



**RadoNorm**  
Managing risks from radon and NORM

*On-line, interactive training course  
The art of public opinion survey analysis:  
Surveying the public on Radon & NORM*

April 2021



## **Day 5: Analysis of survey data: Confirmatory techniques**

**30 April 2021**

<https://zoom.us/j/92190920610?pwd=bGNlcmxUcSs3aTBVeFpOT2l4eWFFQT09>

**Time (CET)**

**Activity**

**Lead**

09:30-10:30 Confirmatory measurement techniques; model fit, differences

Peter

10:30-10:45 *Break (15 minutes)*

10:45-12:00 Confirmatory measurement techniques; model fit, differences

Peter

12:00-13:30 *Break & Course Evaluation (1 hour 30 minutes)*

13:30-13:35 Instructions for individual and group work

Plenary

13:35-15:45 Group 1: Testing latent constructs in own nomological network (Mplus)

Peter, Melisa

Group 2: Evaluating research paper

Tanja, Peter

15:45-16:00 Wrap up of the course and closure

Peter, Tanja, Melisa

# Global assessment of the quality of measurement scales in a public opinion survey

- Are the indicators **VALID**: the question of **VALIDITY**
  - Standardized factor loadings in a factor analysis
  - Criterion validity: association with criterion variables, based on literature
- Are the indicators **RELIABLE**: the question of **RELIABILITY**
  - Over-time external consistency: Test-retest correlations
  - Internal consistency: Cronbach's alpha

## Reliability analysis

In order to test the internal consistency of indicators  
as measures of a unidimensional latent construct

## Reliable Indicators

$$x_i = \tau_i + e_i$$

### Test-retest reliability

- > correlations over time  $r(x_{t1}, x_{t2})$  or  $r(x_{t1}, y_{t2})$
- BUT trade-off reminder – real change

### Internal consistency

- > split-half  $r(\sum x_{\text{helft1}}, \sum x_{\text{helft2}})$
- BUT many possible partitions
- > Cronbach's alpha: mean correlation of all possible partitions

## Cronbach's alpha (1)

Alpha= proportion common variance

**Covariances** = common variance

$$\sigma_{12} = \text{cov ar } (x_1 x_2) = \frac{1}{n-1} \sum_{i=1}^n (x_{i1} - \bar{x}_1)(x_{i2} - \bar{x}_2)$$

Individual **variance** = unique variance

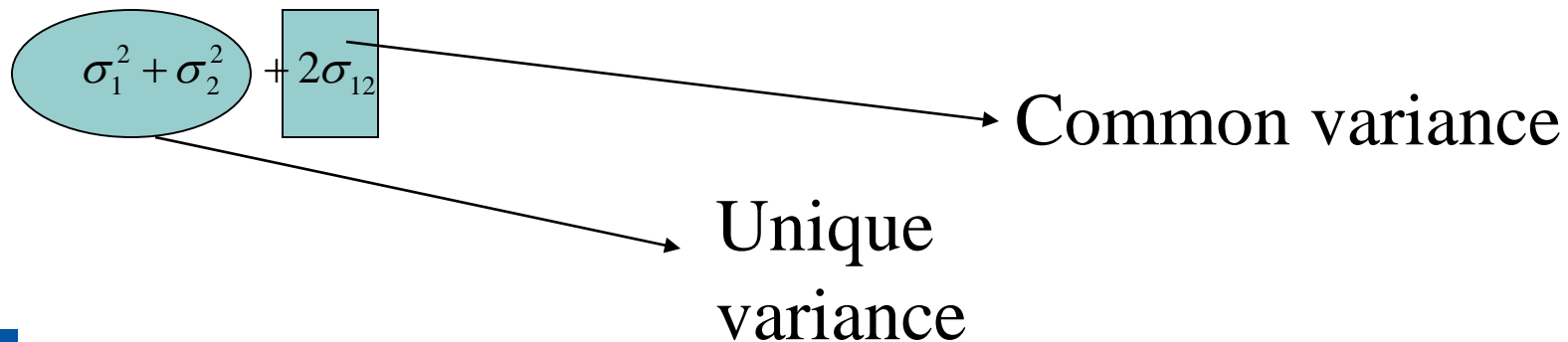
$$\sigma_1^2 = \text{var } (x_1) = \frac{1}{n-1} \sum_{i=1}^n (x_{i1} - \bar{x}_1)^2 = \frac{\sum_{i=1}^n x_{i1}^2}{n-1} - \frac{n\bar{x}^2}{n-1}$$

## Cronbach's alpha (2)

Variance of scale scores = sum scores

$$\text{var}(x_1 + x_2) = \frac{1}{n-1} \sum_{i=1}^n (x_{i1} + x_{i2} - \bar{x}_1 - \bar{x}_2)^2 = \frac{1}{n-1} \sum_{i=1}^n [(x_{i1} - \bar{x}_1) + (x_{i2} - \bar{x}_2)]^2 =$$

$$\frac{1}{n-1} \sum_{i=1}^n (x_{i1} - \bar{x}_1)^2 + \frac{1}{n-1} \sum_{i=1}^n (x_{i2} - \bar{x}_2)^2 + \frac{2}{n-1} \sum_{i=1}^n (x_{i1} - \bar{x}_1)(x_{i2} - \bar{x}_2) =$$



## Cronbach's alpha (3)

Variance of scale scores = sum scores

-> Logic for 4 items

$$\text{var } S = \text{var } (x_1 + x_2 + x_3 + x_4) =$$

$$\sigma_1^2 + \sigma_2^2 + \sigma_3^2 + \sigma_4^2 + \sigma_{12} + \sigma_{21} + \sigma_{13} + \sigma_{31} + \sigma_{14} + \sigma_{41} + \sigma_{23} + \sigma_{32} + \sigma_{24} + \sigma_{42} + \sigma_{34} + \sigma_{43}$$

$$\text{Var } S_i = \sum_{i=1}^n \sigma_i^2 + \sum_{i=1}^n \sum_{\substack{j=1 \\ i \neq j}}^n \sigma_{ij}$$

= unique variance + common variance



## Cronbach's alpha (4)

$$\alpha = \frac{\sum_{i=1}^n \sum_{\substack{j=1 \\ i \neq j}}^n \sigma_{ij}}{\sum_{i=1}^n \sum_{\substack{j=1 \\ i \neq j}}^n \sigma_{ij} + \sum_{i=1}^n \sigma_i^2} = \frac{ESS}{TSS}$$

Alpha is comparable with  $R^2$

Problem: more items  $\Rightarrow$  alpha higher

## Cronbach's alpha (5)

$$\alpha_{adj} = \frac{\sum_{i=1}^n \sum_{\substack{j=1 \\ i \neq j}}^n \sigma_{ij}}{\left( \sum_{i=1}^n \sum_{\substack{j=1 \\ i \neq j}}^n \sigma_{ij} + \sum_{i=1}^n \sigma_i^2 \right)} = \frac{n}{(n-1)} \cdot \alpha \quad \text{because } n^2 - n = n \cdot (n-1)$$

n.n=n<sup>2</sup> elements in covariance matrix

with n diagonal elements

Adjusted alpha comparable with adjusted R<sup>2</sup>

## Political efficacy Inspired by NES US

Q61.a There's no sense in voting; the *parties* do what they want to do anyway.

No opinion= 5; missing= 1 - **teken**

Q61.b *Parties* are only interested in my vote, not in my opinion.

No opinion= 6; missing= 2 - **teken**

Q61.c If people like me let the *politicians* know what we think, then they will take our opinion into account.

No opinion= 52; missing= 1 + **teken => spiegelen**

Q61.d Most *politicians* promise a lot, but don't do anything.

No opinion= 0; missing= 2 - **teken**

Q61.e As soon as they are elected, *politicians* think they are better than people like me.

No opinion= 15; missing= 2 - **teken**

Q61.f Most of our *politicians* are competent people who know what they are doing.

No opinion= 11; missing= 1 + **teken => spiegelen**

# Perceived behavioural control (Flanders)

## Covariance matrix

**Inter-Item Covariance Matrix**

	q61_a	q61_b	q61_cS	q61_d	q61_e	q61_fS
q61_a	1,625	,853	,385	,621	,684	,174
q61_b	,853	1,063	,382	,540	,606	,180
q61_cS	,385	,382	,866	,293	,330	,151
q61_d	,621	,540	,293	1,014	,675	,209
q61_e	,684	,606	,330	,675	1,141	,227
q61_fS	,174	,180	,151	,209	,227	,796

$$\sum_{i=1}^n \sum_{\substack{j=1 \\ i \neq j}}^n \sigma_{ij} = (2.0,853) + (2.0,385) + \dots + (2.0,227) = 12,620$$

$$\sum_{i=1}^n \sigma_i^2 = 1,652 + 1,063 + 0,866 + 1,014 + 1,141 + 0,796 = 6,505$$

# Perceived behavioural control (Flanders)

## Cronbach's alpha (6 items)

$$\alpha_{adj} = \frac{n}{(n-1)} \cdot \frac{\sum_{i=1}^n \sum_{\substack{j=1 \\ i \neq j}}^n \sigma_{ij}}{\sum_{i=1}^n \sum_{\substack{j=1 \\ i \neq j}}^n \sigma_{ij} + \sum_{i=1}^n \sigma_i^2} = \frac{6}{(6-1)} \cdot \frac{12,620}{(12,620 + 6,505)} = 0,792$$

**Item-Total Statistics**

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
q61_a	13,4926	12,066	,614	,463	,744
q61_b	13,9606	12,943	,690	,522	,724
q61_cS	13,7572	15,177	,425	,190	,786
q61_d	13,9579	13,433	,634	,455	,739
q61_e	13,6152	12,940	,656	,482	,732
q61_fS	13,0175	16,447	,260	,078	,816

# Perceived behavioural control (Flanders)

## Cronbach's alpha (6 items)

**Item-Total Statistics**

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
q61_a	10,1499	9,736	,639	,463	,774
q61_b	10,6179	10,624	,708	,521	,750
q61_cS	10,4145	12,801	,418	,184	,829
q61_d	10,6152	11,174	,633	,451	,773
q61_e	10,2726	10,716	,656	,477	,765

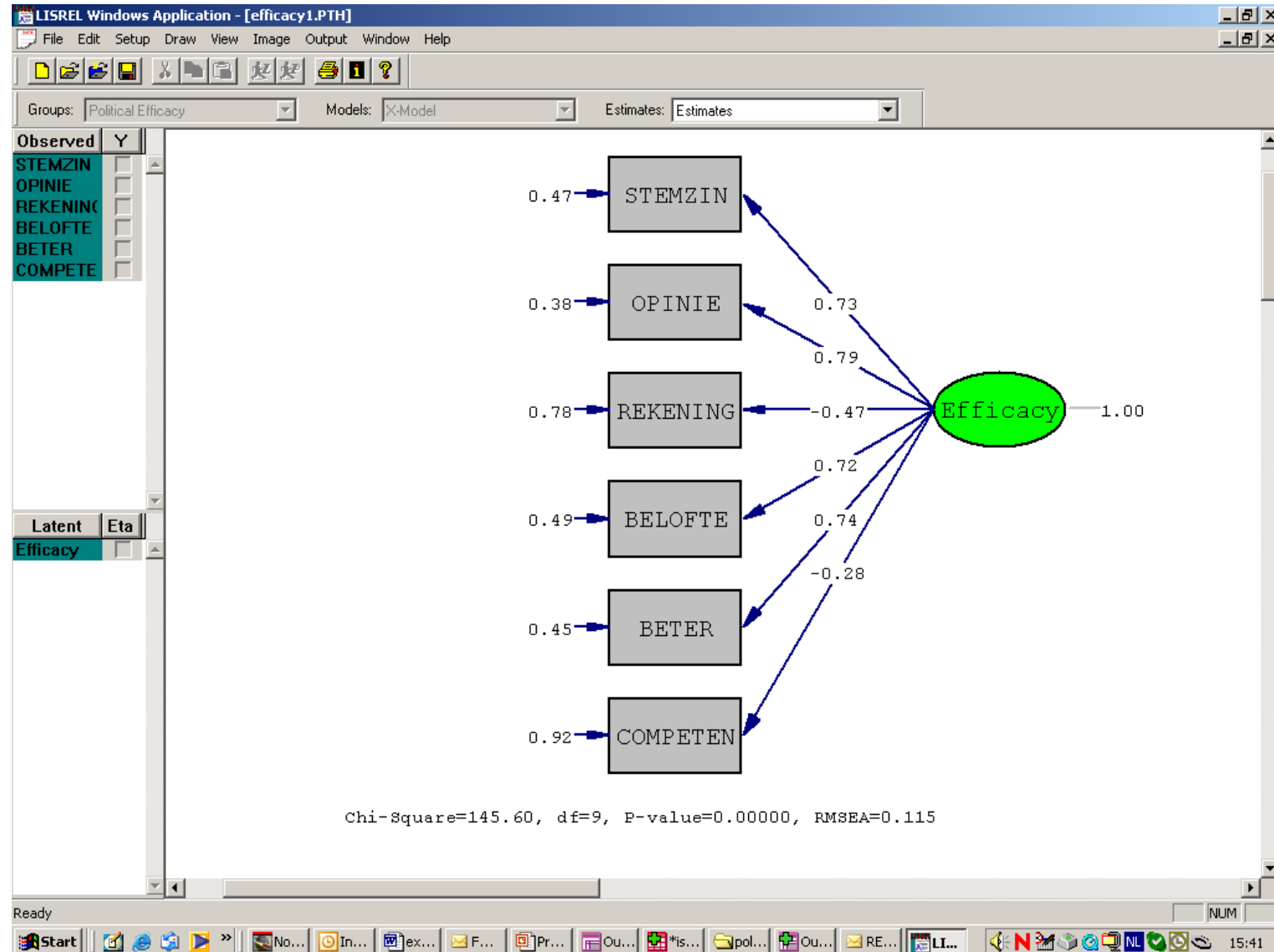
# Confirmatory and Explanatory modeling in a SEM-context

# Confirmatory analysis Structural Equation Modelling (SEM)

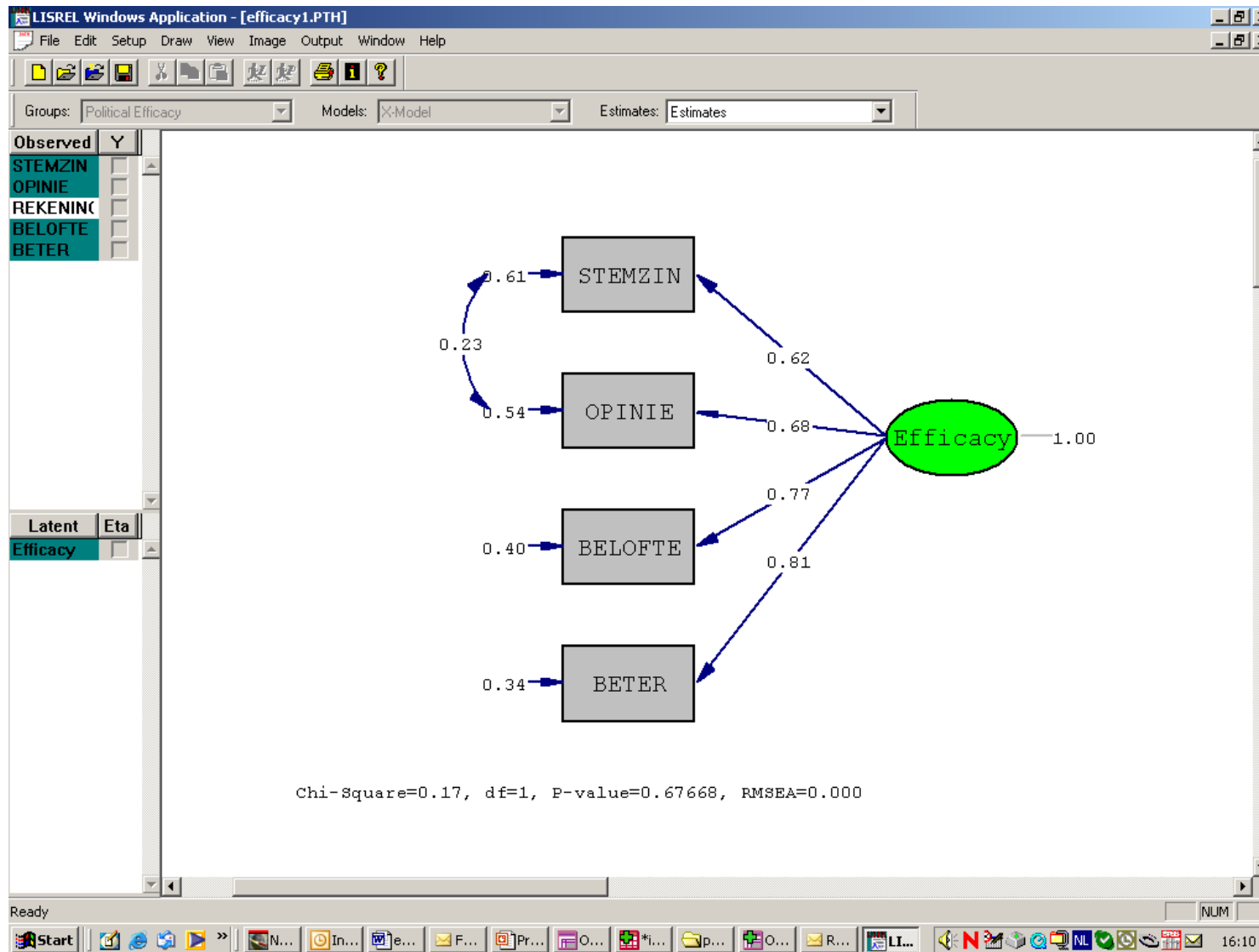
- Structural Equation Modeling (SEM)
- Mplus, Lisrel, Amos



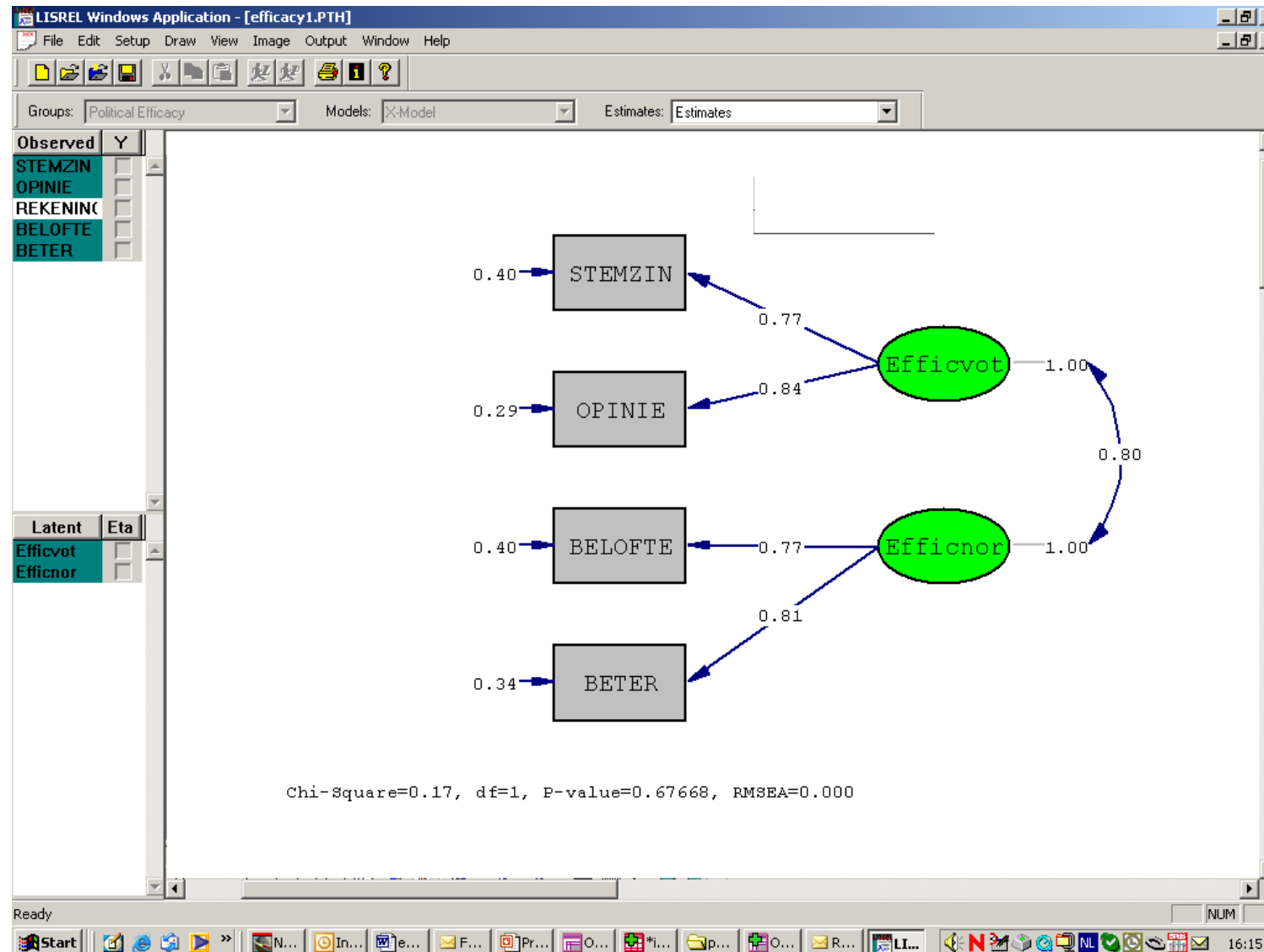
# CFA – Lisrel Path diagram



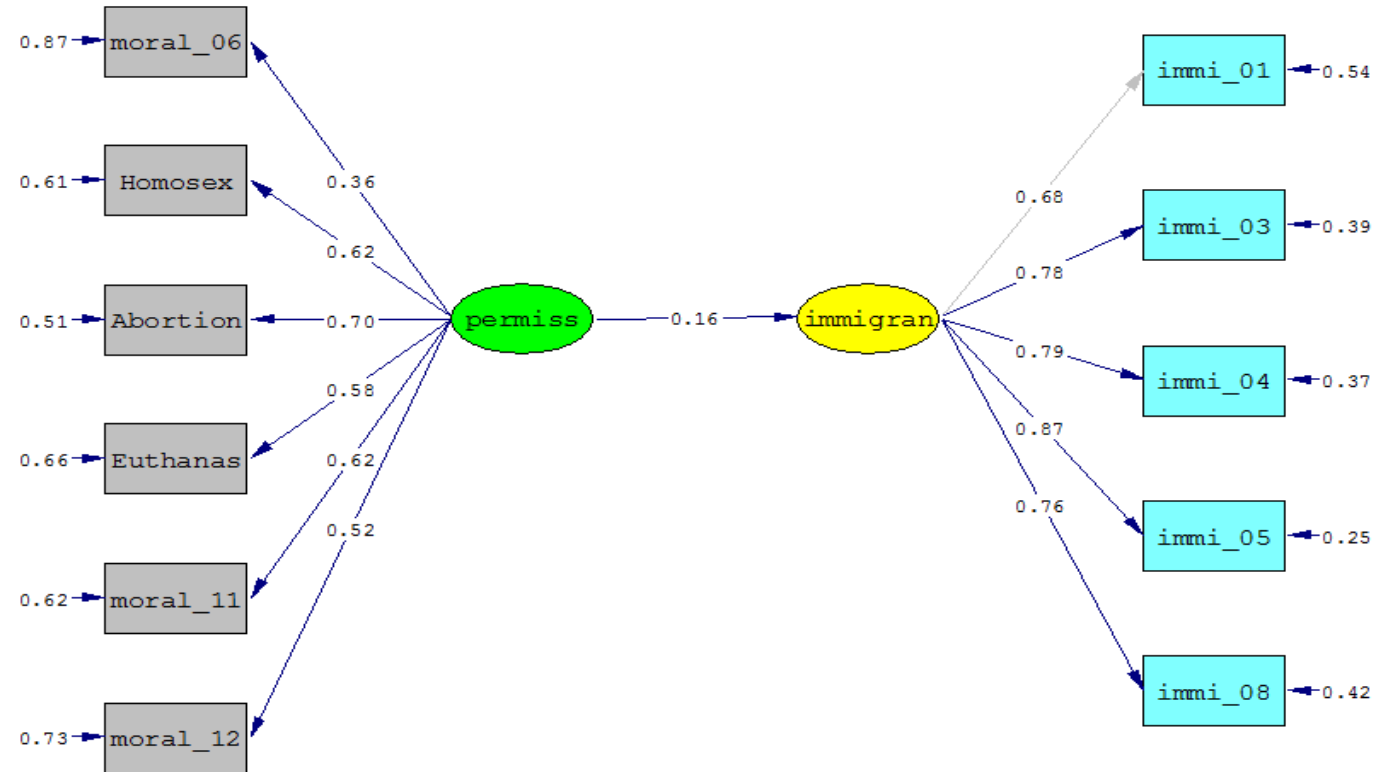
# CFA – Alternative Path model



# CFA – Alternative Padmodel



# Measurement & explanatory model



Chi-Square=191.67, df=43, P-value=0.00000, RMSEA=0.048

## Degrees of freedom

- $\frac{1}{2}[(p).(p+1)]-k$ 
  - $\frac{1}{2}[11.12]-23=66-23=43$

# SEM – Model FIT

## Goodness of Fit Statistics

Degrees of Freedom = 43  
Minimum Fit Function Chi-Square = 194.48 (P = 0.0)  
Root Mean Square Error of Approximation (RMSEA) = 0.048  
90 Percent Confidence Interval for RMSEA = (0.041 ; 0.055)  
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.68

Normed Fit Index (NFI) = 0.98  
Non-Normed Fit Index (NNFI) = 0.98  
Parsimony Normed Fit Index (PNFI) = 0.76  
Comparative Fit Index (CFI) = 0.98  
Incremental Fit Index (IFI) = 0.98  
Relative Fit Index (RFI) = 0.97

Root Mean Square Residual (RMR) = 0.27  
Standardized RMR = 0.047  
Goodness of Fit Index (GFI) = 0.98  
Adjusted Goodness of Fit Index (AGFI) = 0.97  
Parsimony Goodness of Fit Index (PGFI) = 0.64

## Unique assets of confirmatory analysis (SEM)

- 1. We can compare the global fit of measurement models
- 2. We can take error covariances into account
- 3. We can take into account that our indicators are ordinal measures
- 4. We can integrate the full measurement models in an explanatory structural model
- 5. We can estimate and draw a path diagram for the full nomological model
- 6. We can estimate indirect (mediation) effects
- 7. We can improve the fit of the model based on modification indices

# State of the art example ‘how to estimate and isolate acquiescence effects’ in a SEM-context



# Response set issues in public perceptions of radiological risks

- Grouchy smurf

Extremity Response Set



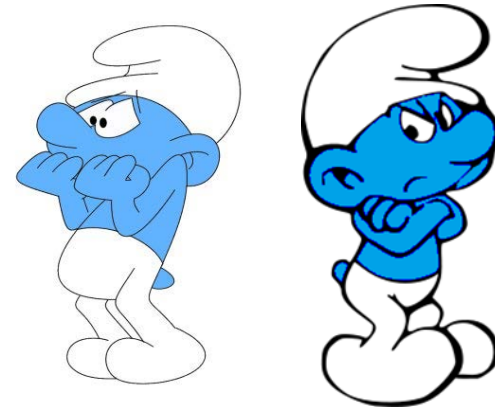
- Dopey smurf

Acquiescent Response set



# Response set issues in public perceptions of radiological risks

- Scaredy smurf / Grouchy smurf  
Extremity Response Set



- Dopey smurf

Acquiescent Response set  
Moderation Response set



# A strange Belgian devide Flemings and Walloons

- Radiation Risk Perception:
  - Subscale for nuclear radiation risks
    - Accident nuclear installation, nuclear waste, terrorist attack
  - Subscale for general radiation risks
    - Natural radiation, mobile phones, medical imaging
- The strange Belgian devide
  - Walloons versus Flemings ...
    - Walloons have a higher radiation risk perception in general
    - Walloons have a higher nuclear radiation risk perception in particular
- Problem: items are unbalanced
  - Response styles might contaminate content factors
  - Focus: Acquiescence (ARS) & Moderation (MRS)

# Testing for response styles

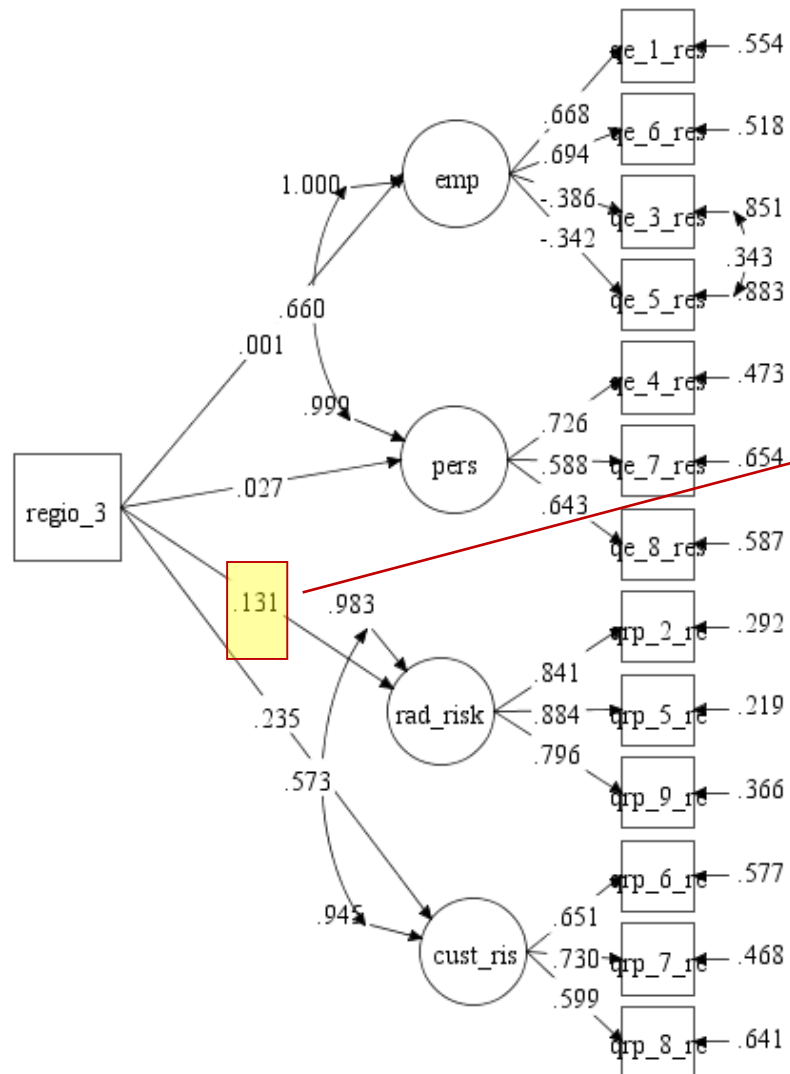
## General solution:

- Use balanced scales and try to eliminate individuals that agree both on the positively and negatively worded items
- But sometimes not available (eg Risk perception)

## Specific solution:

- Include a second uncorrelated scale and try to find an underlying style factor
- In casu: psychological scale (IRI-scale) for empathy
  - emp(athic concern) & pers(pective taking)

# Risk perception in Belgium Confirmatory factor analysis (SEM)

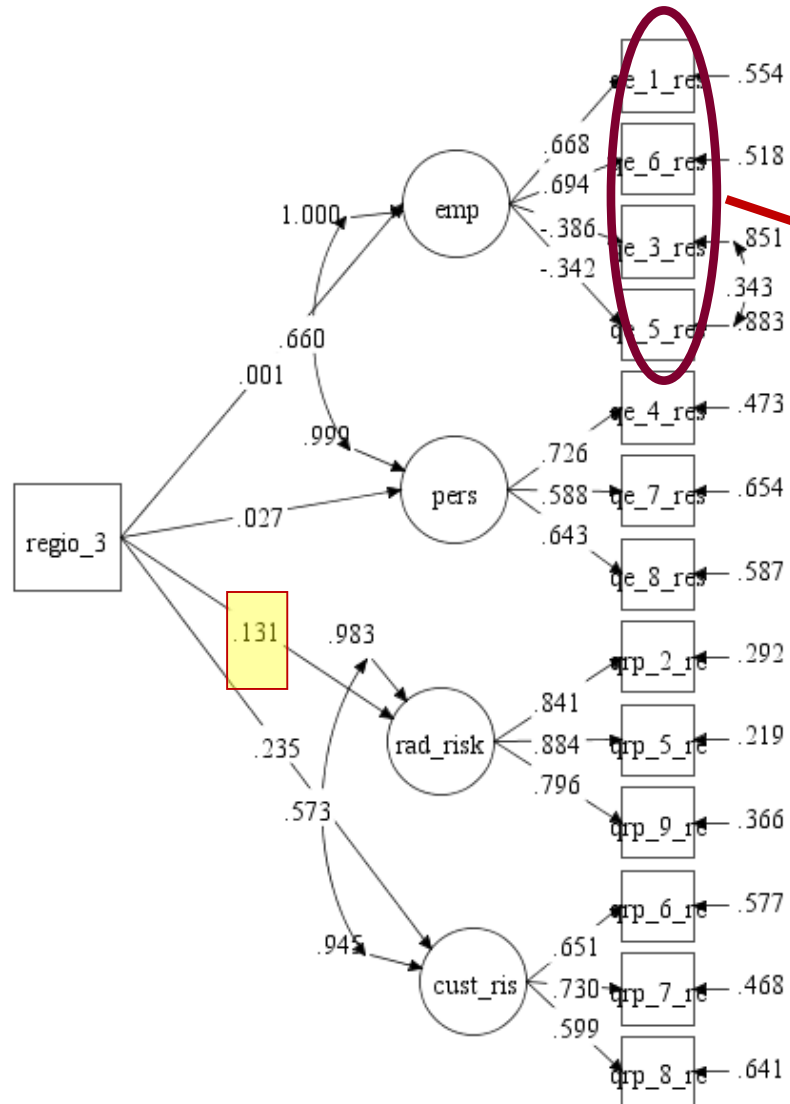


Walloons  
perceive higher  
radiation risks

Model fits  
RMSEA= 0,049

# Risk Perception in Belgium

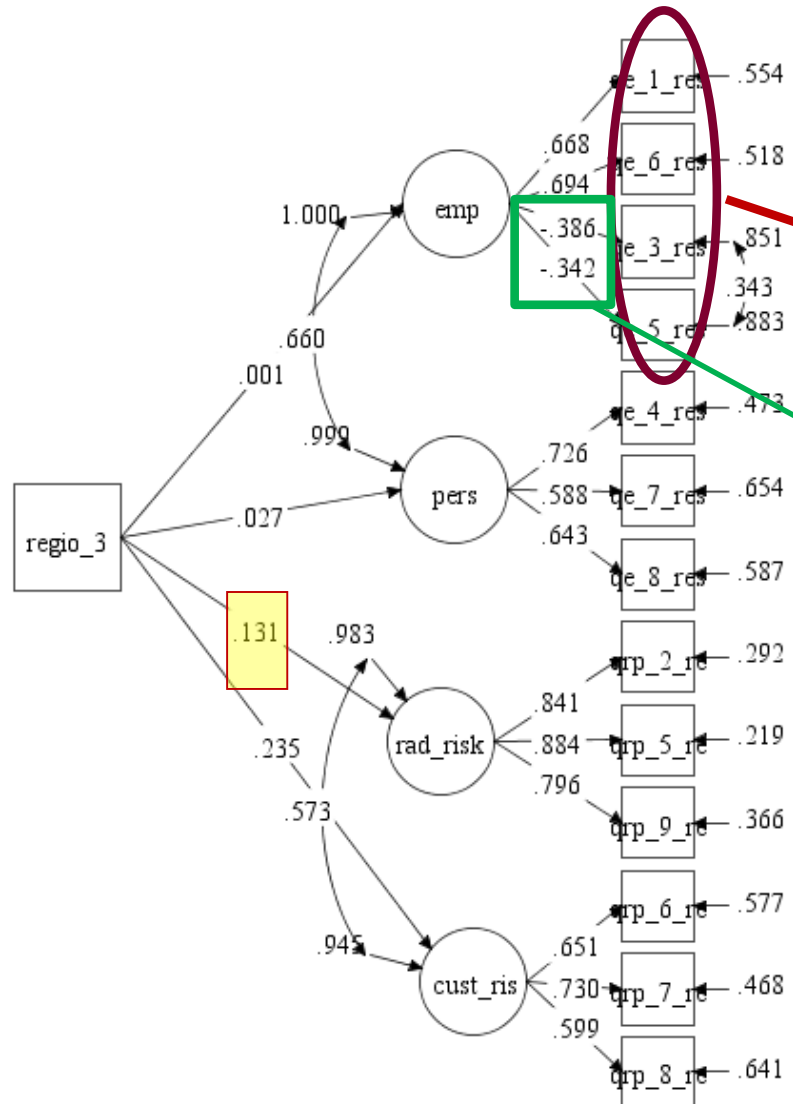
## Cofirmatory factor analysis



4 indicators for  
emphatic concern

# Risk Perception in Belgium

## Cofirmatory factor analysis

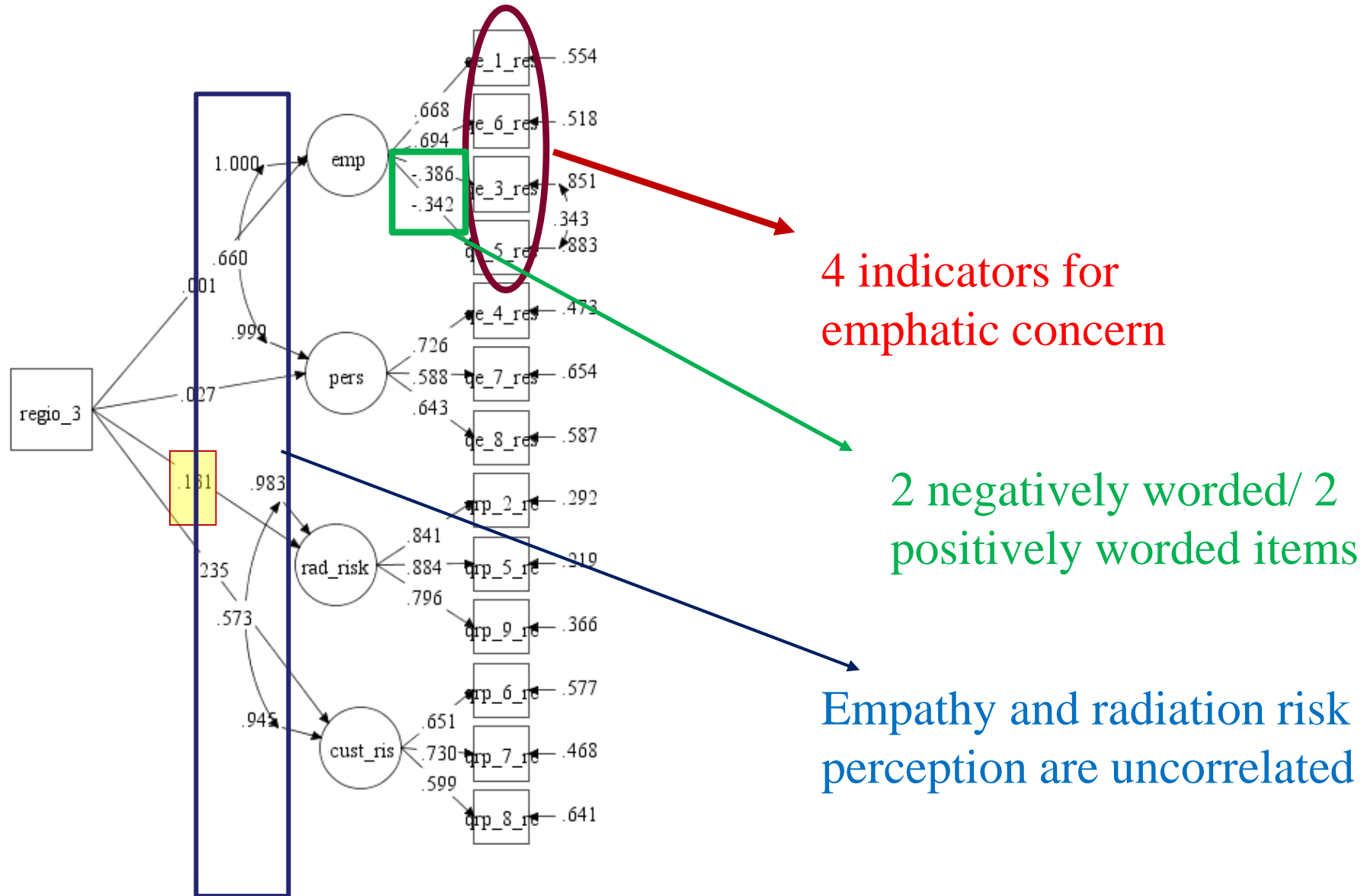


4 indicators for  
emphatic concern

2 negatively worded/ 2  
positively worded items

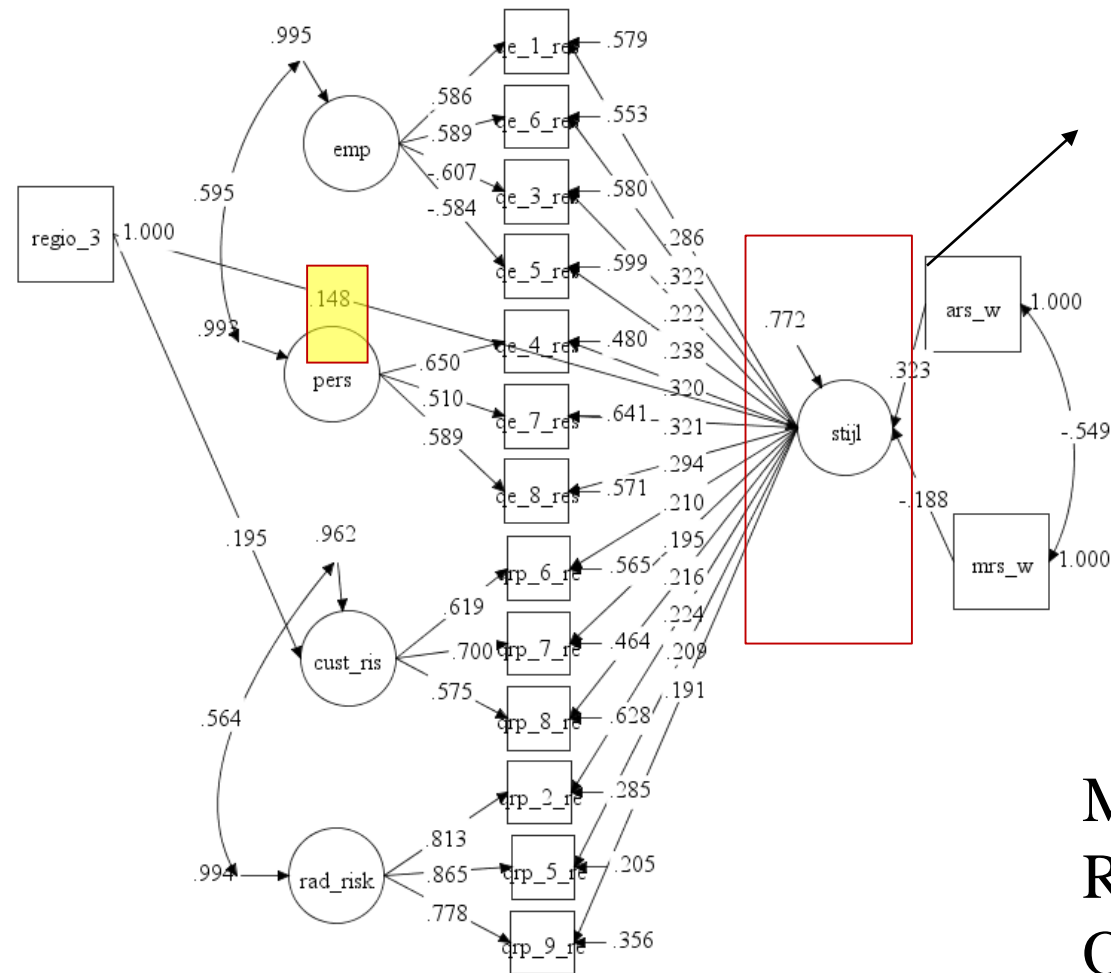
# Risk Perception in Belgium

## Cofirmatory factor analysis





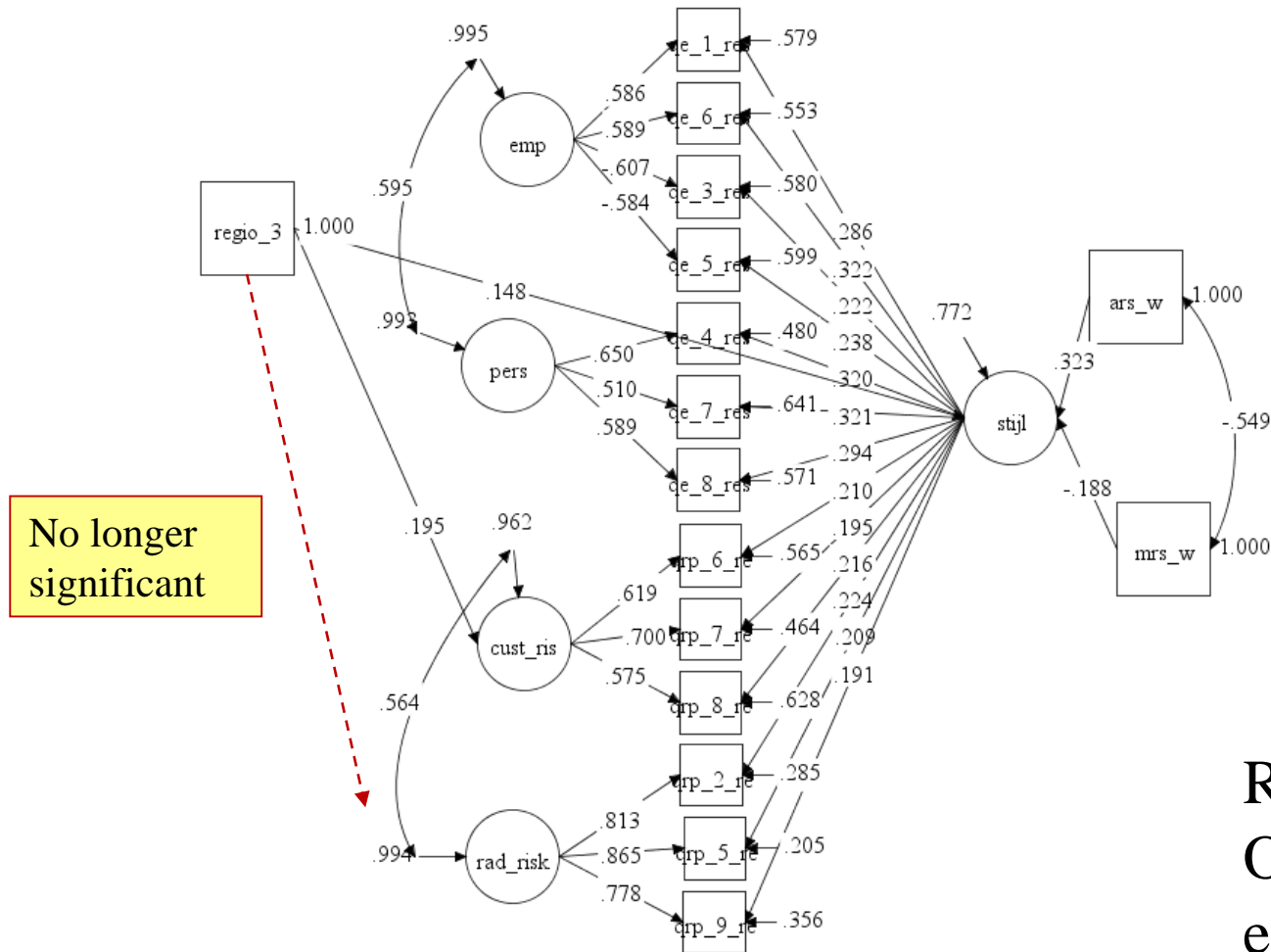
# Radiation Risk Perception in Belgium with response styles



General response  
style factor

Model fits  
RMSEA= 0,048  
Only significant  
effects

# Radiation Risk Perception in Belgium, with response styles

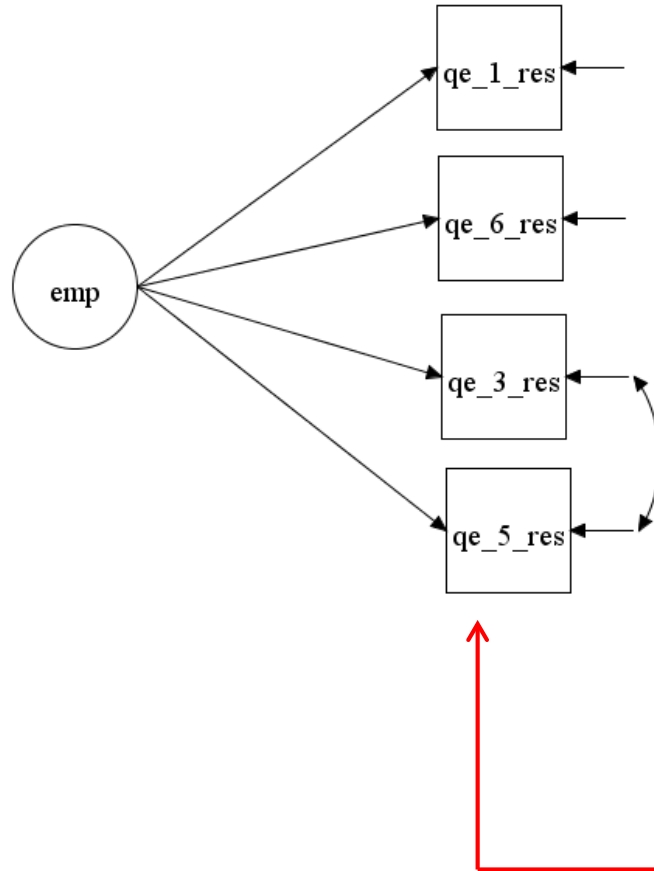


RMSEA= 0,048  
Only significant  
effects

## Conclusions

- Never over-estimate the (technological) knowledge of the general public
- Be aware of cross-national differences in terms of culture and media diet
- When possible use balanced scales
  - People will be more attentive
- It is also possible to test a response style factor

# Measurement model: one latent factor



## INPUT INSTRUCTIONS

### TITLE:

SCK analyse (basis 0-model, met één latente variabele)

### DATA:

FILE IS C:\LISREL 8.8 Examples\SCK\_savoktober.dat;

### VARIABLE:

NAMES ARE Serial TAAL SD2 SD3 QE\_1\_res QE\_2\_res  
QE\_2\_rs QE\_3\_res QE\_3\_rs QE\_4\_res QE\_5\_res  
QE\_5\_rss QE\_6\_res QE\_7\_res QE\_8\_res QRP\_1\_re QRP\_2\_re  
QRP\_3\_re QRP\_4\_re QRP\_5\_re QRP\_6\_re QRP\_7\_re  
QRP\_8\_re QRP\_9\_re QRP\_10\_r QMN\_1\_re QMN\_2\_re  
QMN\_3\_re QMN\_4\_re QMN\_5\_re QMN\_6\_re QSO\_1\_re  
QSO\_2\_re QSO\_2\_rs QSO\_3\_re QSO\_4\_re QSO\_5\_re  
QSO\_5\_rs SD9 regio\_1 regio\_2 regio\_3 missings  
posit ond ARS\_4 ARS\_5 ARS\_W MRS MRS\_W ERS ers1 ers5  
ERS\_W DRS\_1 DRS\_2 DRS\_w ers\_5 ers\_1 ers\_new ers\_1  
ers\_1rs;

!Welke variabelen zijn categorisch(eventueel)

!CATEGORICAL ARE QE\_1\_RES QE\_5\_RES QE\_3\_RES QE\_6\_RES;

!Welke variabelen gebruiken we in de analyse

USEVARIABLES ARE QE\_1\_RES QE\_5\_RES QE\_3\_RES QE\_6\_RES;

### ANALYSIS:

ESTIMATOR = ML;

TYPE=GENERAL;

### MODEL:

!Wat zijn de indicatoren voor de latente constructen

emp BY qe\_1\_res qe\_6\_res QE\_3\_RES QE\_5\_RES;

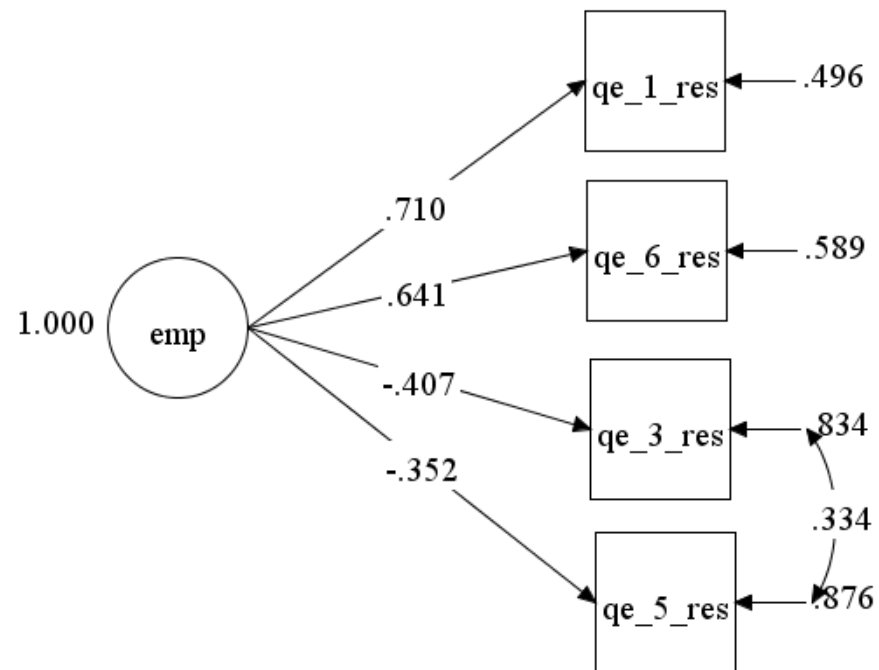
!Laat twee variabelen correleren

QE\_3\_RES with QE\_5\_RES;

### OUTPUT:

standardized MODINDICES (ALL) TECH10 SAMPSTAT tech4;

## Measurement model: one latent factor



### MODEL FIT INFORMATION

Number of Free Parameters 13

#### Loglikelihood

H0 Value -4045.944  
H1 Value -4043.956

#### Information Criteria

Akaike (AIC) 8117.889  
Bayesian (BIC) 8178.105  
Sample-Size Adjusted BIC 8136.824  
(n\* = (n + 2) / 24)

#### Chi-Square Test of Model Fit

Value 3.976  
Degrees of Freedom 1  
P-Value 0.0462

#### RMSEA (Root Mean Square Error Of Approximation)

Estimate 0.063  
90 Percent C.I. 0.007 0.132  
Probability RMSEA <= .05 0.269

#### CFI/TLI

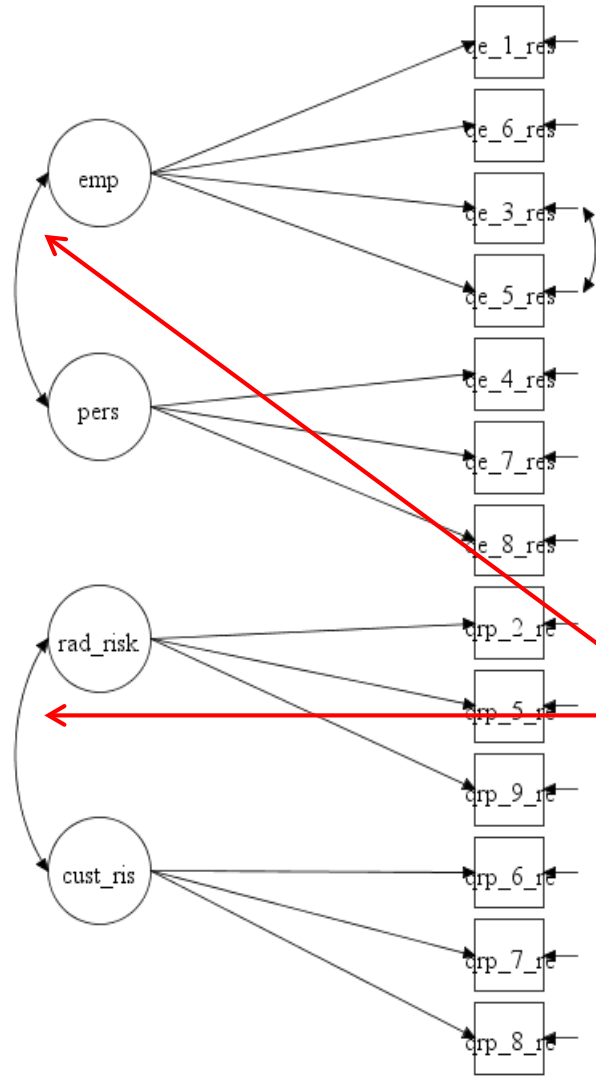
CFI 0.993  
TLI 0.959

#### Chi-Square Test of Model Fit for the Baseline Model

Value 439.703  
Degrees of Freedom 6  
P-Value 0.0000

#### SRMR (Standardized Root Mean Square Residual)

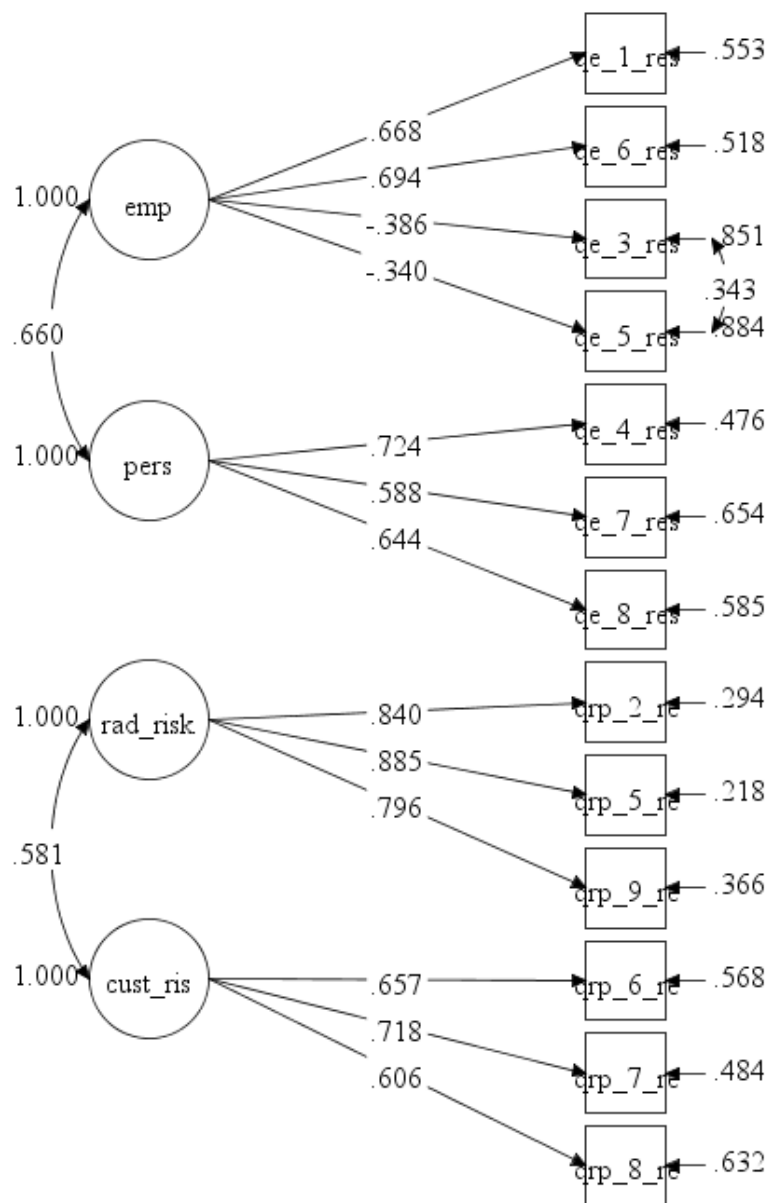
Value 0.011



## INPUT INSTRUCTIONS

```

TITLE:
  SCK analyse
DATA:
  FILE IS C:\LISREL 8.8 Examples\SCK_savoktober.dat;
VARIABLE:
  NAMES ARE Serial TAAL SD2 SD3 QE_1_res QE_2_res
  QE_2_rs QE_3_res QE_3_rs QE_4_res QE_5_res
  QE_5_rss QE_6_res QE_7_res QE_8_res QRP_1_re QRP_2_re
  QRP_3_re QRP_4_re QRP_5_re QRP_6_re QRP_7_re
  QRP_8_re QRP_9_re QRP_10_r QMN_1_re QMN_2_re
  QMN_3_re QMN_4_re QMN_5_re QMN_6_re QSO_1_re
  QSO_2_re QSO_2_rs QSO_3_re QSO_4_re QSO_5_re
  QSO_5_rs SD9 regio_1 regio_2 regio_3 missings
  posit ond ARS_4 ARS_5 ARS_W MRS MRS_W ERS ers1 ers5
  ERS_W DRS_1 DRS_2 DRS_w ers_5 ers_1 ers_new ers_1
  ers_1rs;
  USEVARIABLES ARE QE_1 RES QE_3_RES QE_5_RES QE_6_RES QE_4_RES QE_7_RES QE_8_RES
  QRP_2_RE QRP_5_RE QRP_9_RE QRP_6_RE QRP_7_RE QRP_8_RE;
MODEL:
  !Wat zijn de indicatoren voor de latente constructen
  emp BY qe_1_res qe_6_res QE_3_RES QE_5_RES;
  pers BY qe_4_res qe_7_res qe_8_res;
  rad_risk BY qrp_2_re qrp_5_re qrp_9_re;
  cust_ris BY qrp_6_re qrp_7_re qrp_8_re;
  !Laat latente constructen correleren
  emp WITH pers;
  rad_risk WITH cust_ris;
  !Laat twee variabelen correleren
  QE_3_RES with QE_5_RES;
  !Zet de volgende correlaties op nul (Covariance Constrained to 0)
  emp with rad_risk@0;
  emp with cust_ris@0;
  pers with rad_risk@0;
  pers with cust_ris@0;
OUTPUT:
  standardized MODINDICES (ALL) SAMPSTAT tech4 TECH1;
  
```



#### MODEL FIT INFORMATION

Number of Free Parameters 42

#### Loglikelihood

H0 Value -13092.583  
H1 Value -13011.084

#### Information Criteria

Akaike (AIC) 26269.166  
Bayesian (BIC) 26463.710  
Sample-Size Adjusted BIC 26330.343  
( $n^* = (n + 2) / 24$ )

#### Chi-Square Test of Model Fit

Value 162.999  
Degrees of Freedom 62  
P-Value 0.0000

#### RMSEA (Root Mean Square Error Of Approximation)

Estimate 0.046  
90 Percent C.I. 0.038 0.055  
Probability RMSEA  $\leq .05$  0.746

#### CFI/TLI

CFI 0.965  
TLI 0.955

#### Chi-Square Test of Model Fit for the Baseline Model

Value 2929.462  
Degrees of Freedom 78  
P-Value 0.0000

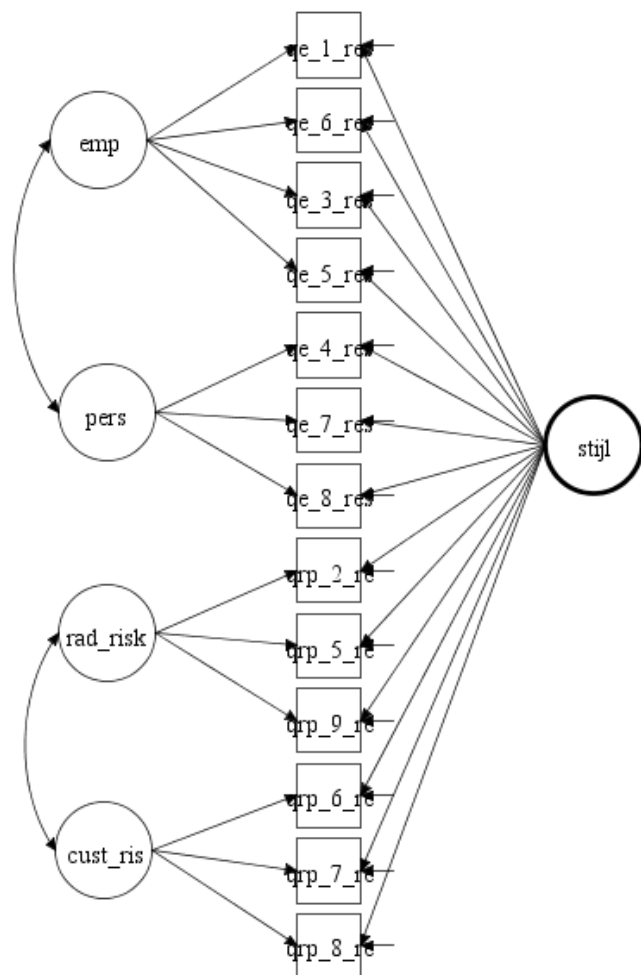
#### SRMR (Standardized Root Mean Square Residual)

Value 0.046



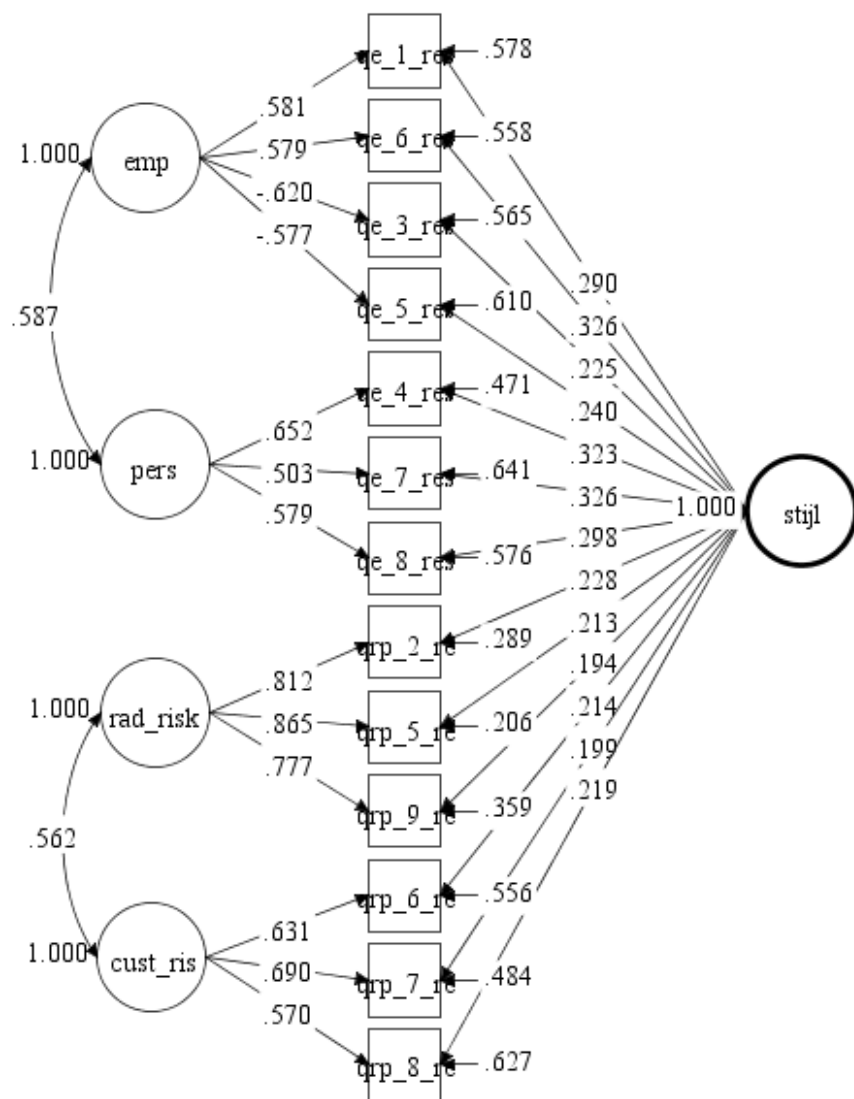


# Introducing Style factor



```
TITLE:
  SCK analyse
DATA:
  FILE IS C:\LISREL 8.8 Examples\SCK_savoktober.dat;
VARIABLE:
  NAMES ARE Serial TAAL SD2 SD3 QE_1_res QE_2_res
  QE_2_rs QE_3_res QE_3_rs QE_4_res QE_5_res
  QE_5_rss QE_6_res QE_7_res QE_8_res QRP_1_re QRP_2_re
  QRP_3_re QRP_4_re QRP_5_re QRP_6_re QRP_7_re
  QRP_8_re QRP_9_re QRP_10_r QMN_1_re QMN_2_re
  QMN_3_re QMN_4_re QMN_5_re QMN_6_re QSO_1_re
  QSO_2_re QSO_2_rs QSO_3_re QSO_4_re QSO_5_re
  QSO_5_rs SD9 regio_1 regio_2 regio_3 missings
  posit ond ARS_4 ARS_5 ARS_W MRS MRS_W ERS ers1 ers5
  ERS_W DRS_1 DRS_2 DRS_w ers_5 ers_1 ers_new ers_1
  ers_1rs;
!Welke variabelen zijn categorisch
!CATEGORICAL ARE QE_1_RES QE_5_RES QE_3_RES QE_6_RES QE_4_RES QE_7_RES QE_8_RES
!QRP_2_RE QRP_5_RE QRP_9_RE QRP_6_RE QRP_7_RE QRP_8_RE;
!Welke variabelen gebruiken we in de analyse
USEVARIABLES ARE QE_1_RES QE_3_RES QE_5_RES QE_6_RES QE_4_RES QE_7_RES QE_8_RES
QRP_2_RE QRP_5_RE QRP_9_RE QRP_6_RE QRP_7_RE QRP_8_RE;
MODEL:
!Wat zijn de indicatoren voor de latente constructen
emp BY qe_1_res qe_6_res QE_3_RES QE_5_RES;
pers BY qe_4_res qe_7_res qe_8_res;
rad_risk BY qrp_2_re qrp_5_re qrp_9_re;
cust_ris BY qrp_6_re qrp_7_re qrp_8_re;
stijl BY qe_1_res@1 QE_3_RES@1 QE_5_RES@1 qe_6_res@1 qe_4_res@1 qe_7_res@1 qe_8_res@1
qrp_2_re@1 qrp_5_re@1 qrp_9_re@1 qrp_6_re@1 qrp_7_re@1 qrp_8_re@1;
!Laat latente constructen correleren
emp WITH pers;
rad_risk WITH cust_ris;
!Laat twee variabelen correleren
!QE_3_RES with QE_5_RES;
!Zet de volgende correlaties op nul (Covariance Constrained to 0)
emp with rad_risk@0;
emp with cust_ris@0;
pers with rad_risk@0;
pers with cust_ris@0;
stijl with emp@0;
stijl with pers@0;
stijl with rad_risk@0;
stijl with cust_ris@0;
OUTPUT:
standardized MODINDICES (ALL) SAMPSTAT tech4 TECH1;
```





#### MODEL FIT INFORMATION

Number of Free Parameters 42

#### Loglikelihood

H0 Value -13089.489  
H1 Value -13011.084

#### Information Criteria

Akaike (AIC) 26262.978  
Bayesian (BIC) 26457.522  
Sample-Size Adjusted BIC 26324.154  
( $n^* = (n + 2) / 24$ )

#### Chi-Square Test of Model Fit

Value 156.811  
Degrees of Freedom 62  
P-Value 0.0000

#### RMSEA (Root Mean Square Error Of Approximation)

Estimate 0.045  
90 Percent C.I. 0.036 0.054  
Probability RMSEA <= .05 0.825

#### CFI/TLI

CFI 0.967  
TLI 0.958

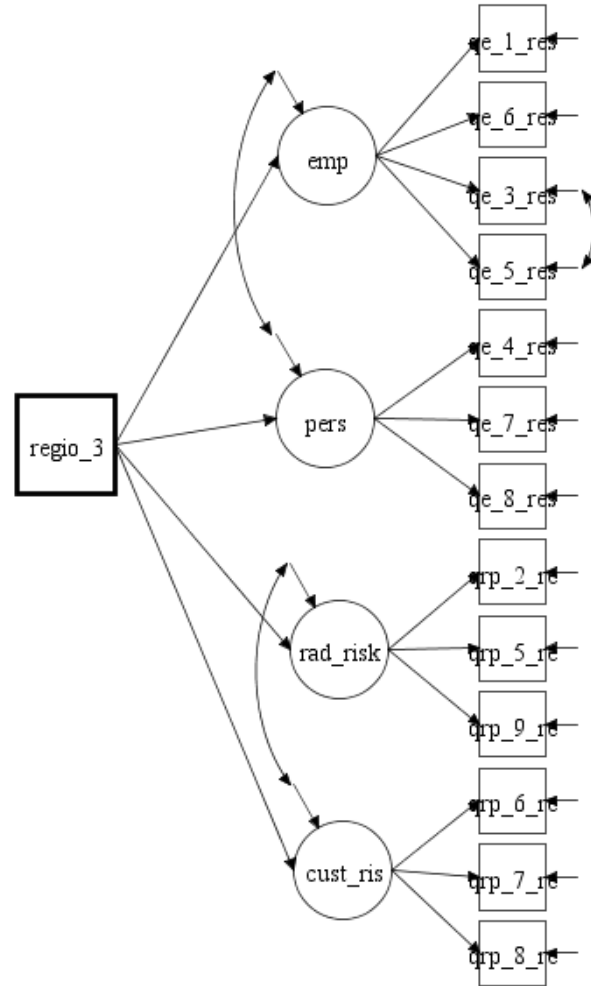
#### Chi-Square Test of Model Fit for the Baseline Model

Value 2929.462  
Degrees of Freedom 78  
P-Value 0.0000

#### SRMR (Standardized Root Mean Square Residual)

Value 0.049

## Effect of region (Wal=1, Fla=0)



```

TITLE:
  SCK analyse
DATA:
  FILE IS C:\LISREL 8.8 Examples\SCK_savoktober.dat;
VARIABLE:
  NAMES ARE Serial TAAL SD2 SD3 QE_1_res QE_2_res
  QE_2_rs QE_3_res QE_3_rs QE_4_res QE_5_res
  QE_5_rss QE_6_res QE_7_res QE_8_res QRP_1_re QRP_2_re
  QRP_3_re QRP_4_re QRP_5_re QRP_6_re QRP_7_re
  QRP_8_re QRP_9_re QRP_10_r QMN_1_re QMN_2_re
  QMN_3_re QMN_4_re QMN_5_re QMN_6_re QSO_1_re
  QSO_2_re QSO_2_rs QSO_3_re QSO_4_re QSO_5_re
  QSO_5_rs SD9 regio_1 regio_2 regio_3 missings
  posit ond ARS_4 ARS_5 ARS_W MRS MRS_W ERS ers1 ers5
  ERS_W DRS_1 DRS_2 DRS_w ers__5 ers__1 ers_new ers_1
  ers__1rs;

!Welke variabelen zijn categorisch
!CATEGORICAL ARE QE_1_RES QE_5_RES QE_3_RES QE_6_RES QE_4_RES QE_7_RES QE_8_RES
!QRP_2_RE QRP_5_RE QRP_9_RE QRP_6_RE QRP_7_RE QRP_8_RE;

!Welke variabelen gebruiken we in de analyse
USEVARIABLES ARE QE_1_RES QE_3_RES QE_5_RES QE_6_RES QE_4_RES QE_7_RES QE_8_RES
QRP_2_RE QRP_5_RE QRP_9_RE QRP_6_RE QRP_7_RE QRP_8_RE regio_3;

MODEL:

!Wat zijn de indicatoren voor de latente constructen
emp BY qe_1_res qe_6_res QE_3_RES QE_5_RES;
pers BY qe_4_res qe_7_res qe_8_res;
rad_risk BY grp_2_re grp_5_re grp_9_re;
cust_ris BY grp_6_re grp_7_re grp_8_re;

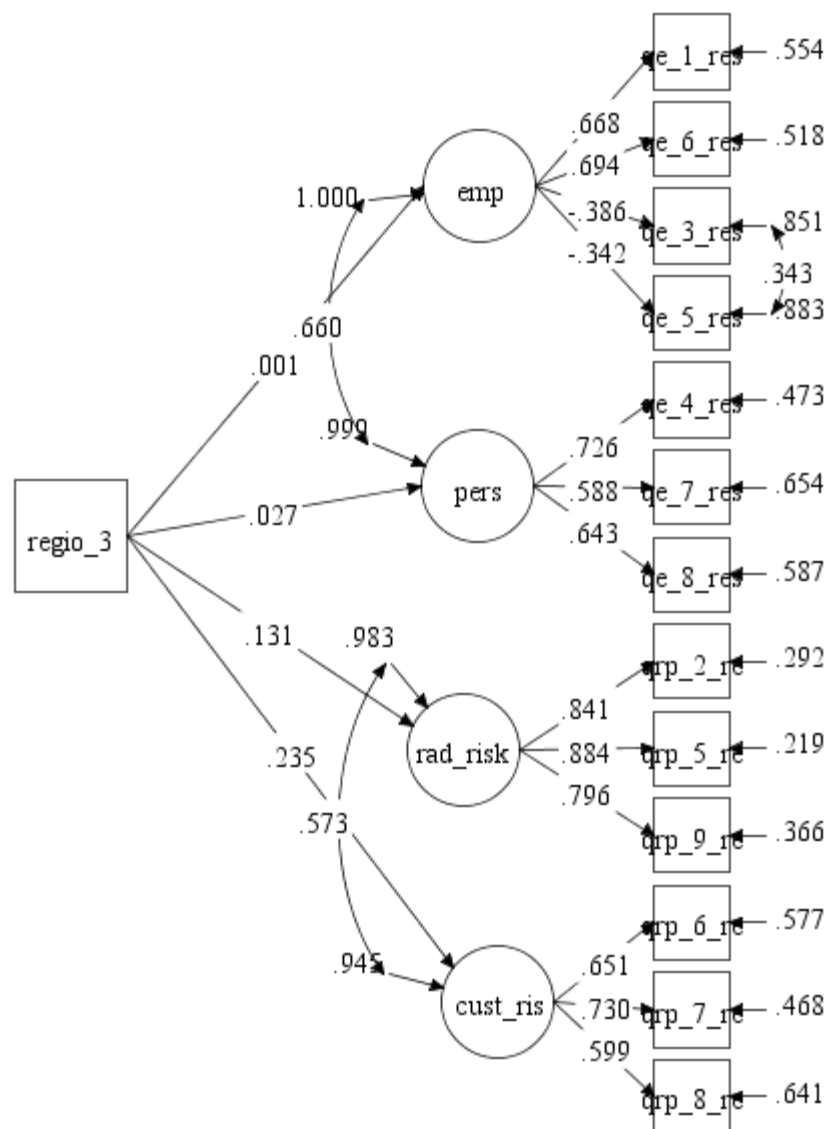
!Laat latente regresseren op regio
emp ON regio_3;
pers ON regio_3;
rad_risk ON regio_3;
cust_ris ON regio_3;

!Laat latente constructen correleren
emp WITH pers;
rad_risk WITH cust_ris;

!Laat twee variabelen correleren
QE_3_RES with QE_5_RES;

!Zet de volgende correlaties op nul (Covariance Constrained to 0)
emp with rad_risk@0;
emp with cust_ris@0;
pers with rad_risk@0;
pers with cust_ris@0;

OUTPUT:
  standardized MODINDICES (ALL) SAMPSTAT tech4 TECH1;
  
```



## MODEL FIT INFORMATION

Number of Free Parameters 46

### Loglikelihood

H0 Value -13076.776

H1 Value -12976.211

### Information Criteria

Akaike (AIC) 26245.553

Bayesian (BIC) 26458.625

Sample-Size Adjusted BIC 26312.555

(n\* = (n + 2) / 24)

### Chi-Square Test of Model Fit

Value 201.132

Degrees of Freedom 71

P-Value 0.0000

### RMSEA (Root Mean Square Error Of Approximation)

Estimate 0.049

90 Percent C.I. 0.041 0.057

Probability RMSEA <= .05 0.556

### CFI/TLI

CFI 0.955

TLI 0.943

### Chi-Square Test of Model Fit for the Baseline Model

Value 2999.208

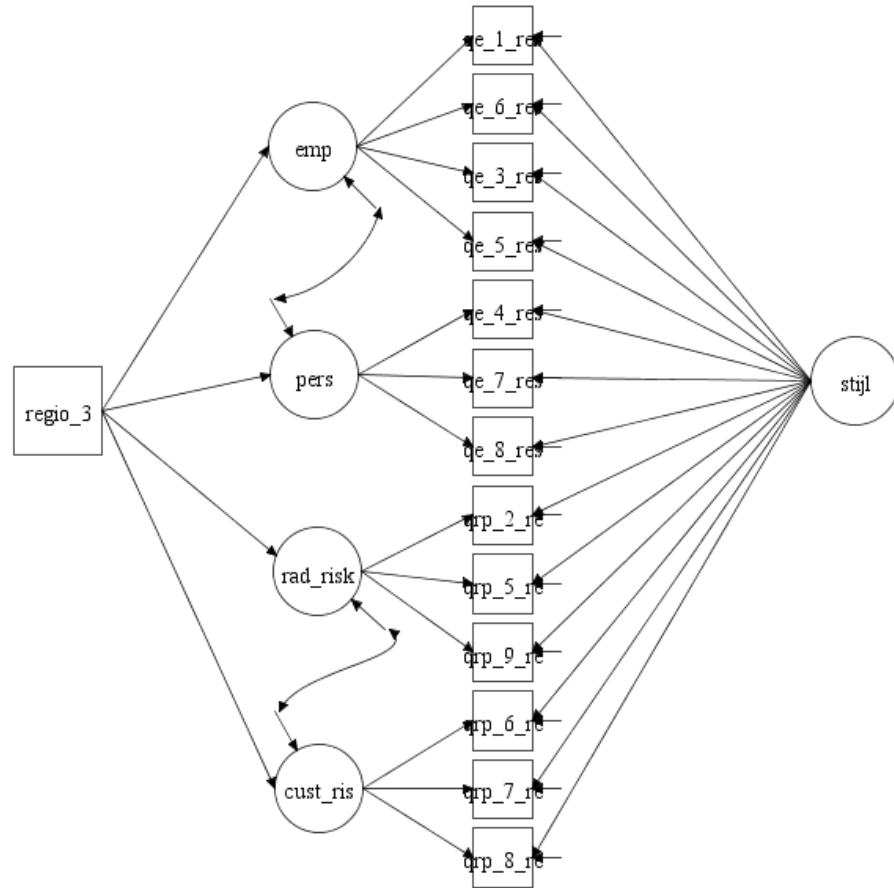
Degrees of Freedom 91

P-Value 0.0000

### SRMR (Standardized Root Mean Square Residual)

Value 0.046

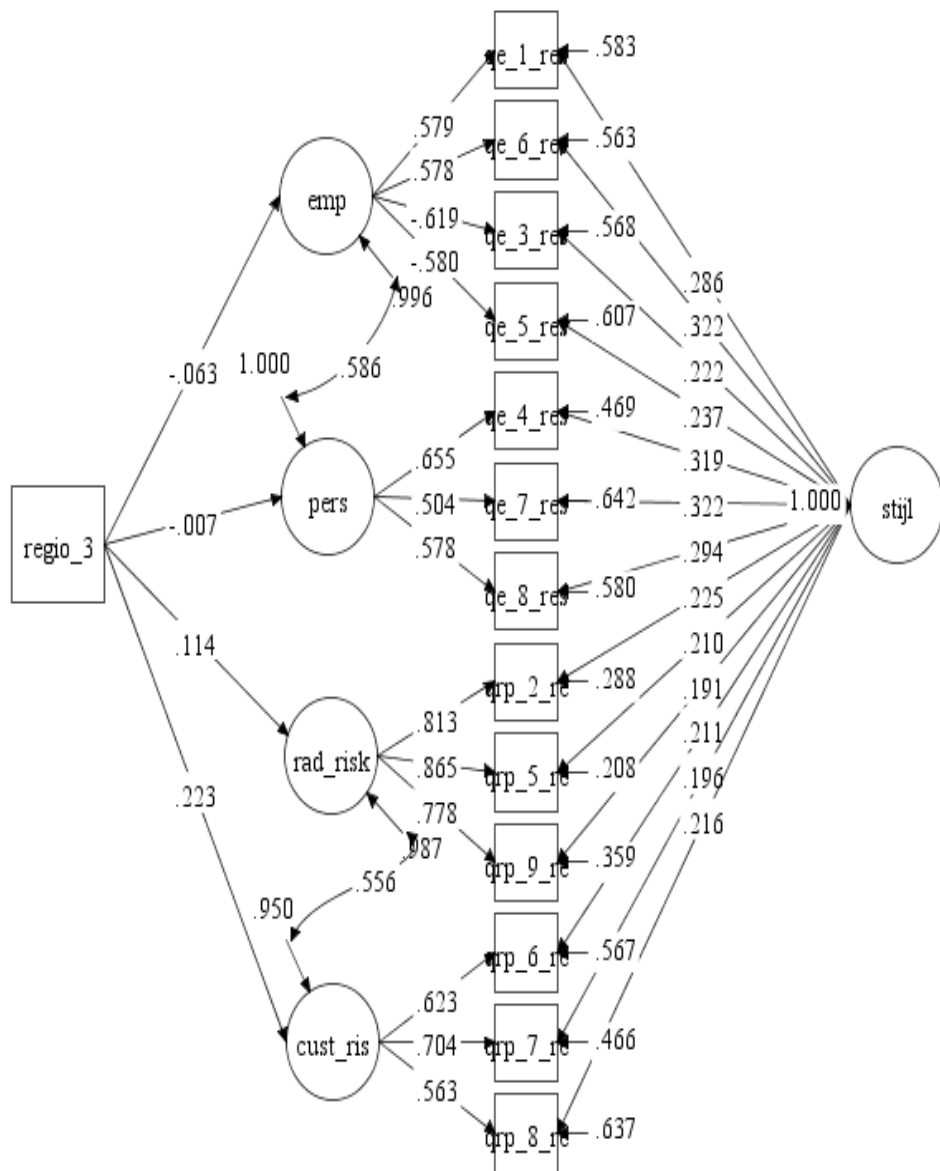
## Effect of region, with style factor



```

TITLE:
  SCK analyse
DATA:
  FILE IS C:\LISREL 8.8 Examples\SCK_savoktober.dat;
VARIABLE:
  NAMES ARE Serial TAAL SD2 SD3 QE_1_res QE_2_res
  QE_2_rs QE_3_res QE_3_rs QE_4_res QE_5_res
  QE_5_rss QE_6_res QE_7_res QE_8_res QRP_1_re QRP_2_re
  QRP_3_re QRP_4_re QRP_5_re QRP_6_re QRP_7_re
  QRP_8_re QRP_9_re QRP_10_r QMN_1_re QMN_2_re
  QMN_3_re QMN_4_re QMN_5_re QMN_6_re QSO_1_re
  QSO_2_re QSO_2_rs QSO_3_re QSO_4_re QSO_5_re
  QSO_5_rs SD9 regio_1 regio_2 regio_3 missings
  posit ond ARS_4 ARS_5 ARS_W MRS MRS_W ERS ers1 ers5
  ERS_W DRS_1 DRS_2 DRS_w ers_5 ers_1 ers_new ers_1
  ers_1rs;
!Welke variabelen zijn categorisch
!CATEGORICAL ARE QE_1_RES QE_5_RES QE_3_RES QE_6_RES QE_4_RES QE_7_RES QE_8_RES
!QRP_2_RE QRP_5_RE QRP_9_RE QRP_6_RE QRP_7_RE QRP_8_RE ;
!Welke variabelen gebruiken we in de analyse
USEVARIABLES ARE regio_3 QE_1_RES QE_3_RES QE_5_RES QE_6_RES QE_4_RES QE_7_RES
QE_8_RES QRP_2_RE QRP_5_RE QRP_9_RE QRP_6_RE QRP_7_RE QRP_8_RE;
MODEL:
!Wat zijn de indicatoren voor de latente constructen
emp BY qe_1_res qe_6_res QE_3_RES QE_5_RES;
pers BY qe_4_res qe_7_res qe_8_res;
rad_risk BY qrp_2_re qrp_5_re qrp_9_re;
cust_ris BY qrp_6_re qrp_7_re qrp_8_re;
!Maak stijlfactor aan
stijl BY qe_1_res@1 QE_3_RES@1 QE_5_RES@1 qe_6_res@1 qe_4_res@1 qe_7_res@1 qe_8_res@1
qrp_2_re@1 qrp_5_re@1 qrp_9_re@1 qrp_6_re@1 qrp_7_re@1 qrp_8_re@1;
!regresseer latente op regio
emp ON regio_3;
pers ON regio_3;
rad_risk ON regio_3;
cust_ris ON regio_3;
!Laat latente constructen correleren
emp WITH pers;
rad_risk WITH cust_ris;
!Laat twee variabelen correleren
!QE_3_RES with QE_5_RES;
!Zet de volgende correlaties op nul (Covariance Constrained to 0)
emp with rad_risk@0;
emp with cust_ris@0;
pers with rad_risk@0;
pers with cust_ris@0;
stijl with emp@0;
stijl with pers@0;
stijl with rad_risk@0;
stijl with cust_ris@0;
OUTPUT:
standardized MODINDICES (ALL) SAMPSTAT tech4 TECH1;

```



#### MODEL FIT INFORMATION

Number of Free Parameters 46

#### Loglikelihood

H0 Value -13075.621  
H1 Value -12976.211

#### Information Criteria

Akaike (AIC) 26243.243  
Bayesian (BIC) 26456.315  
Sample-Size Adjusted BIC 26310.245  
( $n^* = (n + 2) / 24$ )

#### Chi-Square Test of Model Fit

Value 198.822  
Degrees of Freedom 71  
P-Value 0.0000

#### RMSEA (Root Mean Square Error Of Approximation)

Estimate 0.049  
90 Percent C.I. 0.041 0.057  
Probability RMSEA  $\leq$  .05 0.591

#### CFI/TLI

CFI 0.956  
TLI 0.944

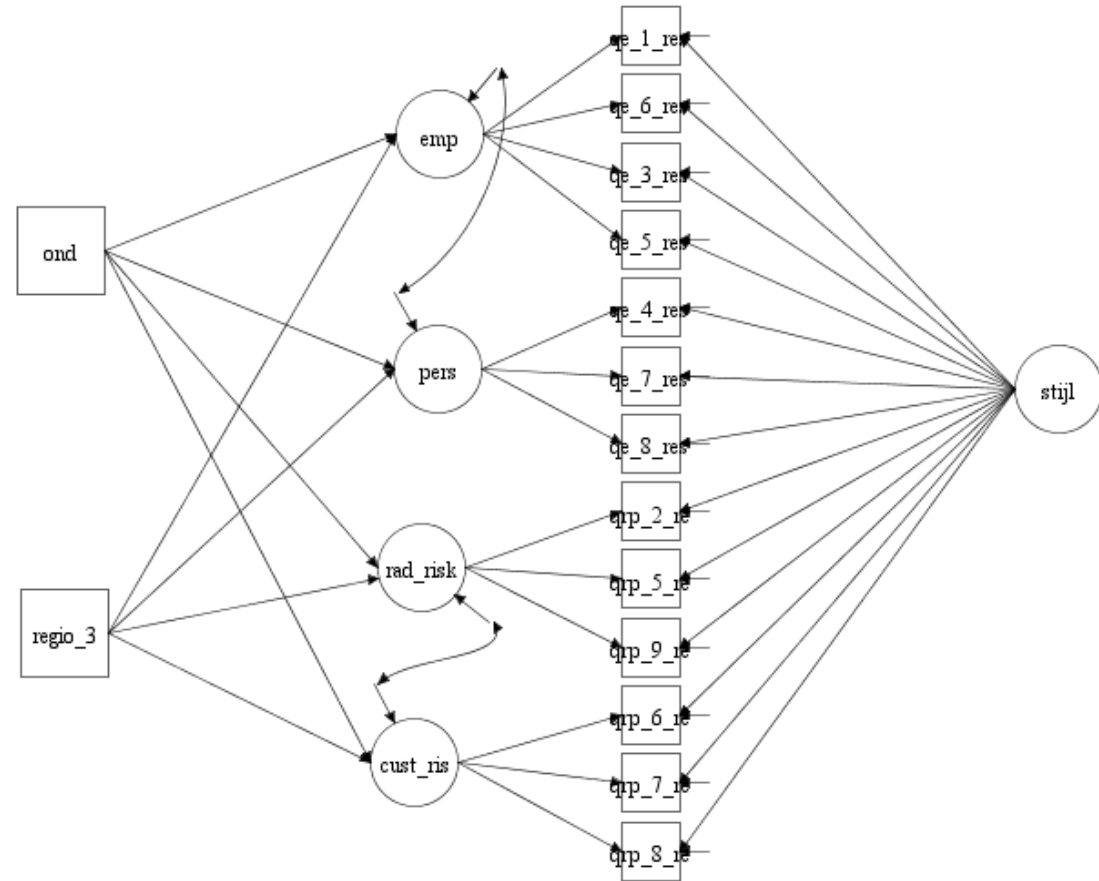
#### Chi-Square Test of Model Fit for the Baseline Model

Value 2999.208  
Degrees of Freedom 91  
P-Value 0.0000

#### SRMR (Standardized Root Mean Square Residual)

Value 0.049

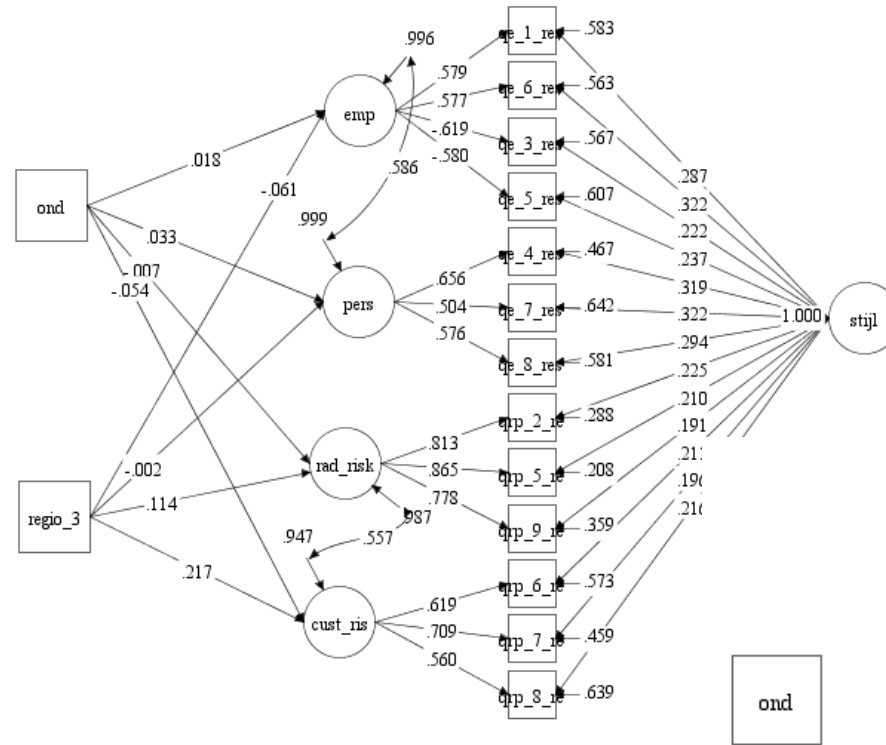




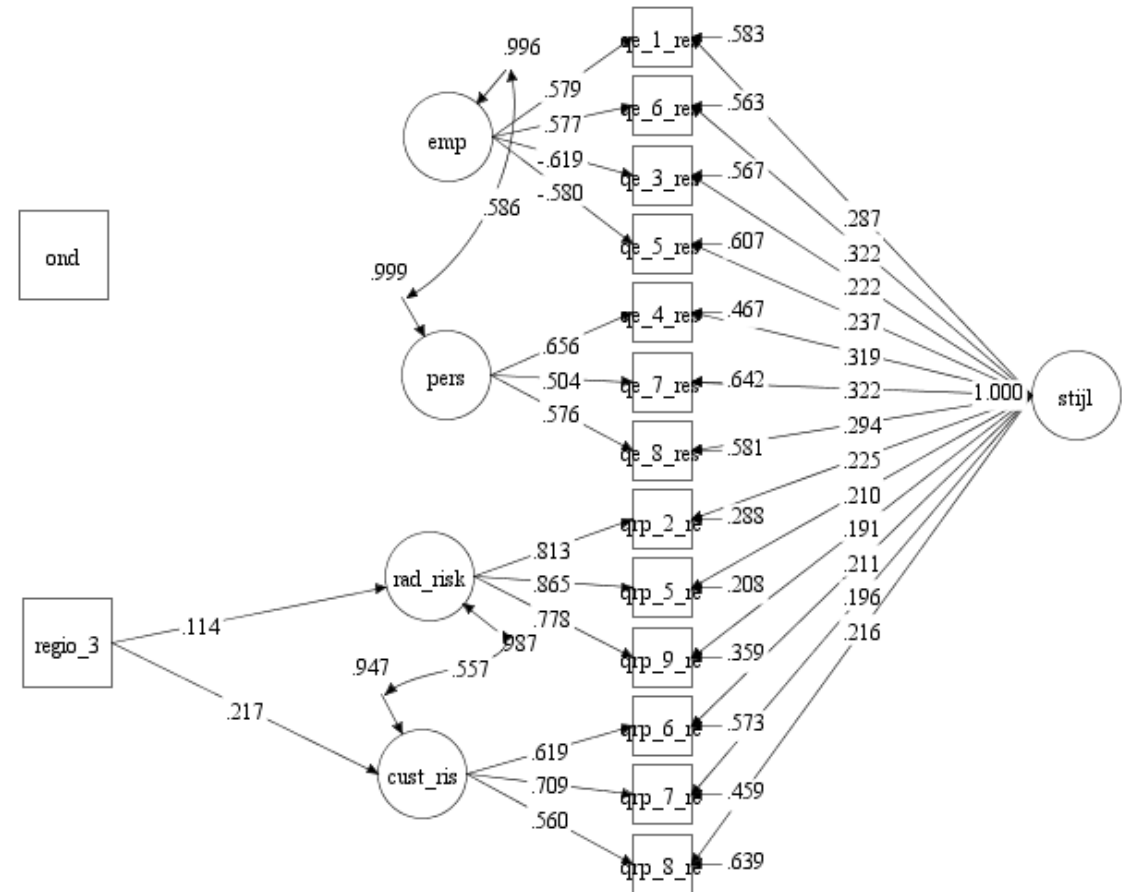
```

TITLE:
  SCK analyse
DATA:
  FILE IS C:\LISREL 8.8 Examples\SCK_savoktober.dat;
VARIABLE:
  NAMES ARE Serial TAAL SD2 SD3 QE_1_res QE_2_res
  QE_2_rs QE_3_res QE_3_rs QE_4_res QE_5_res
  QE_5_rss QE_6_res QE_7_res QE_8_res QRP_1_re QRP_2_re
  QRP_3_re QRP_4_re QRP_5_re QRP_6_re QRP_7_re
  QRP_8_re QRP_9_re QRP_10_r QMN_1_re QMN_2_re
  QMN_3_re QMN_4_re QMN_5_re QMN_6_re QSO_1_re
  QSO_2_re QSO_2_rs QSO_3_re QSO_4_re QSO_5_re
  QSO_5_rs SD9 regio_1 regio_2 regio_3 missings
  posit ond ARS_4 ARS_5 ARS_W MRS MRS_W ERS ers1 ers5
  ERS_W DRS_1 DRS_2 DRS_w ers_5 ers_1 ers_new ers_1
  ers_1rs;
!Welke variabelen zijn categorisch
!CATEGORICAL ARE QE_1_RES QE_5_RES QE_3_RES QE_6_RES QE_4_RES QE_7_RES QE_8_RES
!QRP_2_RE QRP_5_RE QRP_9_RE QRP_6_RE QRP_7_RE QRP_8_RE ;
!Welke variabelen gebruiken we in de analyse
USEVARIABLES ARE ond regio_3 QE_1_RES QE_3_RES QE_5_RES QE_6_RES
QE_4_RES QE_7_RES QE_8_RES QRP_2_RE QRP_5_RE QRP_9_RE QRP_6_RE QRP_7_RE
QRP_8_RE;
MODEL:
!Wat zijn de indicatoren voor de latente constructen
emp BY qe_1_res qe_6_res QE_3_RES QE_5_RES;
pers BY qe_4_res qe_7_res qe_8_res;
rad_risk BY qrp_2_re qrp_5_re qrp_9_re;
cust_ris BY qrp_6_re qrp_7_re qrp_8_re;
stijl BY qe_1_res@1 QE_3_RES@1 QE_5_RES@1 qe_6_res@1 qe_4_res@1 qe_7_res@1 qe_8_res@1
qrp_2_re@1 qrp_5_re@1 qrp_9_re@1 qrp_6_re@1 qrp_7_re@1 qrp_8_re@1;
!regressor op
emp ON regio_3;
pers ON regio_3;
rad_risk ON regio_3;
cust_ris ON regio_3;
emp ON ond;
pers ON ond;
rad_risk ON ond;
cust_ris ON ond;
stijl ; !its variance is estimated
!Laat latente constructen correleren
emp WITH pers;
rad_risk WITH cust_ris;
!Laat twee variabelen correleren
!QE_3_RES with QE_5_RES;
!Zet de volgende correlaties op nul (Covariance Constrained to 0)
emp with rad_risk@0;
emp with cust_ris@0;
pers with rad_risk@0;
pers with cust_ris@0;
stijl with emp@0;
stijl with pers@0;
stijl with rad_risk@0;
stijl with cust_ris@0;

```

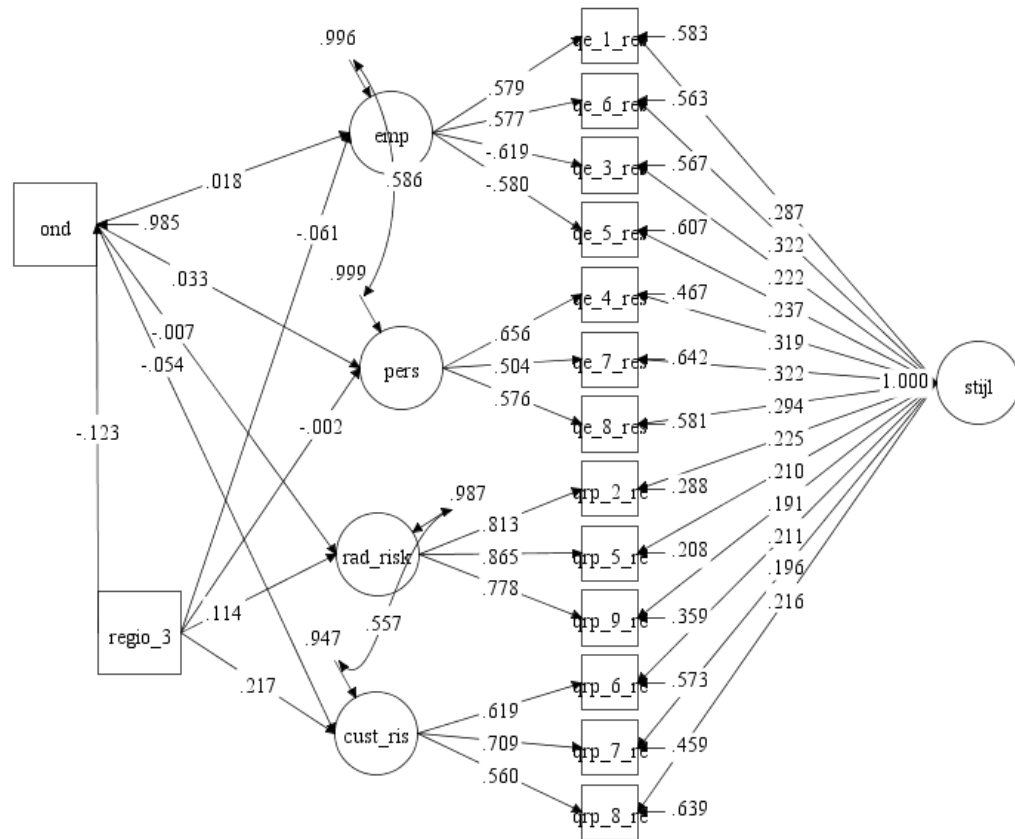


Significant effects only



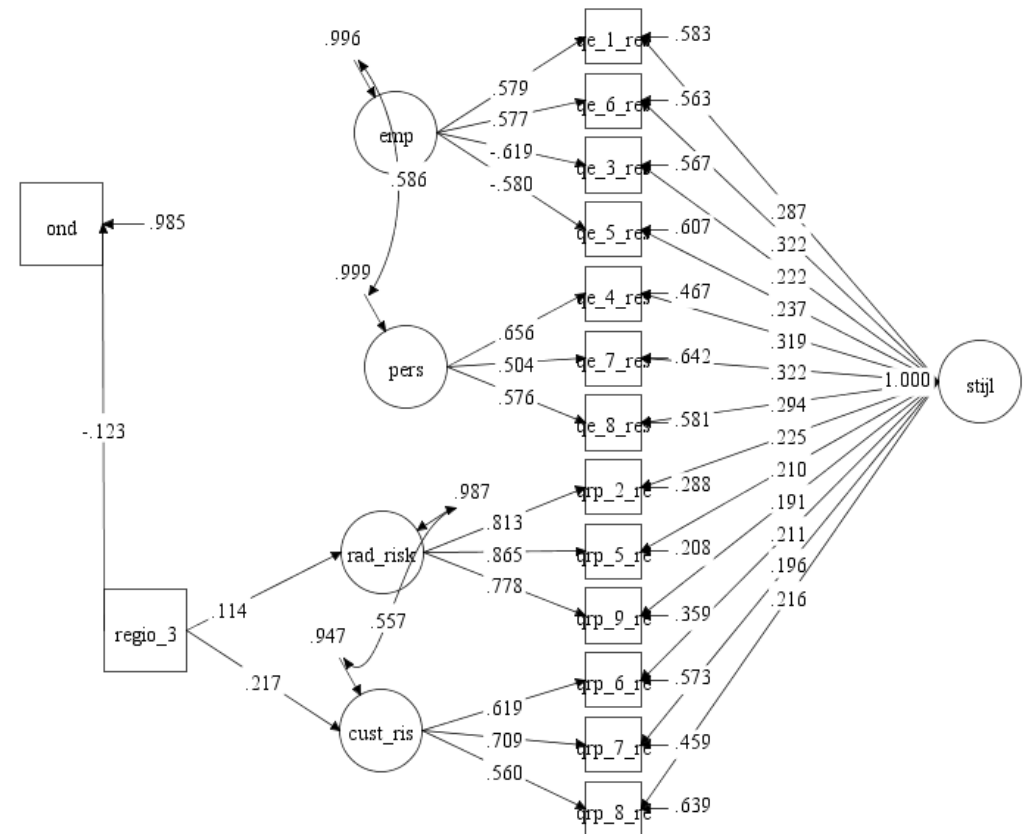
MODEL FIT INFORMATION

Number of Free Parameters	50
Loglikelihood	
H0 Value	-13074.522
H1 Value	-12966.423
Information Criteria	
Akaike (AIC)	26249.044
Bayesian (BIC)	26480.644
Sample-Size Adjusted BIC	26321.873
(n* = (n + 2) / 24)	
Chi-Square Test of Model Fit	
Value	216.197
Degrees of Freedom	80
P-Value	0.0000
RMSEA (Root Mean Square Error Of Approximation)	
Estimate	0.047
90 Percent C.I.	0.040
Probability RMSEA <= .05	0.705
CFI/TLI	
CFI	0.953
TLI	0.939
Chi-Square Test of Model Fit for the Baseline Model	
Value	3018.782
Degrees of Freedom	104
P-Value	0.0000
SRMR (Standardized Root Mean Square Residual)	
Value	0.047

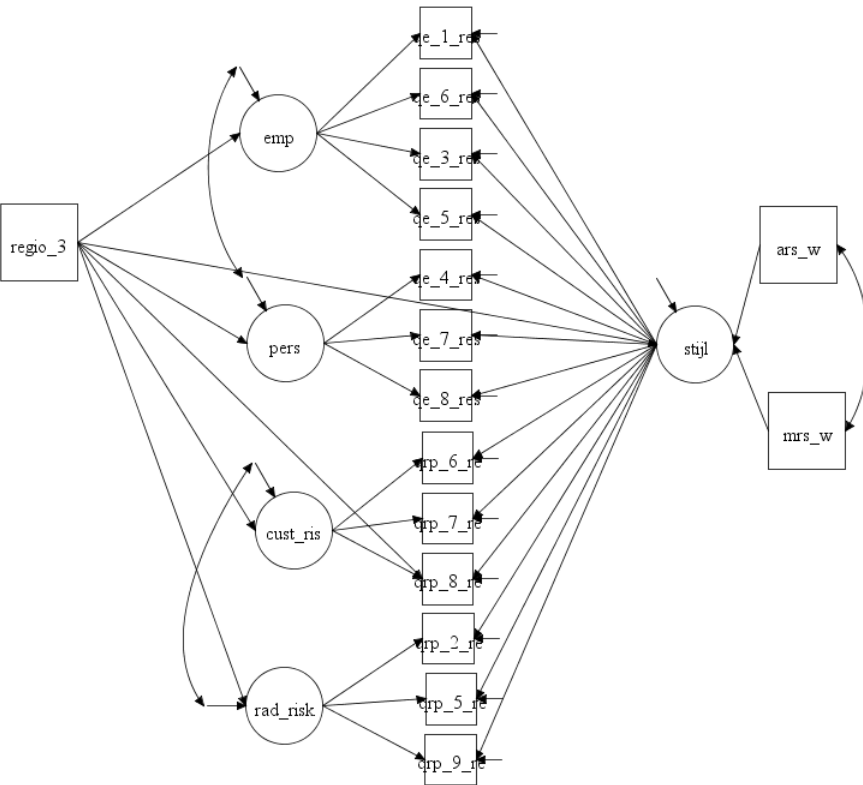


RMSEA (Root Mean Square Error Of Approximation)

Estimate	0.047	
90 Percent C.I.	0.040	0.055
Probability RMSEA <= .05	0.705	







!Wat zijn de indicatoren voor de latente constructen

```
emp BY qe_1_res qe_6_res QE_3_RES QE_5_RES;
pers BY qe_4_res qe_7_res qe_8_res;
rad_risk BY qrp_2_re qrp_5_re qrp_9_re;
cust_ris BY qrp_6_re qrp_7_re qrp_8_re;
stijl BY qe_1_res@1 QE_3_RES@1 QE_5_RES@1 qe_6_res@1 qe_4_res@1 qe_7_res@1 qe_8_res@1
qrp_2_re@1 qrp_5_re@1 qrp_9_re@1 qrp_6_re@1 qrp_7_re@1 qrp_8_re@1;
emp ON regio_3;
pers ON regio_3;
rad_risk ON regio_3;
cust_ris ON regio_3;
stijl ON regio_3;
stijl ON ars_w;
stijl ON mrs_w;
```

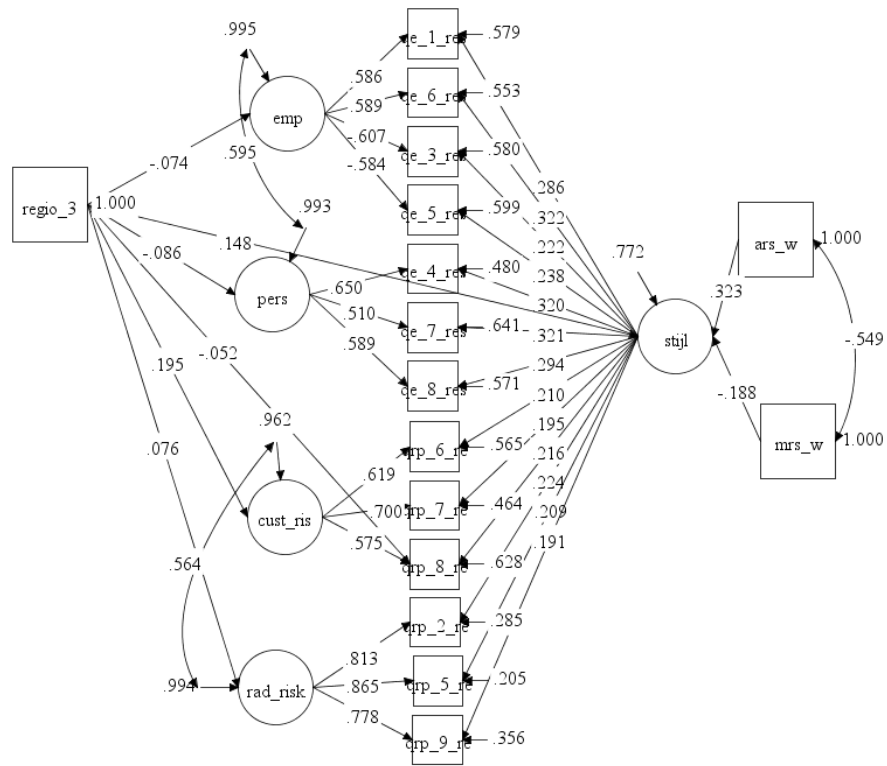
stijl ; !its variance is estimated

!Laat latente constructen correleren

```
emp WITH pers;
rad_risk WITH cust_ris;
MRS W WITH ARS W;
```

!Zet de volgende correlaties op nul (Covariance Constrained to 0)

```
emp with rad_risk@0;
emp with cust_ris@0;
pers with rad_risk@0;
pers with cust_ris@0;
stijl with emp@0;
stijl with pers@0;
stijl with rad_risk@0;
stijl with cust_ris@0;
ars_w with regio_3@0;
mrs_w with regio_3@0;
ars_w with rad_risk@0;
ars_w with cust_ris@0;
mrs_w with rad_risk@0;
mrs_w with cust_ris@0;
```



RMSEA (Root Mean Square Error Of Approximation)

Estimate	0.048	
90 Percent C.I.	0.041	0.055
Probability RMSEA <= .05	0.650	

