19.700	0.177	0.177	0.371	0.371
## 179	tfscs17	~~	tfscs21	2.451	-0.061	-0.061	-0.127	-0.127
## 180	tfscs17	~~	tfscs24	7.612	-0.117	-0.117	-0.220	-0.220
## 181	tfscs17	~~	tfscs27	0.048	-0.009	-0.009	-0.018	-0.018
## 182	tfscs17	~~	tfscs3	0.439	-0.034	-0.034	-0.052	-0.052
## 183	tfscs17	~~	tfscs4	5.203	-0.085	-0.085	-0.183	-0.183
## 184	tfscs17	~~	tfscs9	3.831	-0.076	-0.076	-0.161	-0.161
## 185	tfscs17	~~	tfscs14	0.251	0.021	0.021	0.040	0.040
## 186	tfscs17	~~	tfscs16	16.419	0.201	0.201	0.319	0.319
## 187	tfscs17	~~	tfscs28	0.043	-0.008	-0.008	-0.017	-0.017
## 188	tfscs17	~~	tfscs31	2.062	-0.062	-0.062	-0.113	-0.113
## 189	tfscs22	~~	tfscs23	1.195	0.046	0.046	0.087	0.087
## 190	tfscs22	~~	tfscs33	1.677	0.070	0.070	0.097	0.097
## 191	tfscs22	~~	tfscs6	1.715	-0.063	-0.063	-0.102	-0.102
## 192	tfscs22	~~	tfscs11	3.527	0.101	0.101	0.139	0.139
## 193	tfscs22	~~	tfscs12	0.092	0.015	0.015	0.023	0.023
## 194	tfscs22	~~	tfscs18	6.736	0.118	0.118	0.205	0.205
## 195	tfscs22	~~	tfscs21	6.456	-0.114	-0.114	-0.195	-0.195
## 196	tfscs22	~~	tfscs24	13.003	-0.175	-0.175	-0.272	-0.272
## 197	tfscs22	~~	tfscs27	12.016	0.171	0.171	0.264	0.264
## 198	tfscs22	~~	tfscs3	0.134	-0.021	-0.021	-0.027	-0.027
## 199	tfscs22	~~	tfscs4	9.093	-0.129	-0.129	-0.227	-0.227
## 200	tfscs22	~~	tfscs9	4.397	-0.092	-0.092	-0.161	-0.161
## 201	tfscs22	~~	tfscs14	0.055	-0.011	-0.011	-0.018	-0.018
## 202	tfscs22	~~	tfscs16	4.835	0.124	0.124	0.163	0.163
## 203	tfscs22	~~	tfscs28	1.711	-0.057	-0.057	-0.101	-0.101
## 204	tfscs22	~~	tfscs31	0.670	0.040	0.040	0.060	0.060
## 205	tfscs23	~~	tfscs33	0.055	0.009	0.009	0.019	0.019
## 206	tfscs23	~~	tfscs6	0.258	0.018	0.018	0.042	0.042
## 207	tfscs23	~~	tfscs11	0.212	0.018	0.018	0.036	0.036
## 208	tfscs23	~~	tfscs12	5.046	-0.079	-0.079	-0.179	-0.179
## 209	tfscs23	~~	tfscs18	0.537	-0.024	-0.024	-0.061	-0.061
## 210	tfscs23	~~	tfscs21	0.043	0.007	0.007	0.017	0.017
## 211	tfscs23	~~	tfscs24	1.329	0.040	0.040	0.091	0.091
## 212	tfscs23	~~	tfscs27	1.608	-0.045	-0.045	-0.101	-0.101
## 213	tfscs23	~~	tfscs3	0.666	0.034	0.034	0.063	0.063
## 214	tfscs23	~~	tfscs4	2.570	0.050	0.050	0.127	0.127
## 215	tfscs23	~~	tfscs9	0.005	0.002	0.002	0.006	0.006
## 216	tfscs23	~~	tfscs14	0.003	-0.002	-0.002	-0.004	-0.004
## 217	tfscs23	~~	tfscs16	1.768	-0.055	-0.055	-0.104	-0.104
## 218	tfscs23	~~	tfscs28	0.042	-0.006	-0.006	-0.017	-0.017
## 219	tfscs23	~~	tfscs31	1.600	0.045	0.045	0.098	0.098
## 220	tfscs33	~~	tfscs6	0.050	-0.010	-0.010	-0.017	-0.017
## 221	tfscs33	~~	tfscs11	0.701	-0.042	-0.042	-0.062	-0.062

##	222	tfscs33	~~	tfscs12	2.927	0.078	0.078	0.130	0.130
##	223	tfscs33	~~	tfscs18	0.188	-0.019	-0.019	-0.034	-0.034
##	224	tfscs33	~~	tfscs21	1.260	-0.047	-0.047	-0.086	-0.086
##	225	tfscs33	~~	tfscs24	0.234	0.022	0.022	0.036	0.036
##	226	tfscs33	~~	tfscs27	0.167	-0.019	-0.019	-0.031	-0.031
##	227	tfscs33	~~	tfscs3	0.167	0.022	0.022	0.030	0.030
##	228	tfscs33	~~	tfscs4	0.779	0.035	0.035	0.066	0.066
##	229	tfscs33	~~	tfscs9	0.958	-0.040	-0.040	-0.075	-0.075
##	230	tfscs33	~~	tfscs14	2.644	0.072	0.072	0.122	0.122
##	231	tfscs33	~~	tfscs16	4.670	-0.115	-0.115	-0.160	-0.160
##	232	tfscs33	~~	tfscs28	0.077	-0.011	-0.011	-0.021	-0.021
##	233	tfscs33	~~	tfscs31	0.594	0.036	0.036	0.057	0.057
##	234	tfscs6	~~	tfscs11	0.278	-0.025	-0.025	-0.043	-0.043
##	235	tfscs6	~~	tfscs12	6.751	0.112	0.112	0.221	0.221
##	236	tfscs6	~~	tfscs18	0.614	-0.033	-0.033	-0.071	-0.071
##	237	tfscs6	~~	tfscs21	0.686	-0.033	-0.033	-0.071	-0.071
##	238	tfscs6	~~	tfscs24	0.174	0.018	0.018	0.035	0.035
##	239	tfscs6	~~	tfscs27	0.049	0.010	0.010	0.019	0.019
##	240	tfscs6	~~	tfscs3	0.031	-0.009	-0.009	-0.014	-0.014
##	241	tfscs6	~~	tfscs4	0.085	0.011	0.011	0.023	0.023
##	242	tfscs6	~~	tfscs9	2.434	-0.058	-0.058	-0.127	-0.127
##	243	tfscs6	~~	tfscs14	0.540	-0.029	-0.029	-0.058	-0.058
##	244	tfscs6	~~	tfscs16	1.286	0.054	0.054	0.089	0.089
##	245	tfscs6	~~	tfscs28	0.002	0.002	0.002	0.004	0.004
##	246	tfscs6	~~	tfscs31	0.016	-0.005	-0.005	-0.010	-0.010
##	247	tfscs11	~~	tfscs12	0.002	0.002	0.002	0.003	0.003
##	248	tfscs11	~~	tfscs18	0.271	0.023	0.023	0.043	0.043
##	249	tfscs11	~~	tfscs21	0.393	0.027	0.027	0.049	0.049
##	250	tfscs11	~~	tfscs24	0.382	-0.029	-0.029	-0.048	-0.048
##	251	tfscs11	~~	tfscs27	0.022	-0.007	-0.007	-0.012	-0.012
##	252	tfscs11	~~	tfscs3	0.060	0.013	0.013	0.018	0.018
##	253	tfscs11	~~	tfscs4	1.742	-0.053	-0.053	-0.099	-0.099
##	254	tfscs11	~~	tfscs9	0.115	0.014	0.014	0.026	0.026
##	255	tfscs11	~~	tfscs14	0.081	0.013	0.013	0.021	0.021
##	256	tfscs11	~~	tfscs16	8.890	0.159	0.159	0.222	0.222
##	257	tfscs11	~~	tfscs28	0.081	-0.012	-0.012	-0.022	-0.022
##	258	tfscs11	~~	tfscs31	0.602	-0.036	-0.036	-0.057	-0.057
##	259	tfscs12	~~	tfscs18	1.209	0.045	0.045	0.095	0.095
##	260	tfscs12	~~	tfscs21	6.669	-0.102	-0.102	-0.212	-0.212
##	261	tfscs12	~~	tfscs24	0.865	-0.040	-0.040	-0.075	-0.075
##	262	tfscs12	~~	tfscs27	1.722	0.057	0.057	0.107	0.107
##	263	tfscs12	~~	tfscs3	0.153	0.019	0.019	0.030	0.030
##	264	tfscs12	~~	tfscs4	0.500	-0.026	-0.026	-0.055	-0.055
##	265	tfscs12	~~	tfscs9	2.133	-0.054	-0.054	-0.115	-0.115
##	266	tfscs12	~~	tfscs14	1.375	-0.047	-0.047	-0.091	-0.091
##	267	tfscs12	~~	tfscs16	0.797	0.043	0.043	0.068	0.068
##	268	tfscs12	~~	tfscs28	1.119	-0.039	-0.039	-0.084	-0.084
##	269	tfscs12	~~	tfscs31	0.151	-0.016	-0.016	-0.029	-0.029
##	270	tfscs18	~~	tfscs21	1.336	-0.044	-0.044	-0.101	-0.101
##	271	tfscs18	~~	tfscs24	3.064	-0.072	-0.072	-0.149	-0.149
##	272	tfscs18	~~	tfscs27	3.365	0.077	0.077	0.158	0.158
##	273	tfscs18	~~	tfscs3	0.540	-0.034	-0.034	-0.058	-0.058
##	274	tfscs18	~~	tfscs4	7.986	-0.097	-0.097	-0.227	-0.227
##	275	tfscs18	~~	tfscs9	0.837	-0.032	-0.032	-0.075	-0.075

##	276	tfscs18	~~	tfscs14	0.449	0.025	0.025	0.054	0.054
##	277	tfscs18	~~	tfscs16	8.595	0.133	0.133	0.232	0.232
##	278	tfscs18	~~	tfscs28	0.034	-0.006	-0.006	-0.015	-0.015
##	279	tfscs18	~~	tfscs31	0.486	-0.028	-0.028	-0.055	-0.055
##	280	tfscs21	~~	tfscs24	16.182	0.159	0.159	0.326	0.326
##	281	tfscs21	~~	tfscs27	1.409	-0.048	-0.048	-0.097	-0.097
##	282	tfscs21	~~	tfscs3	0.386	0.028	0.028	0.047	0.047
##	283	tfscs21	~~	tfscs4	5.270	0.077	0.077	0.179	0.179
##	284	tfscs21	~~	tfscs9	3.792	0.067	0.067	0.155	0.155
##	285	tfscs21	~~	tfscs14	0.055	0.009	0.009	0.018	0.018
##	286	tfscs21	~~	tfscs16	5.399	-0.103	-0.103	-0.178	-0.178
##	287	tfscs21	~~	tfscs28	5.818	0.082	0.082	0.192	0.192
##	288	tfscs21	~~	tfscs31	0.081	-0.011	-0.011	-0.022	-0.022
##	289	tfscs24	~~	tfscs27	5.452	-0.101	-0.101	-0.187	-0.187
##	290	tfscs24	~~	tfscs3	1.450	0.060	0.060	0.090	0.090
##	291	tfscs24	~~	tfscs4	1.353	0.042	0.042	0.089	0.089
##	292	tfscs24	~~	tfscs9	1.420	0.045	0.045	0.093	0.093
##	293	tfscs24	~~	tfscs14	0.001	0.001	0.001	0.002	0.002
##	294	tfscs24	~~	tfscs16	1.927	-0.067	-0.067	-0.105	-0.105
##	295	tfscs24	~~	tfscs28	3.667	0.070	0.070	0.150	0.150
##	296	tfscs24	~~	tfscs31	2.246	0.063	0.063	0.113	0.113
##	297	tfscs27	~~	tfscs3	1.514	0.062	0.062	0.093	0.093
##	298	tfscs27	~~	tfscs4	3.060	-0.064	-0.064	-0.135	-0.135
##	299	tfscs27	~~	tfscs9	1.341	-0.044	-0.044	-0.091	-0.091
##	300	tfscs27	~~	tfscs14	0.422	-0.026	-0.026	-0.050	-0.050
##	301	tfscs27	~~	tfscs16	0.466	0.033	0.033	0.052	0.052
##	302	tfscs27	~~	tfscs28	1.310	-0.043	-0.043	-0.090	-0.090
##	303	tfscs27	~~	tfscs31	0.368	-0.026	-0.026	-0.046	-0.046
##	304	tfscs3	~~	tfscs4	1.020	-0.045	-0.045	-0.077	-0.077
##	305	tfscs3	~~	tfscs9	0.351	-0.027	-0.027	-0.046	-0.046
##	306	tfscs3	~~	tfscs14	0.970	-0.048	-0.048	-0.075	-0.075
##	307	tfscs3	~~	tfscs16	0.325	-0.033	-0.033	-0.043	-0.043
##	308	tfscs3	~~	tfscs28	0.535	-0.033	-0.033	-0.057	-0.057
##	309	tfscs3	~~	tfscs31	1.971	0.072	0.072	0.104	0.104
##	310	tfscs4	~~	tfscs9	12.193	0.119	0.119	0.283	0.283
##	311	tfscs4	~~	tfscs14	0.290	0.019	0.019	0.042	0.042
##	312	tfscs4	~~	tfscs16	3.169	-0.077	-0.077	-0.136	-0.136
##	313	tfscs4	~~	tfscs28	0.001	0.001	0.001	0.002	0.002
##	314	tfscs4	~~	tfscs31	0.831	0.034	0.034	0.069	0.069
##	315	tfscs9	~~	tfscs14	1.024	0.038	0.038	0.082	0.082
##	316	tfscs9	~~	tfscs16	1.945	-0.062	-0.062	-0.110	-0.110
##	317	tfscs9	~~	tfscs28	1.720	0.046	0.046	0.111	0.111
##	318	tfscs9	~~	tfscs31	0.199	-0.017	-0.017	-0.035	-0.035
##	319	tfscs14	~~	tfscs16	0.161	-0.019	-0.019	-0.031	-0.031
##	320	tfscs14	~~	tfscs28	0.905	-0.035	-0.035	-0.077	-0.077
##	321	tfscs14	~~	tfscs31	0.055	0.010	0.010	0.018	0.018
##	322	tfscs16	~~	tfscs28	1.226	0.049	0.049	0.087	0.087
##	323	tfscs16	~~	tfscs31	19.957	-0.221	-0.221	-0.334	-0.334
##	324	tfscs28	~~	tfscs31	0.148	0.015	0.015	0.030	0.030

Viewing specific modindices

```
## You can request specific mod indices, such as the loadings
mi_cfa <- modindices(cfa_fit)
mi_cfa[mi_cfa$op == "~",]
```

##	lhs	op	rhs	mi	epc	sepc.lv	sepc.all	sepc.nox
## 73	inhib	=~	tfscs6	0.453	-0.120	-0.074	-0.061	-0.061
## 74	inhib	=~	tfscs11	0.094	-0.059	-0.036	-0.033	-0.033
## 75	inhib	=~	tfscs12	1.153	-0.190	-0.117	-0.105	-0.105
## 76	inhib	=~	tfscs18	1.169	0.185	0.114	0.097	0.097
## 77	inhib	=~	tfscs21	0.056	0.039	0.024	0.023	0.023
## 78	inhib	=~	tfscs24	0.193	-0.077	-0.048	-0.044	-0.044
## 79	inhib	=~	tfscs27	0.958	0.176	0.108	0.096	0.096
## 80	inhib	=~	tfscs3	0.194	0.170	0.104	0.097	0.097
## 81	inhib	=~	tfscs4	0.031	-0.051	-0.032	-0.037	-0.037
## 82	inhib	=~	tfscs9	2.104	-0.457	-0.281	-0.297	-0.297
## 83	inhib	=~	tfscs14	1.204	0.355	0.218	0.232	0.232
## 84	inhib	=~	tfscs16	1.650	0.486	0.299	0.279	0.279
## 85	inhib	=~	tfscs28	4.388	-0.649	-0.399	-0.429	-0.429
## 86	inhib	=~	tfscs31	4.181	0.672	0.413	0.449	0.449
## 87	init	=~	tfscs1	0.916	-0.095	-0.093	-0.104	-0.104
## 88	init	=~	tfscs10	2.017	-0.150	-0.148	-0.156	-0.156
## 89	init	=~	tfscs15	2.023	-0.159	-0.156	-0.164	-0.164
## 90	init	=~	tfscs17	27.568	0.626	0.615	0.545	0.545
## 91	init	=~	tfscs22	0.176	-0.054	-0.053	-0.049	-0.049
## 92	init	=~	tfscs23	2.417	-0.152	-0.149	-0.163	-0.163
## 93	init	=~	tfscs33	0.524	-0.087	-0.085	-0.085	-0.085
## 94	init	=~	tfscs3	4.179	0.320	0.314	0.293	0.293
## 95	init	=~	tfscs4	6.703	-0.306	-0.301	-0.351	-0.351
## 96	init	=~	tfscs9	4.014	-0.252	-0.248	-0.262	-0.262
## 97	init	=~	tfscs14	1.028	-0.132	-0.130	-0.138	-0.138
## 98	init	=~	tfscs16	18.183	0.653	0.642	0.600	0.600
## 99	init	=~	tfscs28	1.544	0.154	0.151	0.163	0.163
## 100	init	=~	tfscs31	0.968	-0.131	-0.129	-0.140	-0.140
## 101	cont	=~	tfscs1	0.039	0.062	0.036	0.041	0.041
## 102	cont	=~	tfscs10	0.157	-0.132	-0.077	-0.082	-0.082
## 103	cont	=~	tfscs15	0.098	0.109	0.064	0.067	0.067
## 104	cont	=~	tfscs17	4.455	0.813	0.476	0.422	0.422
## 105	cont	=~	tfscs22	7.202	-1.067	-0.624	-0.582	-0.582
## 106	cont	=~	tfscs23	0.002	-0.013	-0.008	-0.008	-0.008
## 107	cont	=~	tfscs33	0.171	-0.154	-0.090	-0.090	-0.090
## 108	cont	=~	tfscs6	0.985	-0.224	-0.131	-0.109	-0.109
## 109	cont	=~	tfscs11	0.012	0.027	0.016	0.014	0.014
## 110	cont	=~	tfscs12	4.405	-0.468	-0.273	-0.245	-0.245
## 111	cont	=~	tfscs18	0.016	0.028	0.016	0.014	0.014
## 112	cont	=~	tfscs21	4.304	0.429	0.251	0.238	0.238
## 113	cont	=~	tfscs24	2.224	0.331	0.194	0.180	0.180
## 114	cont	=~	tfscs27	0.304	-0.125	-0.073	-0.065	-0.065

Parameter estimates (alternative view)

```
# Another way to view parameter estimates is with parameterEstimates().
# This also provides confidence intervals for
# factor loadings, regression coefficients,
# means, and variances
parameterEstimates(cfa_fit)
```

##	lhs	op	rhs	est	se	z	pvalue	ci.lower	ci.upper
## 1	inhib	==	tfscs1	1.000	0.000	NA	NA	1.000	1.000
## 2	inhib	==	tfscs10	1.043	0.118	8.851	0	0.812	1.274
## 3	inhib	==	tfscs15	0.928	0.119	7.801	0	0.695	1.162
## 4	inhib	==	tfscs17	1.409	0.144	9.806	0	1.128	1.691
## 5	inhib	==	tfscs22	1.003	0.134	7.491	0	0.741	1.265
## 6	inhib	==	tfscs23	1.111	0.115	9.678	0	0.886	1.336
## 7	inhib	==	tfscs33	0.927	0.125	7.416	0	0.682	1.172
## 8	init	==	tfscs6	1.000	0.000	NA	NA	1.000	1.000
## 9	init	==	tfscs11	0.745	0.073	10.174	0	0.601	0.888
## 10	init	==	tfscs12	0.865	0.070	12.303	0	0.727	1.003
## 11	init	==	tfscs18	0.989	0.073	13.608	0	0.846	1.131
## 12	init	==	tfscs21	0.832	0.067	12.394	0	0.700	0.963
## 13	init	==	tfscs24	0.803	0.070	11.551	0	0.667	0.940
## 14	init	==	tfscs27	0.870	0.072	12.093	0	0.729	1.011
## 15	cont	==	tfscs3	1.000	0.000	NA	NA	1.000	1.000
## 16	cont	==	tfscs4	0.959	0.139	6.875	0	0.686	1.232
## 17	cont	==	tfscs9	1.173	0.160	7.316	0	0.859	1.488
## 18	cont	==	tfscs14	1.044	0.152	6.874	0	0.747	1.342
## 19	cont	==	tfscs16	1.065	0.166	6.419	0	0.740	1.390
## 20	cont	==	tfscs28	1.154	0.157	7.350	0	0.846	1.461
## 21	cont	==	tfscs31	0.879	0.139	6.303	0	0.605	1.152
## 22	tfscs1	~~	tfscs1	0.419	0.047	8.989	0	0.328	0.510
## 23	tfscs10	~~	tfscs10	0.482	0.054	8.986	0	0.377	0.588
## 24	tfscs15	~~	tfscs15	0.580	0.062	9.403	0	0.459	0.701
## 25	tfscs17	~~	tfscs17	0.522	0.064	8.206	0	0.397	0.647
## 26	tfscs22	~~	tfscs22	0.771	0.081	9.458	0	0.611	0.930
## 27	tfscs23	~~	tfscs23	0.367	0.043	8.501	0	0.282	0.452
## 28	tfscs33	~~	tfscs33	0.683	0.072	9.492	0	0.542	0.824
## 29	tfscs6	~~	tfscs6	0.491	0.059	8.382	0	0.376	0.606
## 30	tfscs11	~~	tfscs11	0.680	0.072	9.428	0	0.538	0.821
## 31	tfscs12	~~	tfscs12	0.524	0.059	8.864	0	0.408	0.640
## 32	tfscs18	~~	tfscs18	0.434	0.053	8.185	0	0.330	0.538
## 33	tfscs21	~~	tfscs21	0.443	0.051	8.704	0	0.343	0.542
## 34	tfscs24	~~	tfscs24	0.537	0.060	9.026	0	0.421	0.654
## 35	tfscs27	~~	tfscs27	0.543	0.061	8.912	0	0.424	0.663
## 36	tfscs3	~~	tfscs3	0.811	0.085	9.588	0	0.645	0.977
## 37	tfscs4	~~	tfscs4	0.419	0.046	9.049	0	0.329	0.510
## 38	tfscs9	~~	tfscs9	0.424	0.050	8.501	0	0.326	0.522
## 39	tfscs14	~~	tfscs14	0.513	0.056	9.208	0	0.404	0.622
## 40	tfscs16	~~	tfscs16	0.756	0.080	9.395	0	0.598	0.914
## 41	tfscs28	~~	tfscs28	0.410	0.047	8.671	0	0.318	0.503
## 42	tfscs31	~~	tfscs31	0.581	0.061	9.533	0	0.462	0.701
## 43	inhib	~~	inhib	0.378	0.070	5.367	0	0.240	0.516
## 44	init	~~	init	0.967	0.140	6.916	0	0.693	1.240

```

## 45    cont ~~    cont 0.342 0.085  4.004      0    0.174    0.509
## 46  inhib ~~    init 0.468 0.071  6.616      0    0.330    0.607
## 47  inhib ~~    cont 0.321 0.057  5.640      0    0.209    0.432
## 48    init ~~    cont 0.477 0.081  5.853      0    0.317    0.636
## 49  tfscs1 ~1      3.549 0.062 56.794      0    3.427    3.671
## 50 tfscs10 ~1      3.559 0.066 53.771      0    3.429    3.689
## 51 tfscs15 ~1      3.701 0.067 55.545      0    3.570    3.832
## 52 tfscs17 ~1      3.309 0.079 41.898      0    3.154    3.464
## 53 tfscs22 ~1      3.235 0.075 43.081      0    3.088    3.382
## 54 tfscs23 ~1      3.623 0.064 56.689      0    3.497    3.748
## 55 tfscs33 ~1      3.309 0.070 47.082      0    3.171    3.447
## 56  tfscs6 ~1      3.206 0.085 37.926      0    3.040    3.372
## 57 tfscs11 ~1      2.902 0.077 37.589      0    2.751    3.053
## 58 tfscs12 ~1      3.167 0.078 40.507      0    3.013    3.320
## 59 tfscs18 ~1      3.333 0.082 40.541      0    3.172    3.494
## 60 tfscs21 ~1      3.275 0.074 44.373      0    3.130    3.419
## 61 tfscs24 ~1      3.358 0.075 44.507      0    3.210    3.506
## 62 tfscs27 ~1      3.382 0.079 42.777      0    3.227    3.537
## 63  tfscs3 ~1      3.304 0.075 43.952      0    3.157    3.451
## 64  tfscs4 ~1      3.627 0.060 60.484      0    3.510    3.745
## 65  tfscs9 ~1      3.784 0.066 57.144      0    3.655    3.914
## 66 tfscs14 ~1      3.461 0.066 52.522      0    3.332    3.590
## 67 tfscs16 ~1      3.093 0.075 41.318      0    2.946    3.240
## 68 tfscs28 ~1      3.451 0.065 52.989      0    3.323    3.579
## 69 tfscs31 ~1      3.706 0.064 57.585      0    3.580    3.832
## 70  inhib ~1      0.000 0.000    NA      NA    0.000    0.000
## 71    init ~1      0.000 0.000    NA      NA    0.000    0.000
## 72    cont ~1      0.000 0.000    NA      NA    0.000    0.000

```

Residual covariances and variances

```
lavResiduals(cfa_fit)
```

```

## $type
## [1] "cor.bentler"
##
## $cov
##      tfscs1 tfsc10 tfsc15 tfsc17 tfsc22 tfsc23 tfsc33 tfscs6 tfsc11 tfsc12
## tfscs1    0.000
## tfscs10   0.041   0.000
## tfscs15  -0.046   0.019   0.000
## tfscs17   0.004  -0.039  -0.032   0.000
## tfscs22  -0.039   0.080   0.041  -0.015   0.000
## tfscs23   0.028  -0.075   0.031   0.006   0.036   0.000
## tfscs33  -0.033   0.120   0.013  -0.078   0.057   0.008   0.000
## tfscs6   -0.021  -0.052  -0.129   0.135  -0.056  -0.023  -0.030   0.000
## tfscs11  -0.091  -0.043   0.000   0.047   0.064  -0.013  -0.052  -0.014   0.000
## tfscs12  -0.011  -0.075  -0.067   0.121  -0.012  -0.101   0.030   0.056   0.001   0.000
## tfscs18  -0.046  -0.060  -0.028   0.192   0.075  -0.029  -0.019  -0.014   0.013   0.023
## tfscs21  -0.011   0.014  -0.029   0.044  -0.090  -0.016  -0.051  -0.017   0.018  -0.063
## tfscs24   0.021  -0.067  -0.031  -0.007  -0.145   0.001  -0.003   0.010  -0.020  -0.025
## tfscs27  -0.014   0.054   0.042   0.088   0.122  -0.042  -0.018   0.005  -0.005   0.033

```

```

## tfscs3    0.115 -0.058 -0.068 -0.005 -0.035  0.034  0.019  0.027  0.044  0.031
## tfscs4    0.019  0.079  0.006 -0.056 -0.150  0.048  0.030 -0.045 -0.083 -0.087
## tfscs9    0.049  0.025 -0.008 -0.049 -0.114 -0.011 -0.049 -0.077 -0.011 -0.094
## tfscs14   -0.064  0.029  0.102  0.040 -0.027  0.009  0.071 -0.047 -0.002 -0.077
## tfscs16   -0.047 -0.045  0.034  0.158  0.084 -0.031 -0.089  0.105  0.186  0.083
## tfscs28   -0.024 -0.079  0.014 -0.008 -0.090 -0.024 -0.028  0.008  0.007 -0.039
## tfscs31    0.051  0.076  0.038 -0.012  0.032  0.067  0.049 -0.031 -0.046 -0.052
##          tfsc18 tfsc21 tfsc24 tfsc27 tfscs3 tfscs4 tfscs9 tfsc14 tfsc16 tfsc28
## tfscs1
## tfscs10
## tfscs15
## tfscs17
## tfscs22
## tfscs23
## tfscs33
## tfscs6
## tfscs11
## tfscs12
## tfscs18    0.000
## tfscs21   -0.023  0.000
## tfscs24   -0.039  0.105  0.000
## tfscs27    0.038 -0.029 -0.063  0.000
## tfscs3     0.020  0.079  0.096  0.076  0.000
## tfscs4    -0.116  0.051  0.017 -0.102 -0.041  0.000
## tfscs9    -0.049  0.050  0.029 -0.066 -0.021  0.110  0.000
## tfscs14    0.001  0.014  0.004 -0.043 -0.041  0.019  0.032  0.000
## tfscs16    0.165  0.021  0.039  0.092 -0.026 -0.070 -0.048 -0.016  0.000
## tfscs28    0.015  0.107  0.093 -0.022 -0.026  0.001  0.036 -0.030  0.038  0.000
## tfscs31   -0.038 -0.008  0.054 -0.044  0.064  0.037 -0.016  0.010 -0.198  0.014
##          tfsc31
## tfscs1
## tfscs10
## tfscs15
## tfscs17
## tfscs22
## tfscs23
## tfscs33
## tfscs6
## tfscs11
## tfscs12
## tfscs18
## tfscs21
## tfscs24
## tfscs27
## tfscs3
## tfscs4
## tfscs9
## tfscs14
## tfscs16
## tfscs28
## tfscs31    0.000
##
## $mean
## tfscs1 tfscs10 tfscs15 tfscs17 tfscs22 tfscs23 tfscs33 tfscs6 tfscs11 tfscs12

```

```

##      0      0      0      0      0      0      0      0      0      0
## tfscs18 tfscs21 tfscs24 tfscs27 tfscs3 tfscs4 tfscs9 tfscs14 tfscs16 tfscs28
##      0      0      0      0      0      0      0      0      0      0
## tfscs31
##      0
##
## $cov.z
##      tfscs1 tfsc10 tfsc15 tfsc17 tfsc22 tfsc23 tfsc33 tfscs6 tfsc11 tfsc12
## tfscs1      0.000
## tfscs10     1.114 0.000
## tfscs15    -1.308 0.488 0.000
## tfscs17     0.126 -1.405 -0.964 0.000
## tfscs22    -1.063 1.879 0.923 -0.333 0.000
## tfscs23     0.856 -2.879 0.876 0.194 1.009 0.000
## tfscs33    -0.859 2.673 0.301 -2.330 1.213 0.229 0.000
## tfscs6     -0.452 -1.103 -2.474 2.897 -1.061 -0.556 -0.634 0.000
## tfscs11    -1.624 -0.779 -0.003 0.962 1.187 -0.247 -0.922 -0.322 0.000
## tfscs12    -0.233 -1.436 -1.277 2.546 -0.216 -2.053 0.618 1.274 0.031 0.000
## tfscs18    -0.977 -1.242 -0.583 4.397 1.656 -0.638 -0.418 -0.274 0.273 0.490
## tfscs21    -0.242 0.319 -0.596 0.897 -1.686 -0.373 -0.994 -0.447 0.437 -1.729
## tfscs24     0.436 -1.303 -0.579 -0.128 -2.461 0.032 -0.058 0.259 -0.473 -0.692
## tfscs27    -0.294 1.150 0.883 1.705 2.505 -0.895 -0.351 0.127 -0.105 0.849
## tfscs3      2.333 -1.153 -1.330 -0.125 -0.622 0.727 0.366 0.547 0.866 0.602
## tfscs4      0.434 1.734 0.132 -1.499 -3.039 1.180 0.626 -1.055 -1.514 -1.826
## tfscs9      1.159 0.577 -0.170 -1.390 -2.530 -0.283 -1.085 -1.896 -0.221 -2.148
## tfscs14    -1.477 0.621 2.131 1.043 -0.570 0.214 1.465 -1.100 -0.039 -1.604
## tfscs16    -0.959 -0.898 0.652 2.830 1.415 -0.641 -1.681 2.020 3.669 1.508
## tfscs28    -0.550 -1.818 0.291 -0.219 -1.949 -0.597 -0.620 0.213 0.150 -0.938
## tfscs31     1.072 1.581 0.771 -0.299 0.618 1.500 0.948 -0.675 -0.857 -1.018
##      tfsc18 tfsc21 tfsc24 tfsc27 tfscs3 tfscs4 tfscs9 tfsc14 tfsc16 tfsc28
## tfscs1
## tfscs10
## tfscs15
## tfscs17
## tfscs22
## tfscs23
## tfscs33
## tfscs6
## tfscs11
## tfscs12
## tfscs18      0.000
## tfscs21     -0.566 0.000
## tfscs24     -1.049 2.312 0.000
## tfscs27      0.850 -0.843 -1.876 0.000
## tfscs3       0.435 1.763 2.032 1.571 0.000
## tfscs4      -2.651 1.147 0.356 -2.154 -0.996 0.000
## tfscs9      -1.277 1.108 0.607 -1.582 -0.579 2.735 0.000
## tfscs14      0.027 0.310 0.081 -0.929 -0.967 0.496 0.913 0.000
## tfscs16      3.205 0.416 0.787 1.705 -0.549 -1.937 -1.439 -0.374 0.000
## tfscs28      0.394 2.623 2.101 -0.555 -0.679 0.026 1.094 -0.884 0.985 0.000
## tfscs31     -0.857 -0.166 1.107 -0.883 1.295 0.849 -0.438 0.220 -4.603 0.360
##      tfsc31
## tfscs1
## tfscs10

```

```

## tfscs15
## tfscs17
## tfscs22
## tfscs23
## tfscs33
## tfscs6
## tfscs11
## tfscs12
## tfscs18
## tfscs21
## tfscs24
## tfscs27
## tfscs3
## tfscs4
## tfscs9
## tfscs14
## tfscs16
## tfscs28
## tfscs31 0.000
##
## $mean.z
##   tfscs1 tfscs10 tfscs15 tfscs17 tfscs22 tfscs23 tfscs33 tfscs6 tfscs11 tfscs12
##       0       0       0       0       0       0       0       0       0       0
##   tfscs18 tfscs21 tfscs24 tfscs27 tfscs3  tfscs4  tfscs9  tfscs14 tfscs16 tfscs28
##       0       0       0       0       0       0       0       0       0       0
##   tfscs31
##       0
##
## $summary
##               cov mean total
## srmr           0.058 0.00 0.056
## srmr.se         0.006  NA 0.005
## srmr.exactfit.z 2.242  NA 2.242
## srmr.exactfit.pvalue 0.012  NA 0.012
## usrmr           0.036 0.00 0.034
## usrmr.se         0.008  NA 0.007
## usrmr.ci.lower  0.023  NA 0.022
## usrmr.ci.upper  0.049  NA 0.047
## usrmr.closefit.h0.value 0.050 0.05 0.050
## usrmr.closefit.z -1.810  NA -2.097
## usrmr.closefit.pvalue 0.965  NA 0.982

```

Troubleshooting Errors

`lavInspect()` is equivalent to `TECH1` in `Mplus` and is a helpful tool if you're getting error messages. It assigns numbers to parameters, which help you identify the source of difficulty in the model.

```
lavInspect(cfa_fit)
```

```

## $lambda
##      inhib init cont
## tfscs1      0   0   0
## tfscs10     1   0   0

```



```

## tfscs15      2    0    0
## tfscs17      3    0    0
## tfscs22      4    0    0
## tfscs23      5    0    0
## tfscs33      6    0    0
## tfscs6       0    0    0
## tfscs11      0    7    0
## tfscs12      0    8    0
## tfscs18      0    9    0
## tfscs21      0   10    0
## tfscs24      0   11    0
## tfscs27      0   12    0
## tfscs3       0    0    0
## tfscs4       0    0   13
## tfscs9       0    0   14
## tfscs14      0    0   15
## tfscs16      0    0   16
## tfscs28      0    0   17
## tfscs31      0    0   18
##
## $theta
##      tfscs1 tfsc10 tfsc15 tfsc17 tfsc22 tfsc23 tfsc33 tfscs6 tfsc11 tfsc12
## tfscs1  19
## tfscs10 0      20
## tfscs15 0      0      21
## tfscs17 0      0      0      22
## tfscs22 0      0      0      0      23
## tfscs23 0      0      0      0      0      24
## tfscs33 0      0      0      0      0      0      25
## tfscs6   0      0      0      0      0      0      0      26
## tfscs11 0      0      0      0      0      0      0      0      27
## tfscs12 0      0      0      0      0      0      0      0      0      28
## tfscs18 0      0      0      0      0      0      0      0      0      0
## tfscs21 0      0      0      0      0      0      0      0      0      0
## tfscs24 0      0      0      0      0      0      0      0      0      0
## tfscs27 0      0      0      0      0      0      0      0      0      0
## tfscs3   0      0      0      0      0      0      0      0      0      0
## tfscs4   0      0      0      0      0      0      0      0      0      0
## tfscs9   0      0      0      0      0      0      0      0      0      0
## tfscs14 0      0      0      0      0      0      0      0      0      0
## tfscs16 0      0      0      0      0      0      0      0      0      0
## tfscs28 0      0      0      0      0      0      0      0      0      0
## tfscs31 0      0      0      0      0      0      0      0      0      0
##      tfsc18 tfsc21 tfsc24 tfsc27 tfscs3 tfscs4 tfscs9 tfsc14 tfsc16 tfsc28
## tfscs1
## tfscs10
## tfscs15
## tfscs17
## tfscs22
## tfscs23
## tfscs33
## tfscs6
## tfscs11
## tfscs12

```

```

## tfscs18 29
## tfscs21 0      30
## tfscs24 0      0      31
## tfscs27 0      0      0      32
## tfscs3  0      0      0      0      33
## tfscs4  0      0      0      0      0      34
## tfscs9  0      0      0      0      0      0      35
## tfscs14 0      0      0      0      0      0      0      36
## tfscs16 0      0      0      0      0      0      0      0      37
## tfscs28 0      0      0      0      0      0      0      0      0      38
## tfscs31 0      0      0      0      0      0      0      0      0      0
##      tfsc31
## tfscs1
## tfscs10
## tfscs15
## tfscs17
## tfscs22
## tfscs23
## tfscs33
## tfscs6
## tfscs11
## tfscs12
## tfscs18
## tfscs21
## tfscs24
## tfscs27
## tfscs3
## tfscs4
## tfscs9
## tfscs14
## tfscs16
## tfscs28
## tfscs31 39
##
## $psi
##      inhib init cont
## inhib 40
## init  43      41
## cont  44      45      42
##
## $nu
##      intrcp
## tfscs1      46
## tfscs10     47
## tfscs15     48
## tfscs17     49
## tfscs22     50
## tfscs23     51
## tfscs33     52
## tfscs6      53
## tfscs11     54
## tfscs12     55
## tfscs18     56
## tfscs21     57

```

```
## tfscs24      58
## tfscs27      59
## tfscs3       60
## tfscs4       61
## tfscs9       62
## tfscs14      63
## tfscs16      64
## tfscs28      65
## tfscs31      66
##
## $alpha
##      intrcp
## inhib      0
## init       0
## cont       0
```

For a deeper understanding of the model estimated by lavaan, you can use 'r lavInspect(cfa_fit, what = "list")', which will list the fixed and free parameters, starting values, grouping, whether it's an endogenous or exogenous variable, and more.

```
lavInspect(cfa_fit, what = "list")
```

```
##      id      lhs op      rhs user block group free  ustart exo label plabel start
## 1  1  inhib == tfscs1    1    1    1    0    1    0      .p1. 1.000
## 2  2  inhib == tfscs10   1    1    1    1    NA    0      .p2. 0.989
## 3  3  inhib == tfscs15   1    1    1    2    NA    0      .p3. 0.901
## 4  4  inhib == tfscs17   1    1    1    3    NA    0      .p4. 1.293
## 5  5  inhib == tfscs22   1    1    1    4    NA    0      .p5. 1.043
## 6  6  inhib == tfscs23   1    1    1    5    NA    0      .p6. 1.057
## 7  7  inhib == tfscs33   1    1    1    6    NA    0      .p7. 0.926
## 8  8  init  == tfscs6    1    1    1    0    1    0      .p8. 1.000
## 9  9  init  == tfscs11   1    1    1    7    NA    0      .p9. 0.729
## 10 10 init  == tfscs12   1    1    1    8    NA    0     .p10. 0.869
## 11 11 init  == tfscs18   1    1    1    9    NA    0     .p11. 0.969
## 12 12 init  == tfscs21   1    1    1   10    NA    0     .p12. 0.807
## 13 13 init  == tfscs24   1    1    1   11    NA    0     .p13. 0.782
## 14 14 init  == tfscs27   1    1    1   12    NA    0     .p14. 0.856
## 15 15 cont  == tfscs3    1    1    1    0    1    0     .p15. 1.000
## 16 16 cont  == tfscs4    1    1    1   13    NA    0     .p16. 1.000
## 17 17 cont  == tfscs9    1    1    1   14    NA    0     .p17. 1.185
## 18 18 cont  == tfscs14   1    1    1   15    NA    0     .p18. 1.036
## 19 19 cont  == tfscs16   1    1    1   16    NA    0     .p19. 0.852
## 20 20 cont  == tfscs28   1    1    1   17    NA    0     .p20. 1.186
## 21 21 cont  == tfscs31   1    1    1   18    NA    0     .p21. 0.880
## 22 22 tfscs1 ~~ tfscs1    0    1    1   19    NA    0     .p22. 0.398
## 23 23 tfscs10 ~~ tfscs10  0    1    1   20    NA    0     .p23. 0.447
## 24 24 tfscs15 ~~ tfscs15  0    1    1   21    NA    0     .p24. 0.453
## 25 25 tfscs17 ~~ tfscs17  0    1    1   22    NA    0     .p25. 0.636
## 26 26 tfscs22 ~~ tfscs22  0    1    1   23    NA    0     .p26. 0.575
## 27 27 tfscs23 ~~ tfscs23  0    1    1   24    NA    0     .p27. 0.417
## 28 28 tfscs33 ~~ tfscs33  0    1    1   25    NA    0     .p28. 0.504
## 29 29 tfscs6  ~~ tfscs6   0    1    1   26    NA    0     .p29. 0.729
## 30 30 tfscs11 ~~ tfscs11  0    1    1   27    NA    0     .p30. 0.608
```

##	31	31	tfscs12	~~	tfscs12	0	1	1	28	NA	0	.p31.	0.623
##	32	32	tfscs18	~~	tfscs18	0	1	1	29	NA	0	.p32.	0.690
##	33	33	tfscs21	~~	tfscs21	0	1	1	30	NA	0	.p33.	0.555
##	34	34	tfscs24	~~	tfscs24	0	1	1	31	NA	0	.p34.	0.581
##	35	35	tfscs27	~~	tfscs27	0	1	1	32	NA	0	.p35.	0.638
##	36	36	tfscs3	~~	tfscs3	0	1	1	33	NA	0	.p36.	0.576
##	37	37	tfscs4	~~	tfscs4	0	1	1	34	NA	0	.p37.	0.367
##	38	38	tfscs9	~~	tfscs9	0	1	1	35	NA	0	.p38.	0.447
##	39	39	tfscs14	~~	tfscs14	0	1	1	36	NA	0	.p39.	0.443
##	40	40	tfscs16	~~	tfscs16	0	1	1	37	NA	0	.p40.	0.572
##	41	41	tfscs28	~~	tfscs28	0	1	1	38	NA	0	.p41.	0.433
##	42	42	tfscs31	~~	tfscs31	0	1	1	39	NA	0	.p42.	0.422
##	43	43	inhib	~~	inhib	0	1	1	40	NA	0	.p43.	0.050
##	44	44	init	~~	init	0	1	1	41	NA	0	.p44.	0.050
##	45	45	cont	~~	cont	0	1	1	42	NA	0	.p45.	0.050
##	46	46	inhib	~~	init	0	1	1	43	NA	0	.p46.	0.000
##	47	47	inhib	~~	cont	0	1	1	44	NA	0	.p47.	0.000
##	48	48	init	~~	cont	0	1	1	45	NA	0	.p48.	0.000
##	49	49	tfscs1	~1		0	1	1	46	NA	0	.p49.	3.549
##	50	50	tfscs10	~1		0	1	1	47	NA	0	.p50.	3.559
##	51	51	tfscs15	~1		0	1	1	48	NA	0	.p51.	3.701
##	52	52	tfscs17	~1		0	1	1	49	NA	0	.p52.	3.309
##	53	53	tfscs22	~1		0	1	1	50	NA	0	.p53.	3.235
##	54	54	tfscs23	~1		0	1	1	51	NA	0	.p54.	3.623
##	55	55	tfscs33	~1		0	1	1	52	NA	0	.p55.	3.309
##	56	56	tfscs6	~1		0	1	1	53	NA	0	.p56.	3.206
##	57	57	tfscs11	~1		0	1	1	54	NA	0	.p57.	2.902
##	58	58	tfscs12	~1		0	1	1	55	NA	0	.p58.	3.167
##	59	59	tfscs18	~1		0	1	1	56	NA	0	.p59.	3.333
##	60	60	tfscs21	~1		0	1	1	57	NA	0	.p60.	3.275
##	61	61	tfscs24	~1		0	1	1	58	NA	0	.p61.	3.358
##	62	62	tfscs27	~1		0	1	1	59	NA	0	.p62.	3.382
##	63	63	tfscs3	~1		0	1	1	60	NA	0	.p63.	3.304
##	64	64	tfscs4	~1		0	1	1	61	NA	0	.p64.	3.627
##	65	65	tfscs9	~1		0	1	1	62	NA	0	.p65.	3.784
##	66	66	tfscs14	~1		0	1	1	63	NA	0	.p66.	3.461
##	67	67	tfscs16	~1		0	1	1	64	NA	0	.p67.	3.093
##	68	68	tfscs28	~1		0	1	1	65	NA	0	.p68.	3.451
##	69	69	tfscs31	~1		0	1	1	66	NA	0	.p69.	3.706
##	70	70	inhib	~1		0	1	1	0	0	0	.p70.	0.000
##	71	71	init	~1		0	1	1	0	0	0	.p71.	0.000
##	72	72	cont	~1		0	1	1	0	0	0	.p72.	0.000
##			est		se								
##	1		1.000		0.000								
##	2		1.043		0.118								
##	3		0.928		0.119								
##	4		1.409		0.144								
##	5		1.003		0.134								
##	6		1.111		0.115								
##	7		0.927		0.125								
##	8		1.000		0.000								
##	9		0.745		0.073								
##	10		0.865		0.070								
##	11		0.989		0.073								

12 0.832 0.067
13 0.803 0.070
14 0.870 0.072
15 1.000 0.000
16 0.959 0.139
17 1.173 0.160
18 1.044 0.152
19 1.065 0.166
20 1.154 0.157
21 0.879 0.139
22 0.419 0.047
23 0.482 0.054
24 0.580 0.062
25 0.522 0.064
26 0.771 0.081
27 0.367 0.043
28 0.683 0.072
29 0.491 0.059
30 0.680 0.072
31 0.524 0.059
32 0.434 0.053
33 0.443 0.051
34 0.537 0.060
35 0.543 0.061
36 0.811 0.085
37 0.419 0.046
38 0.424 0.050
39 0.513 0.056
40 0.756 0.080
41 0.410 0.047
42 0.581 0.061
43 0.378 0.070
44 0.967 0.140
45 0.342 0.085
46 0.468 0.071
47 0.321 0.057
48 0.477 0.081
49 3.549 0.062
50 3.559 0.066
51 3.701 0.067
52 3.309 0.079
53 3.235 0.075
54 3.623 0.064
55 3.309 0.070
56 3.206 0.085
57 2.902 0.077
58 3.167 0.078
59 3.333 0.082
60 3.275 0.074
61 3.358 0.075
62 3.382 0.079
63 3.304 0.075
64 3.627 0.060
65 3.784 0.066

```
## 66 3.461 0.066
## 67 3.093 0.075
## 68 3.451 0.065
## 69 3.706 0.064
## 70 0.000 0.000
## 71 0.000 0.000
## 72 0.000 0.000
```