EAM2025

XI Conference

23RD - 25TH JULY 2025

Spain Tenerife
Canary Islands

European Association of Methodology

Presentation 2

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Gobierno de Canarias
Consejería de Universidades, Ciencia e Innovación y Cultura
Agencia Canaria de Investigación, Innovación y Sociedad de la Información

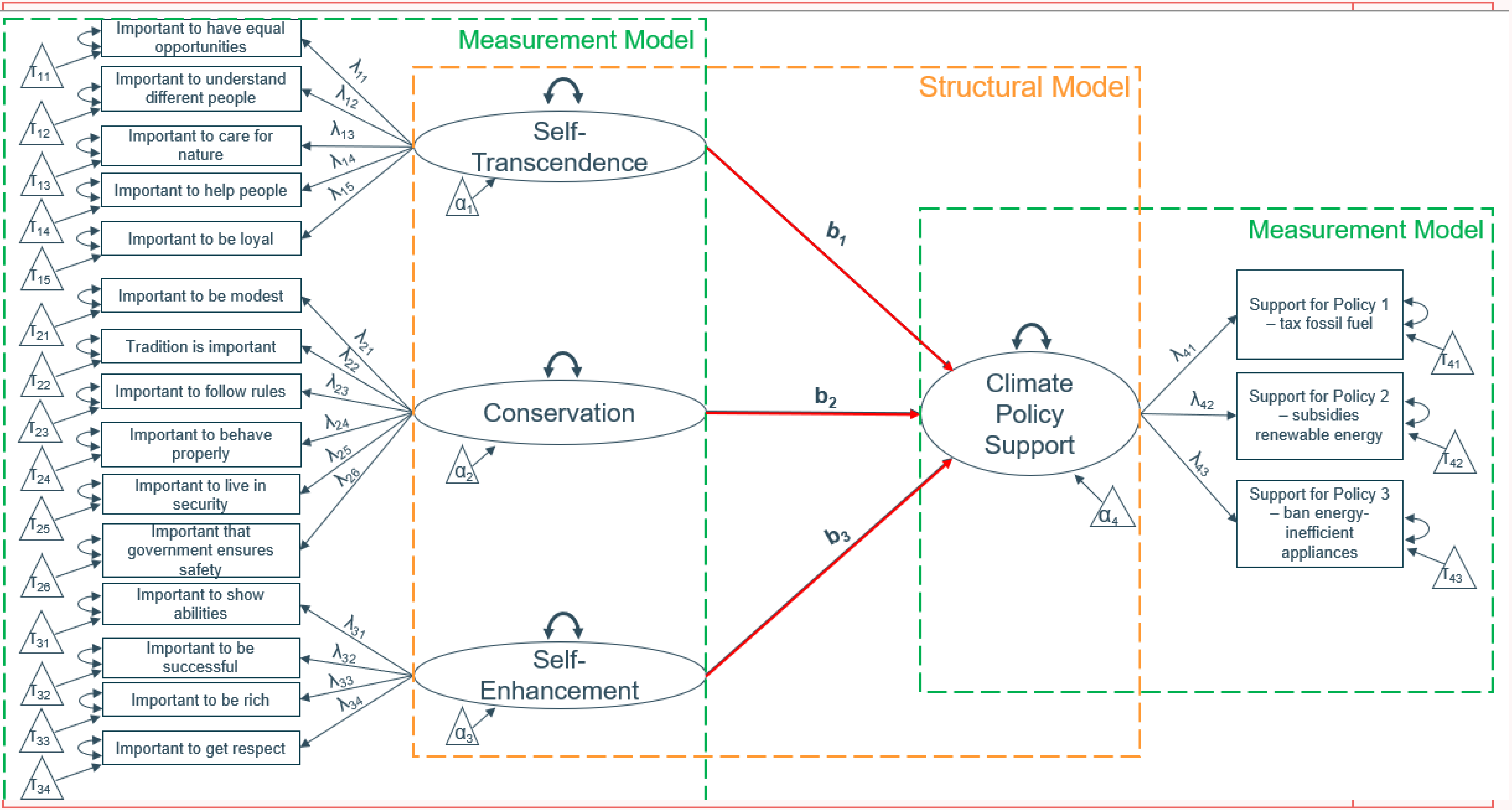
ICI Instituto Canario de Igualdad

tea

hogrefe

Extending MMG-SEM for Ordinal Data

Andres Felipe Perez Alonso



Measurement Model
Structural Model
Measurement Model
Important to have equal opportunities
Important to understand different people
Important to care for nature
Important to help people
Important to be loyal
Important to be modest
Tradition is important
Important to follow rules
Important to behave properly
Important to live in security
Important that government ensures safety
Important to show abilities
Important to be successful
Important to be rich
Important to get respect
Self-Transcendence
Conservation
Self-Enhancement
Climate Policy Support
Support for Policy 1 – tax fossil fuel
Support for Policy 2 – subsidies renewable energy
Support for Policy 3 – ban energy-inefficient appliances
b_1
b_2
b_3
λ_{11} λ_{12} λ_{13} λ_{14} λ_{15}
λ_{21} λ_{22} λ_{23} λ_{24} λ_{25} λ_{26}
λ_{31} λ_{32} λ_{33} λ_{34}
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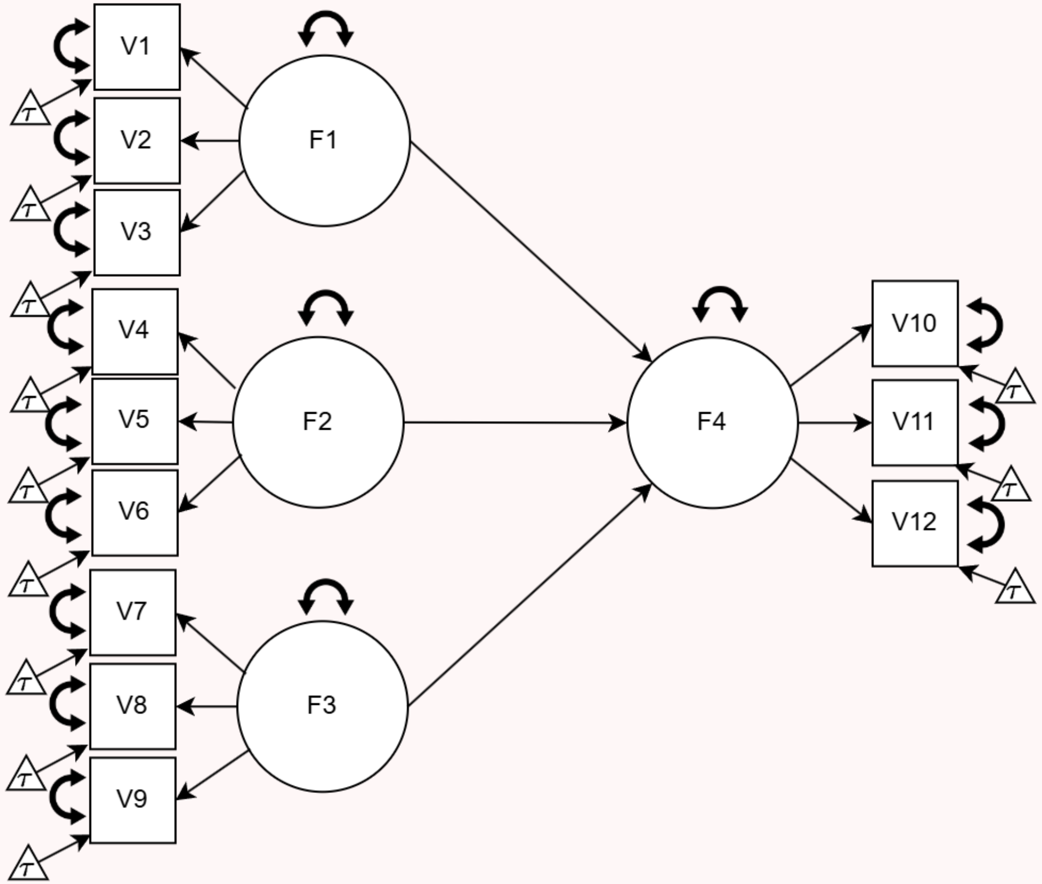
α_1 α_2 α_3 α_4

A bit simpler…

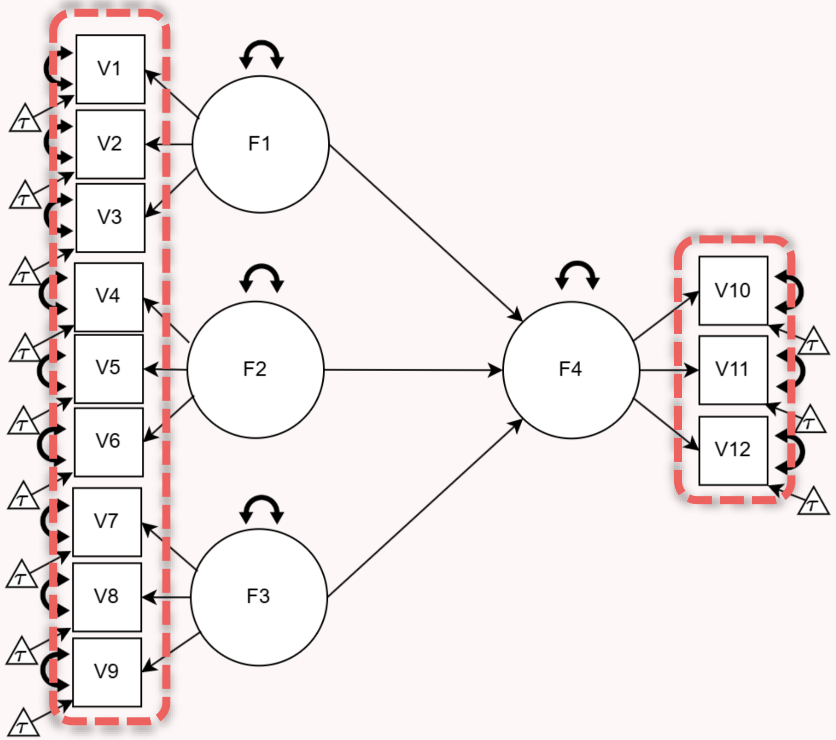


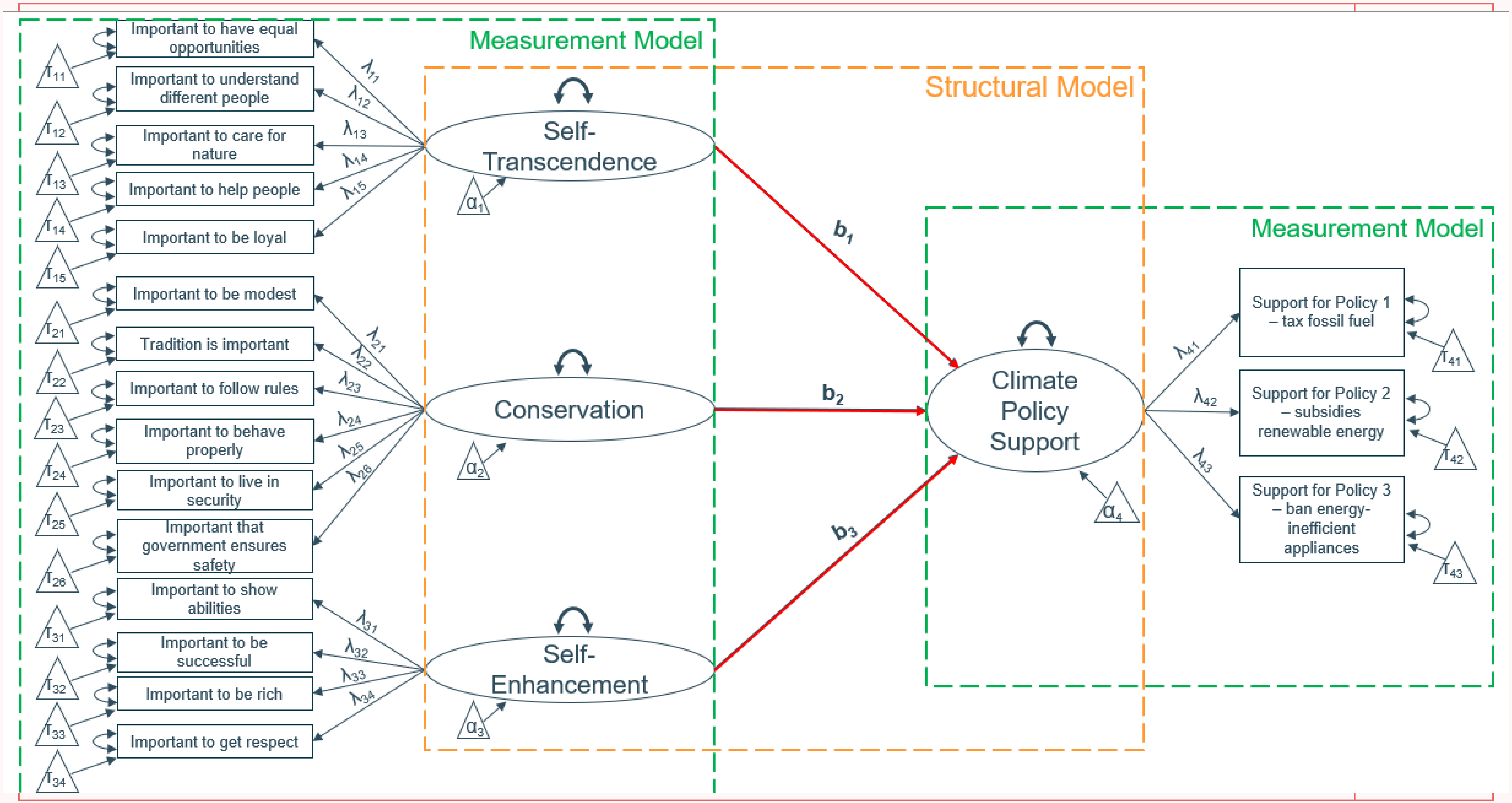
The problem

Dealing with real data…

Real life

- Default MMG-SEM works for **continuous** indicators.





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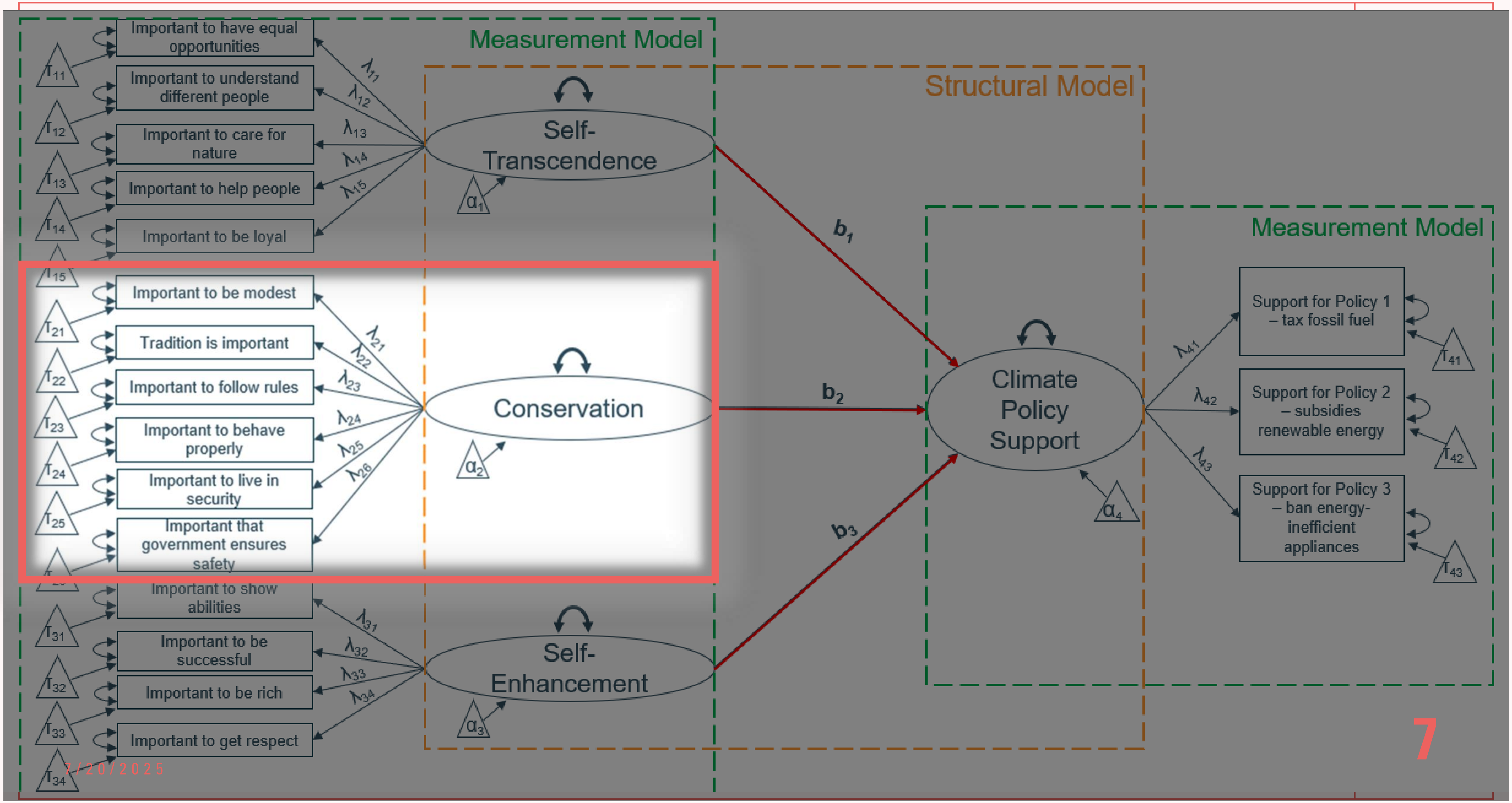

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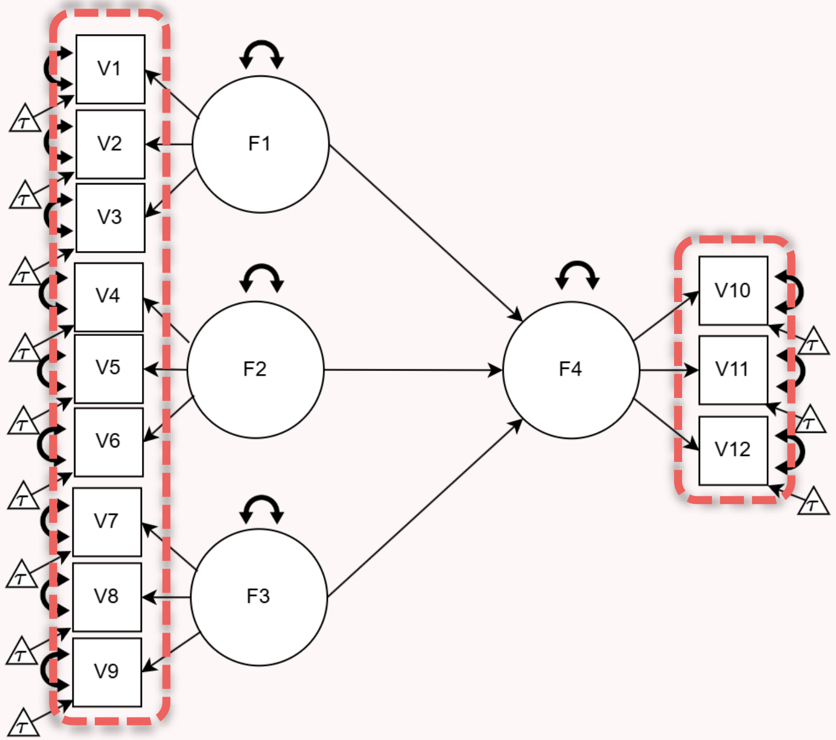

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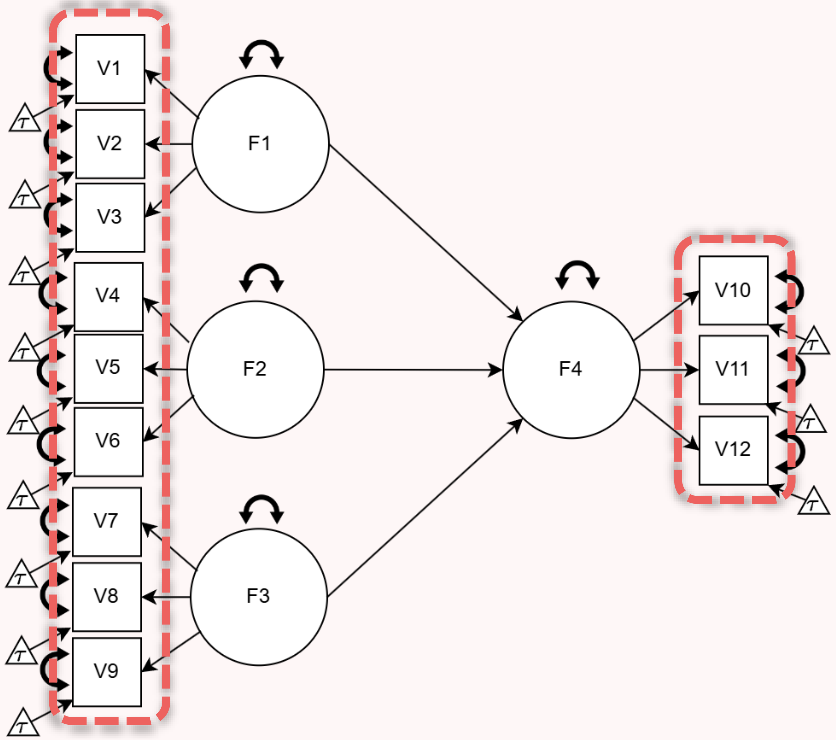
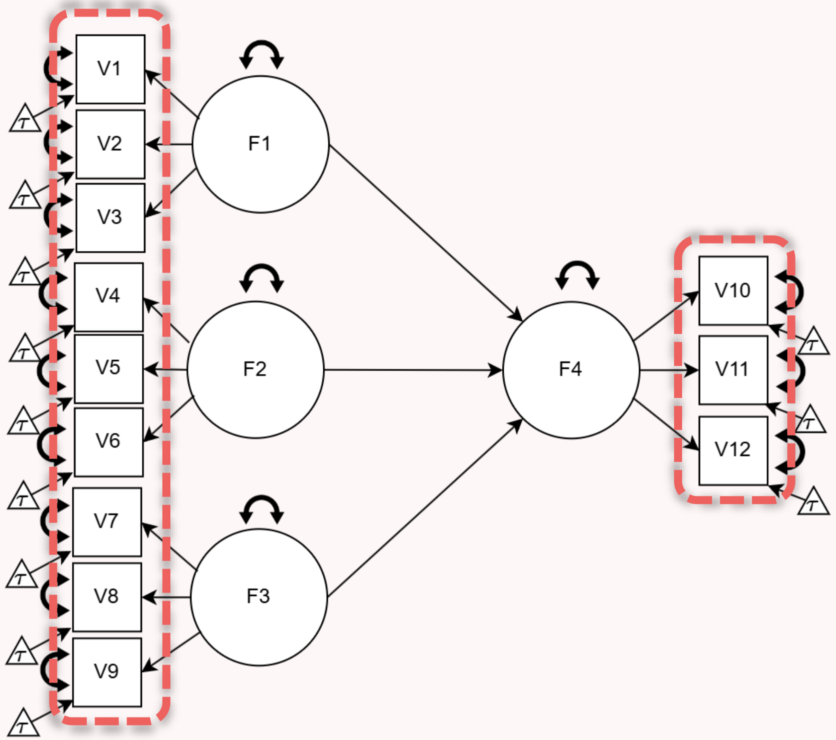


Real life

- Default MMG-SEM works for **continuous** indicators.
- In real life, the items are (always) **ordinal**.
- Ignoring ordinality can cause **bias!**



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Keywords: categorical indicators, confirmatory factor analysis, maximum likelihood, categorical least-squares, robust statistics

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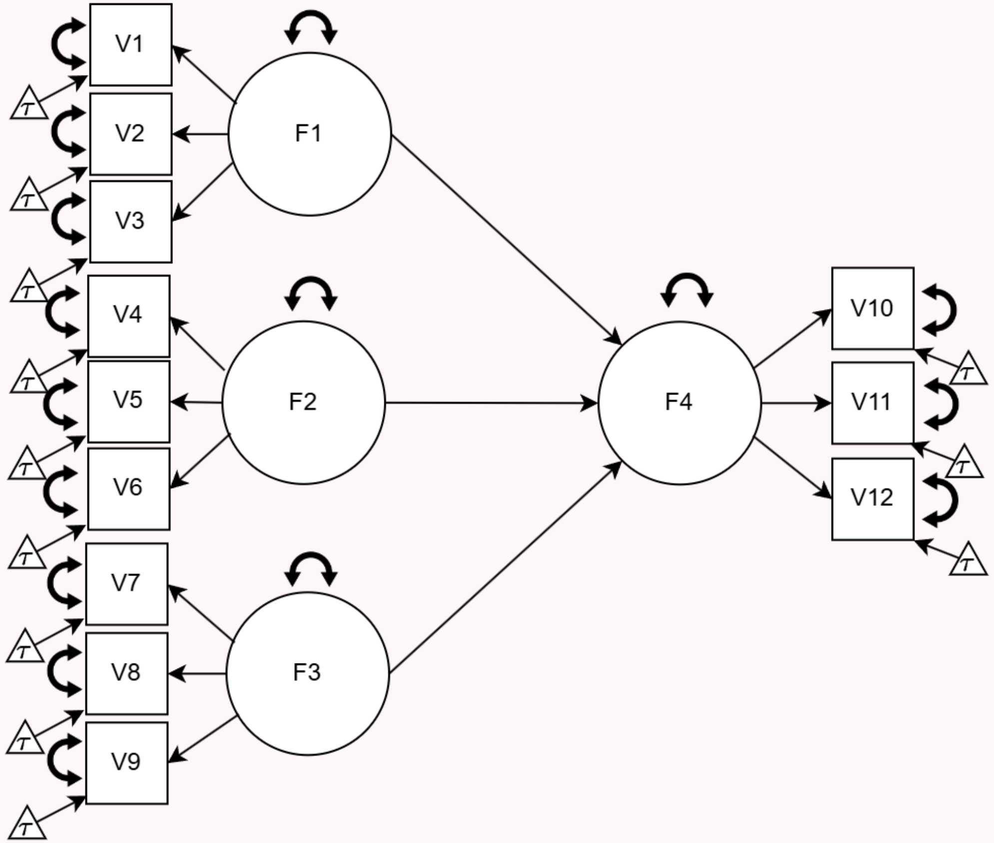

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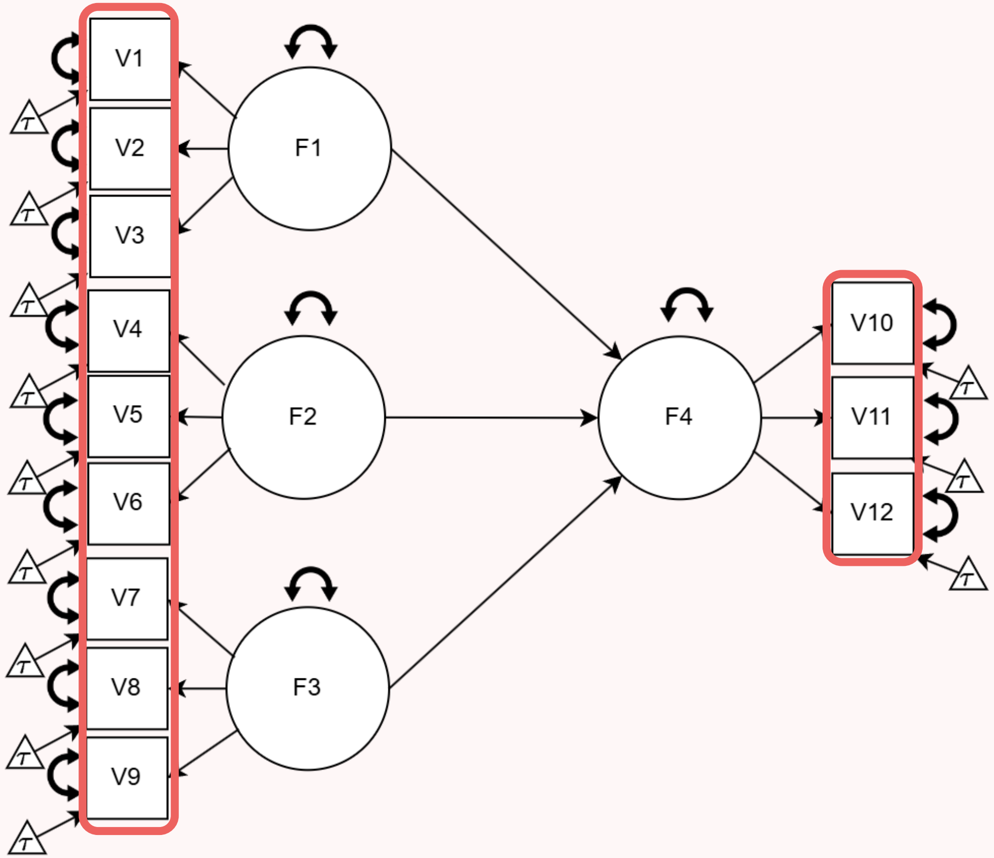

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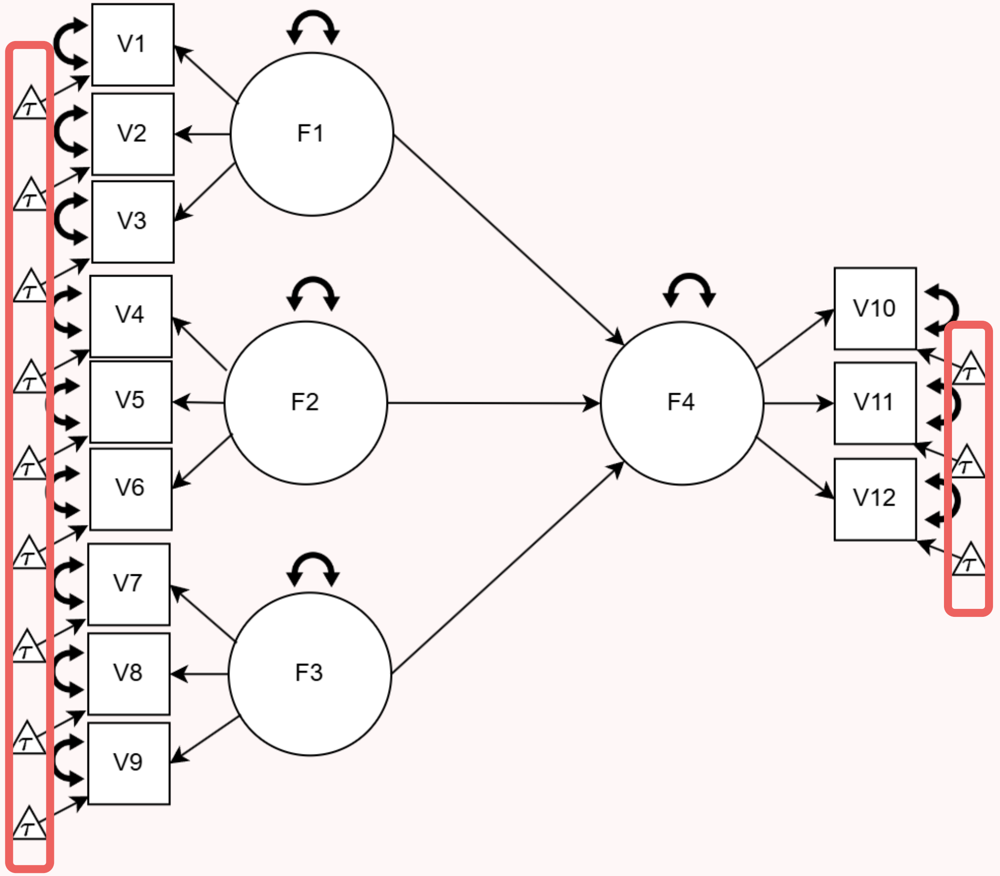

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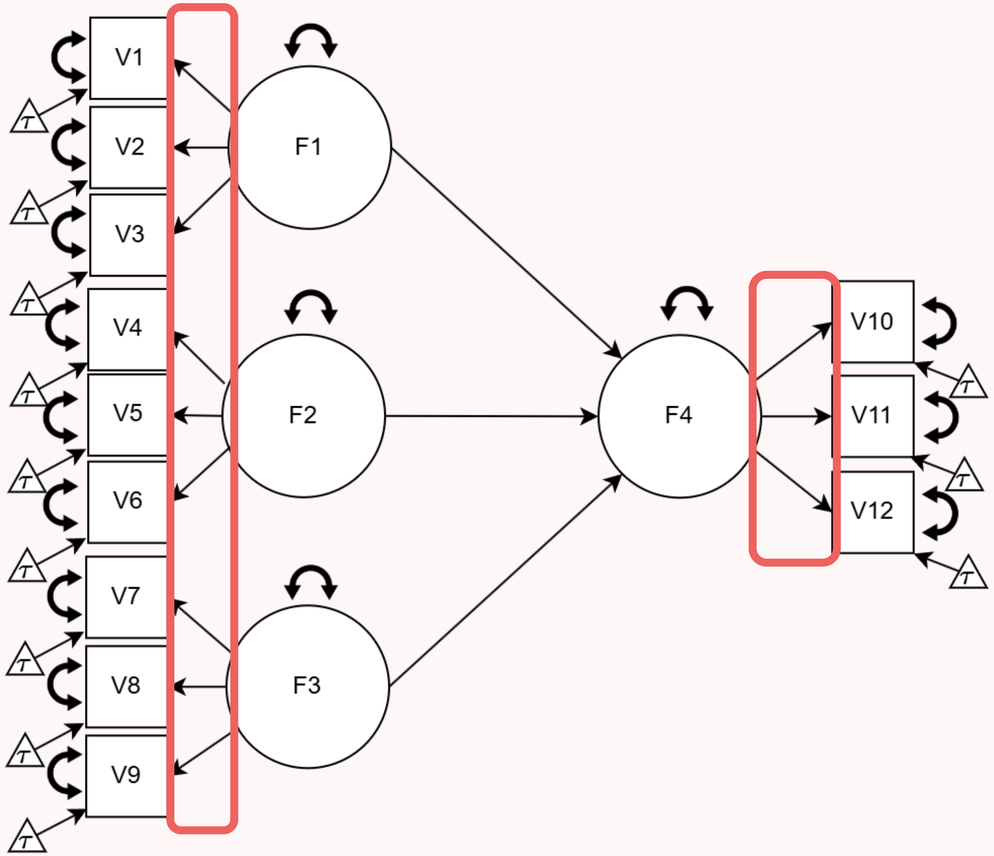

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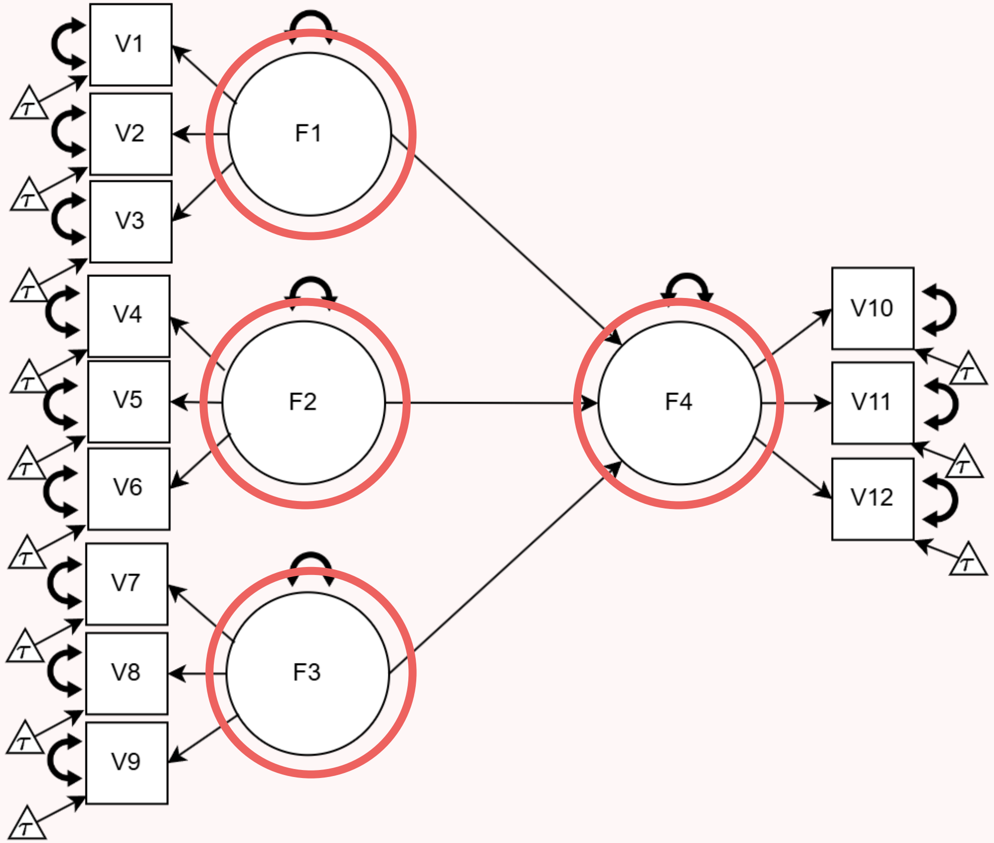

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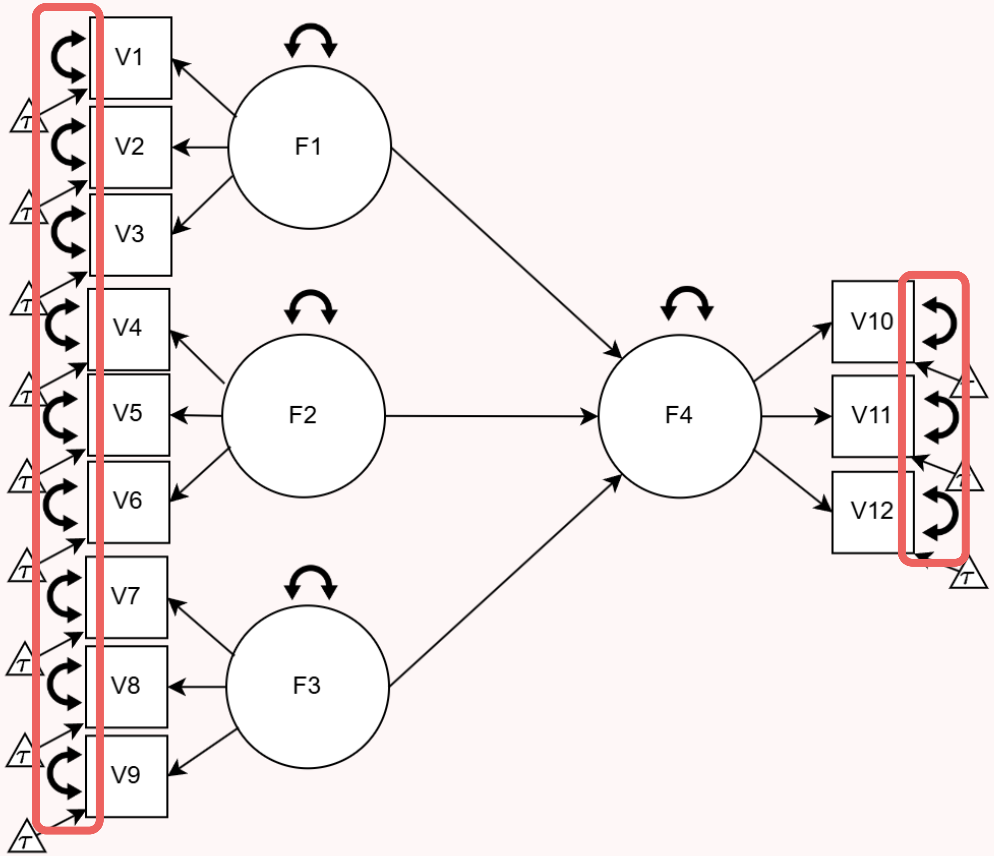

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Thresholds!

How do we compute thresholds?

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- The thresholds represent the proportion of people in each category.

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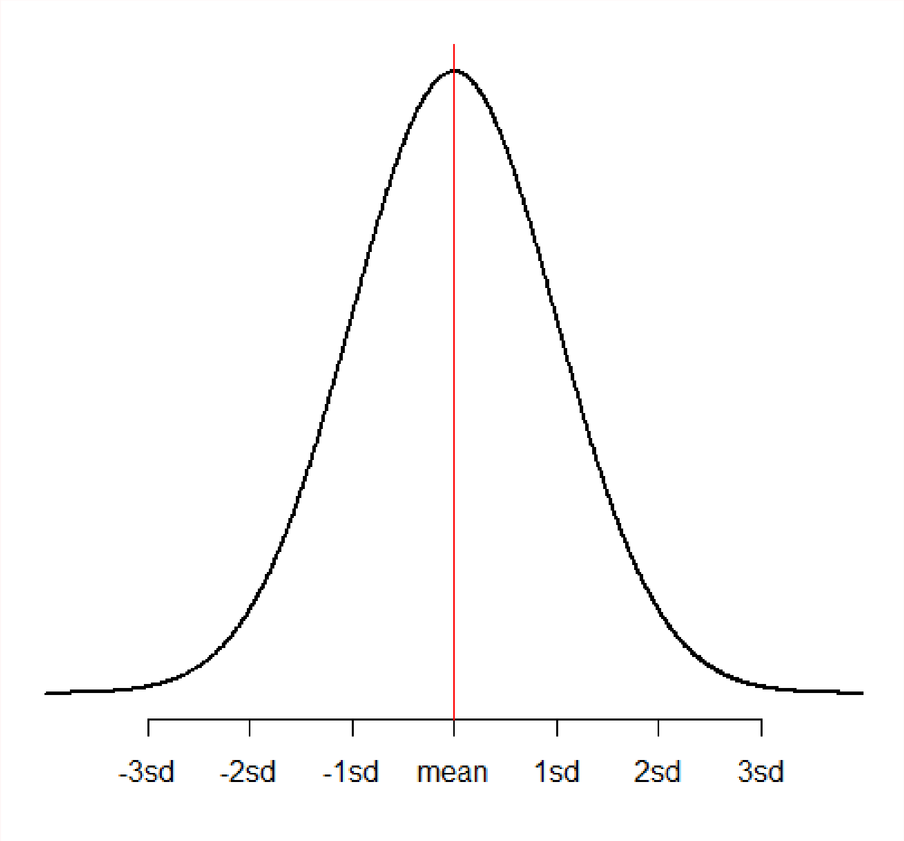
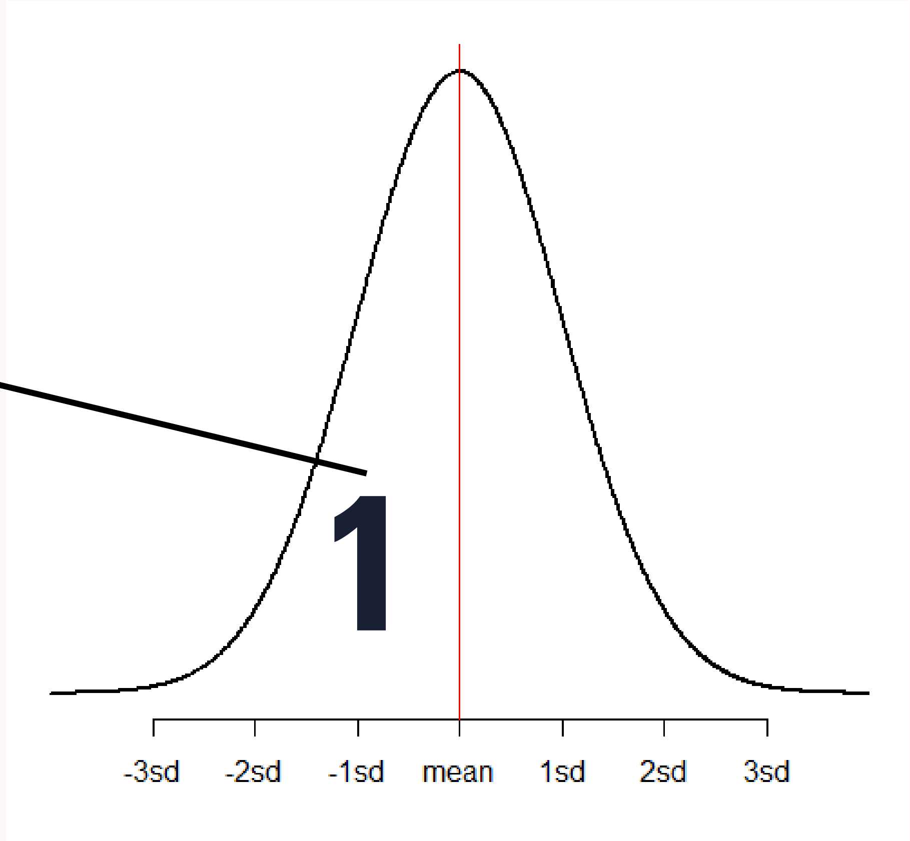
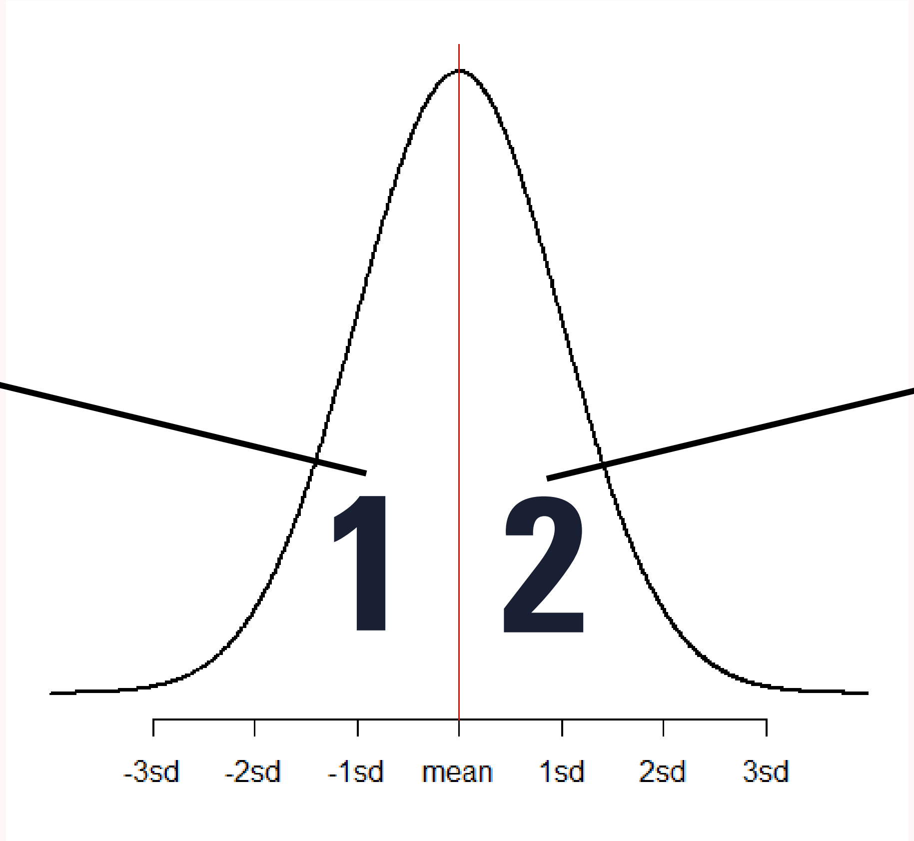
- They are z-scores (we work with standardized latent scales).


-3sd
-2sd
-1sd
mean
1sd
2sd
3sd

50% answered 1

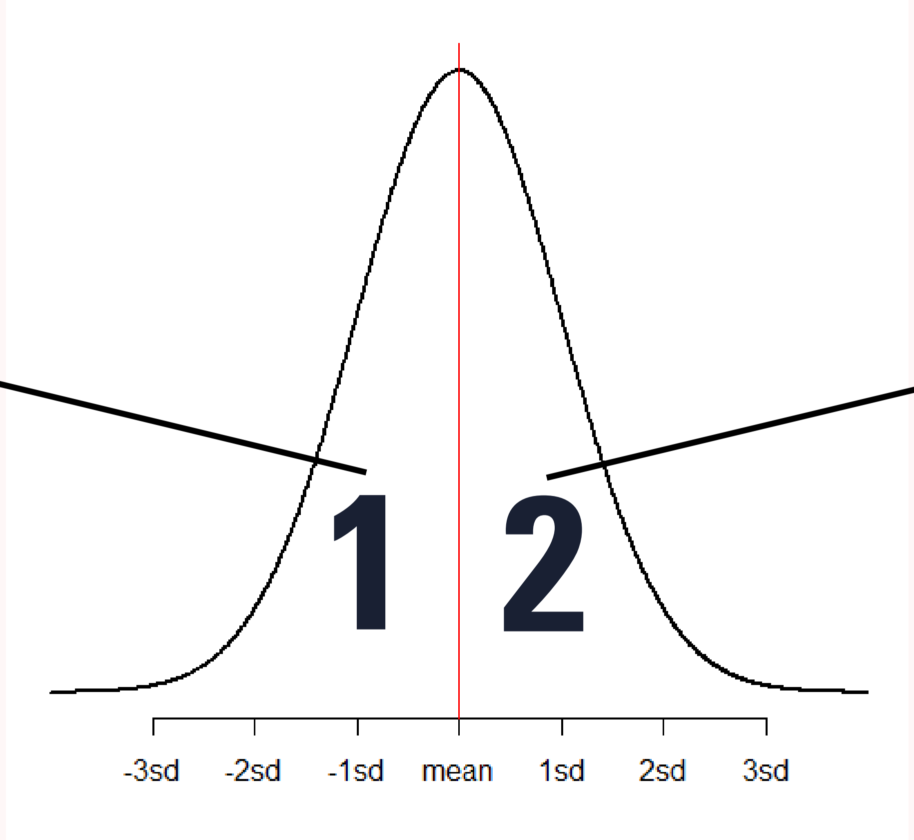


50% answered 1



50% answered 2

50% answered 1



50% answered 2

Threshold is 0

Now, in MMG-SEM?

Challenges

Ordinal estimation

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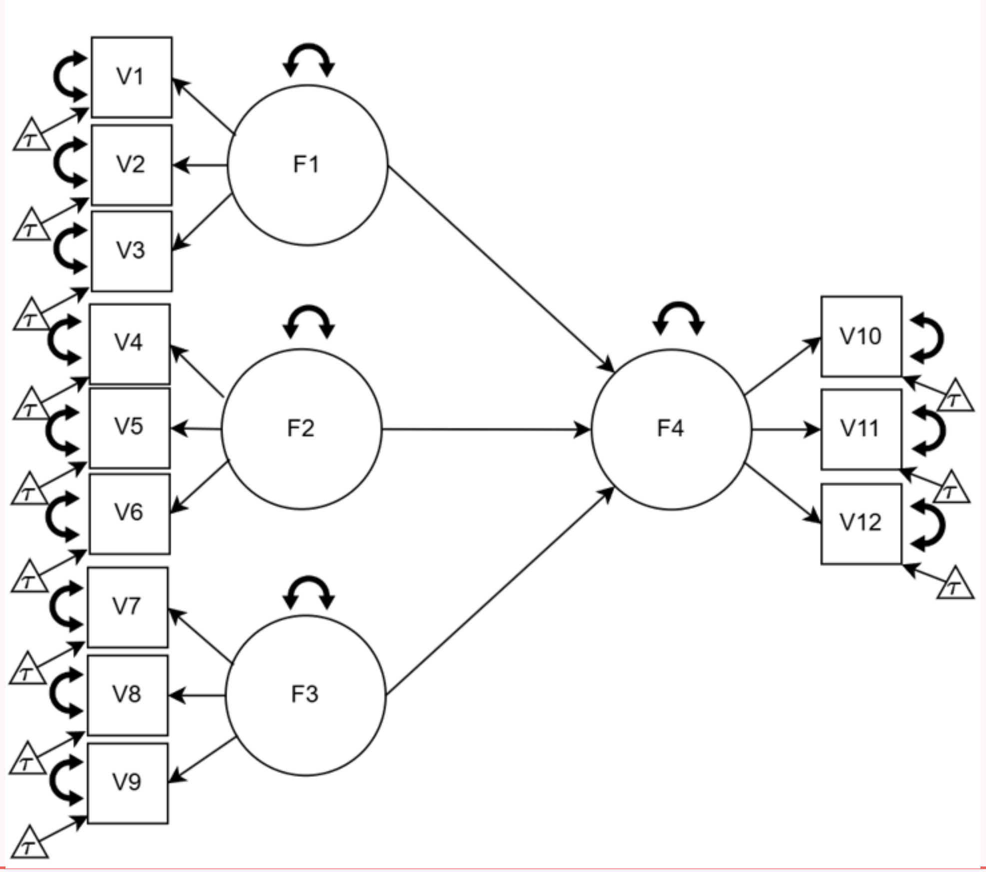
  - Instead of MG-CFA.
- Least Squares (LS) estimation.
  - Instead of ML.
- **How can we use LS (for MG-CCFA) and ML (for the clustering)?**

The perks of stepwise estimation



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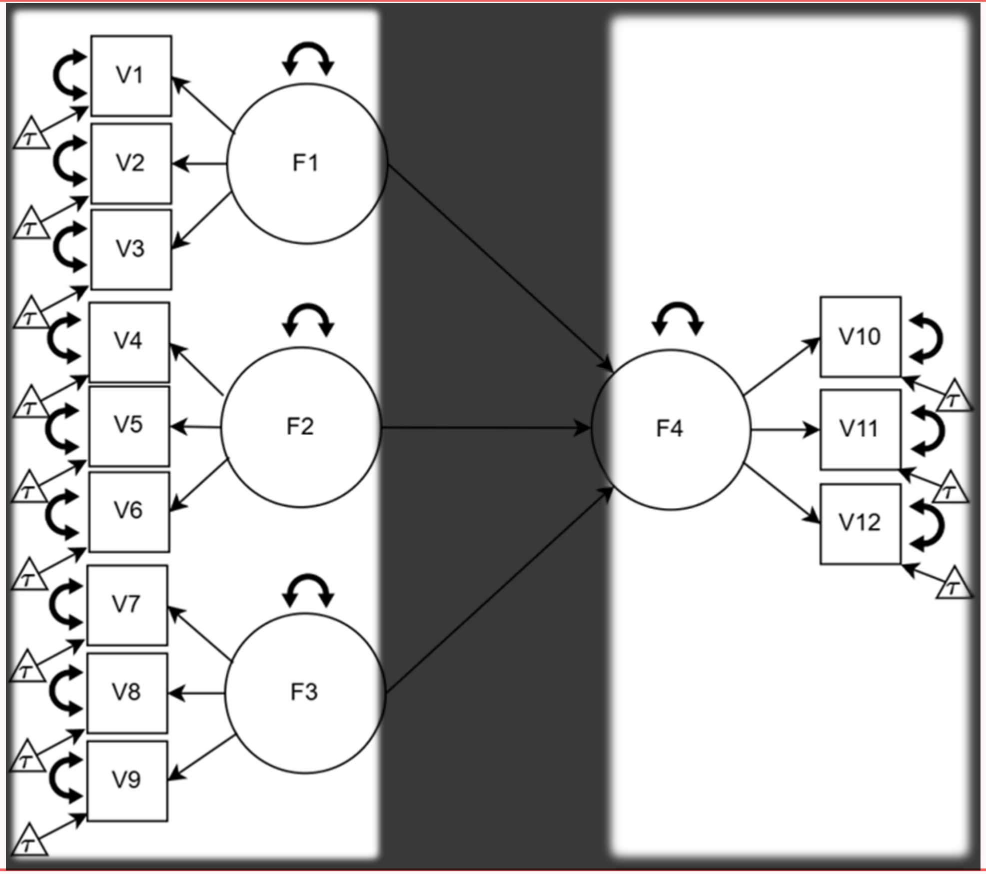
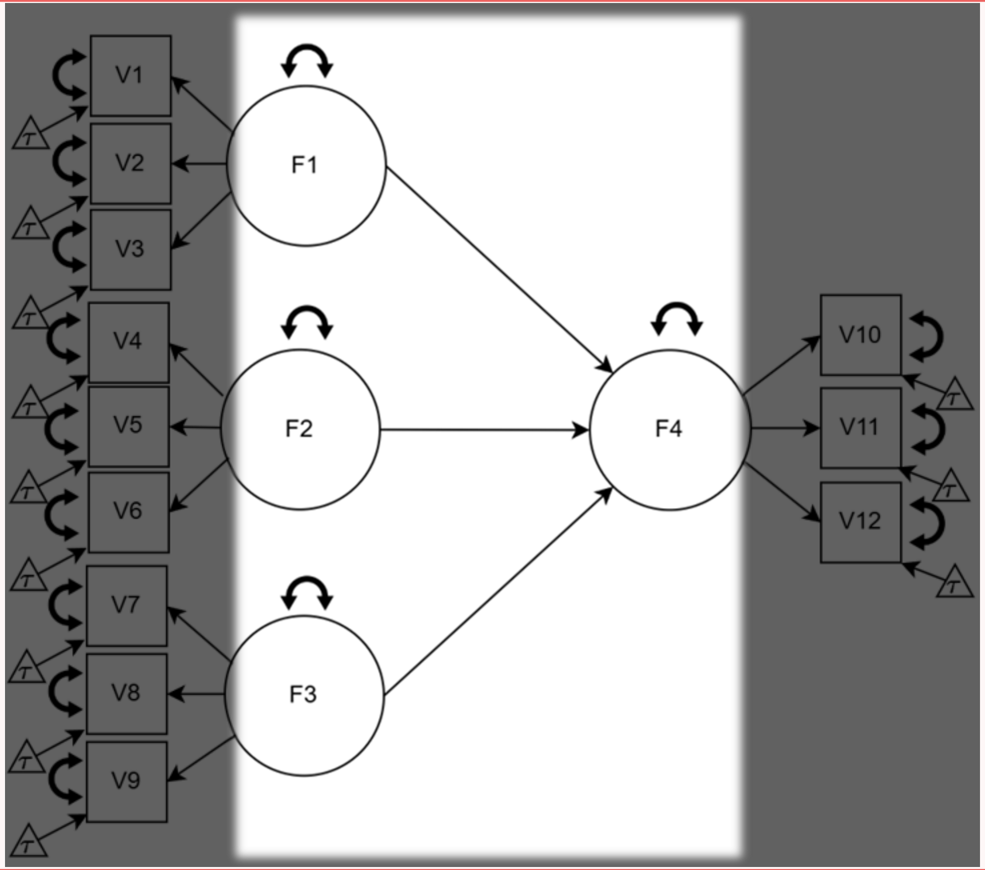


Measurement model

The perks of stepwise estimation



Structural model

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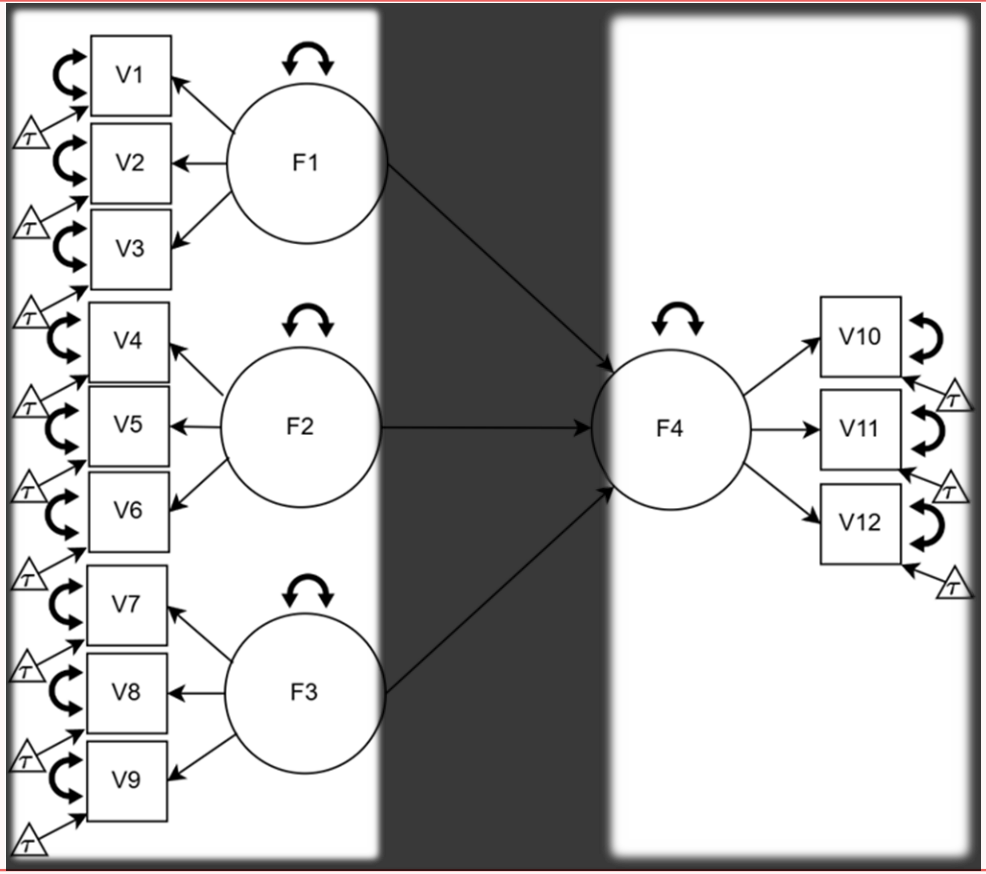

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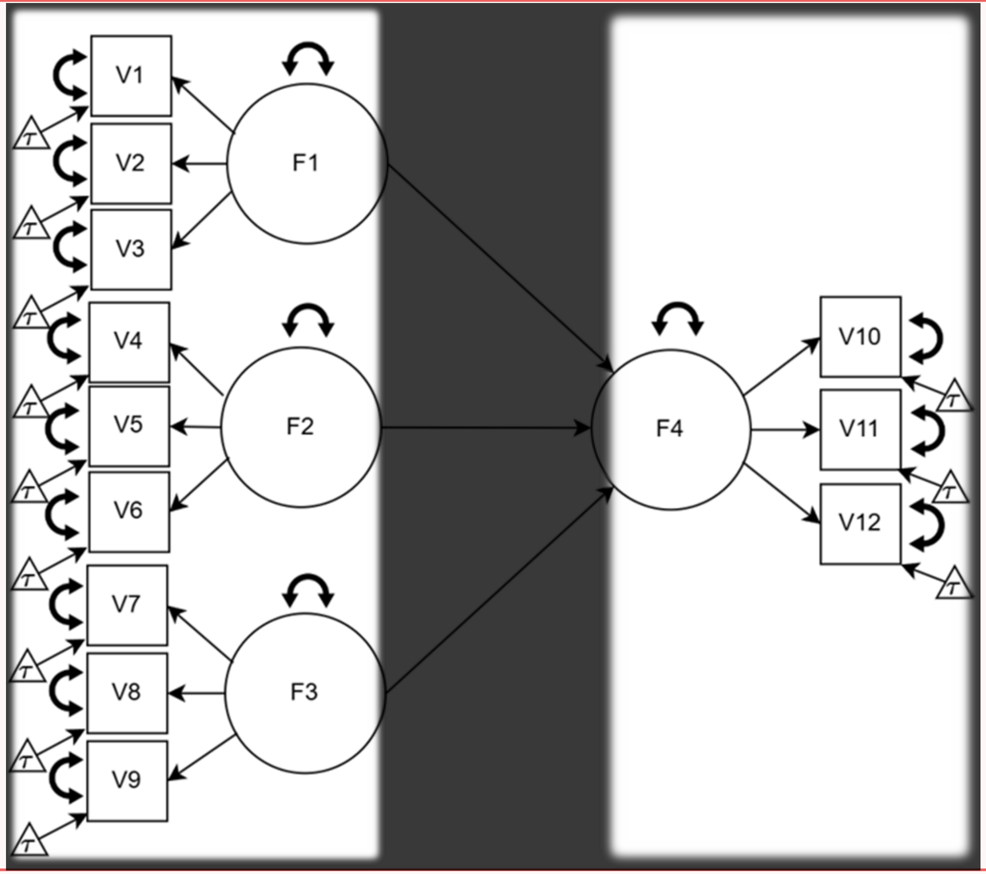

Measurement model

Ordinal variables are important here!

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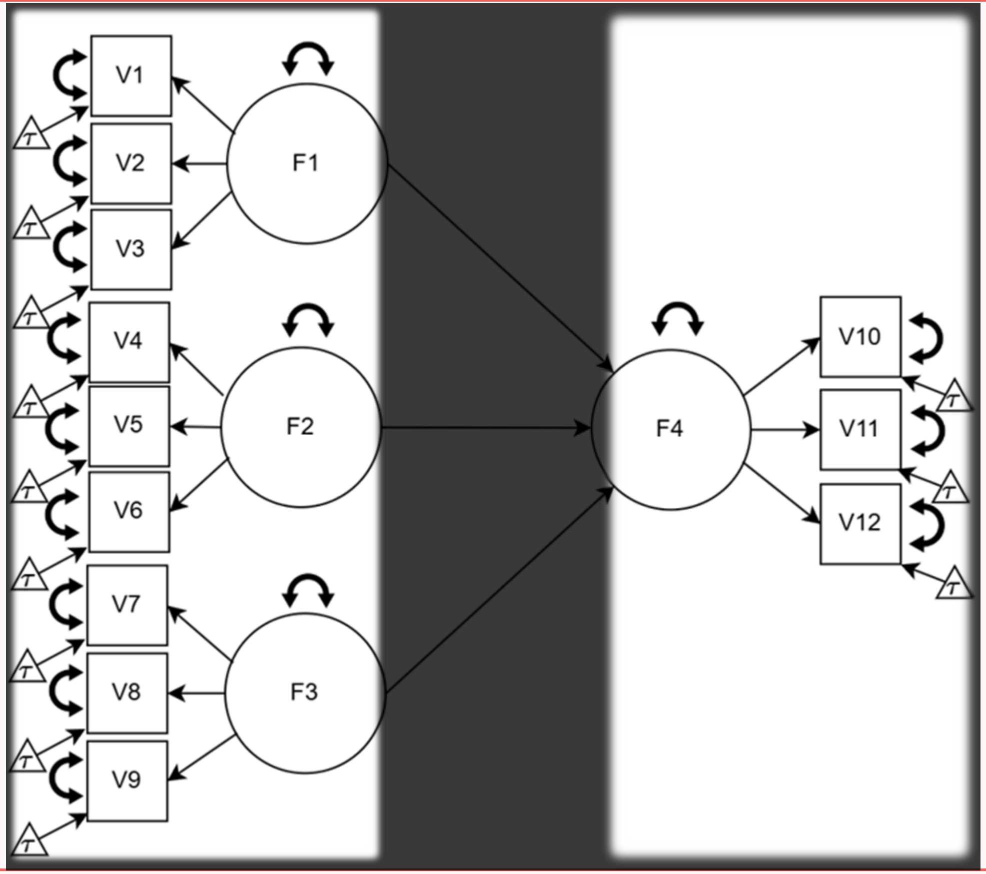

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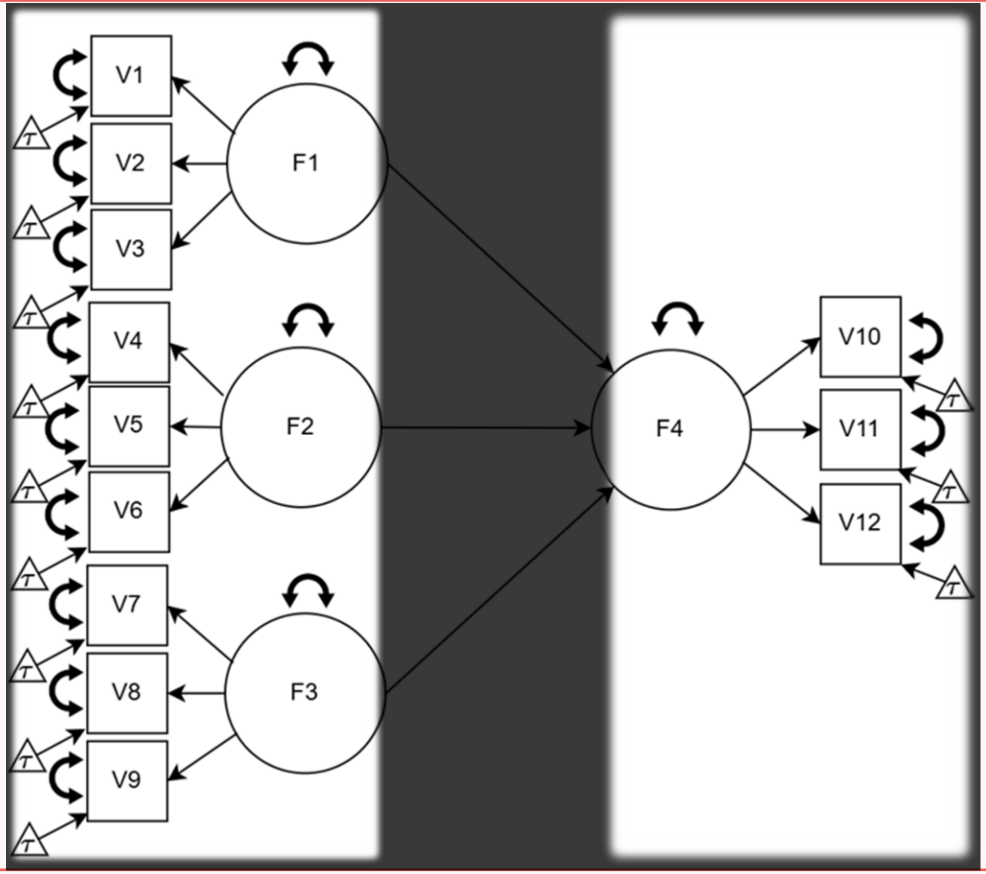

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MG-CFA → MG-CCFA

LS estimation here!

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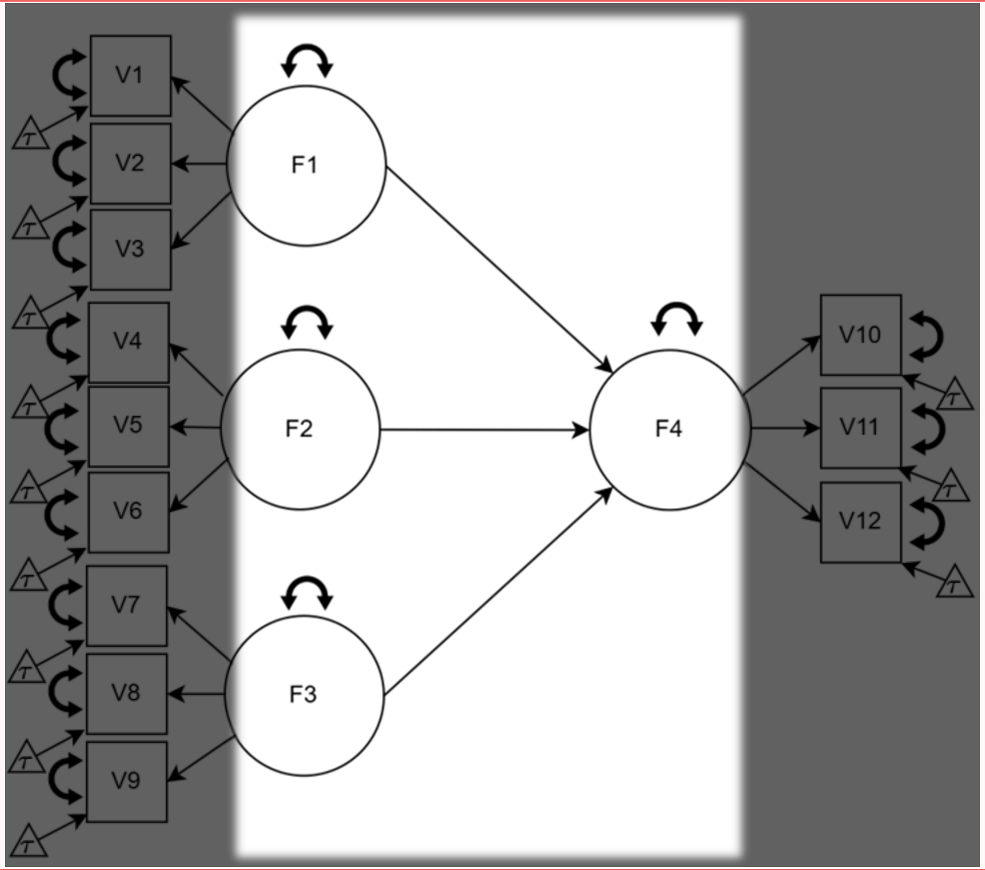

Structural model

ML estimation here!

Does this actually matter?

Some expectations and results

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2-4 categories

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5-7 categories

the greater the bias in ML estimates. As with two to four categories, ML estimates of the structural model parameters (in this case, the correlation between two factors) were extremely accurate, producing marginally better estimates than cat-LS.

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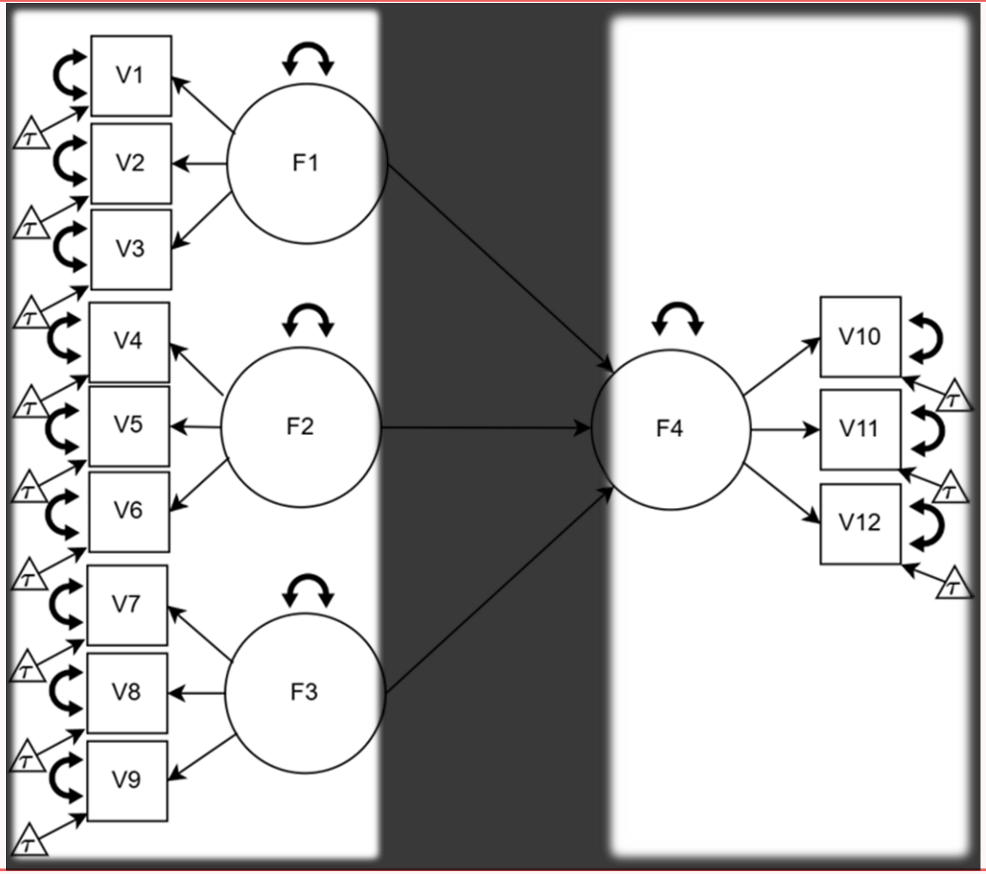
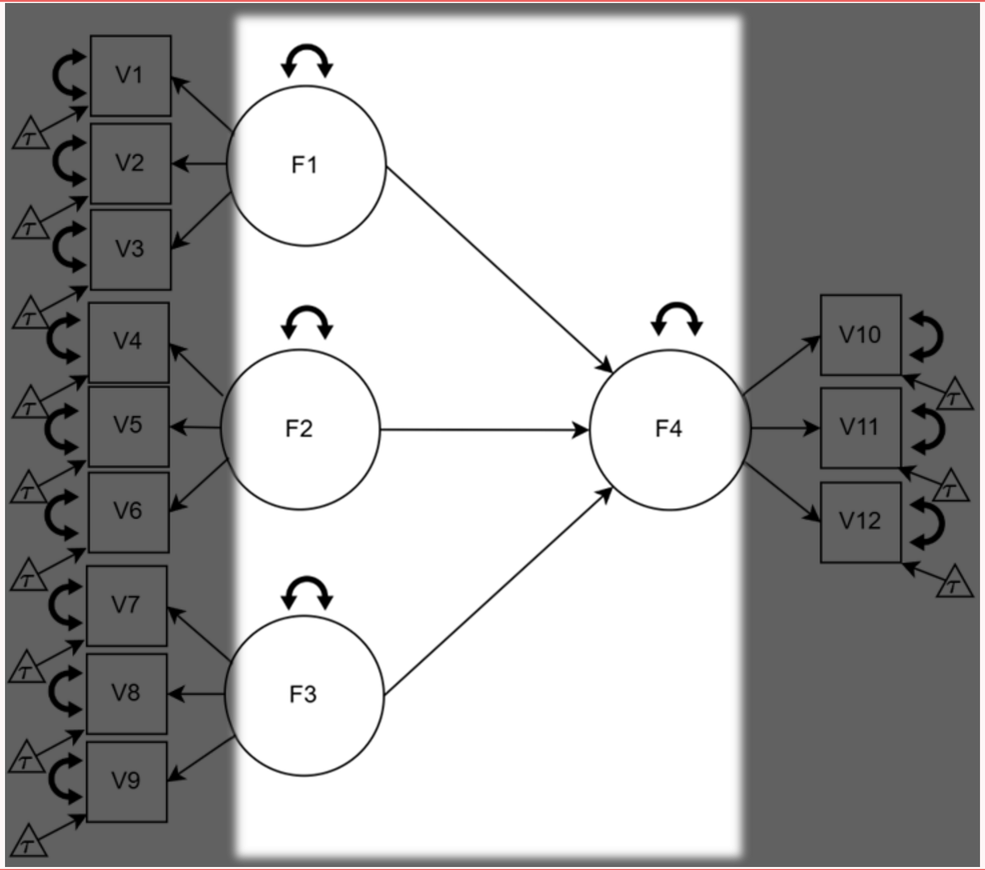


Bias here!

The perks of stepwise estimation



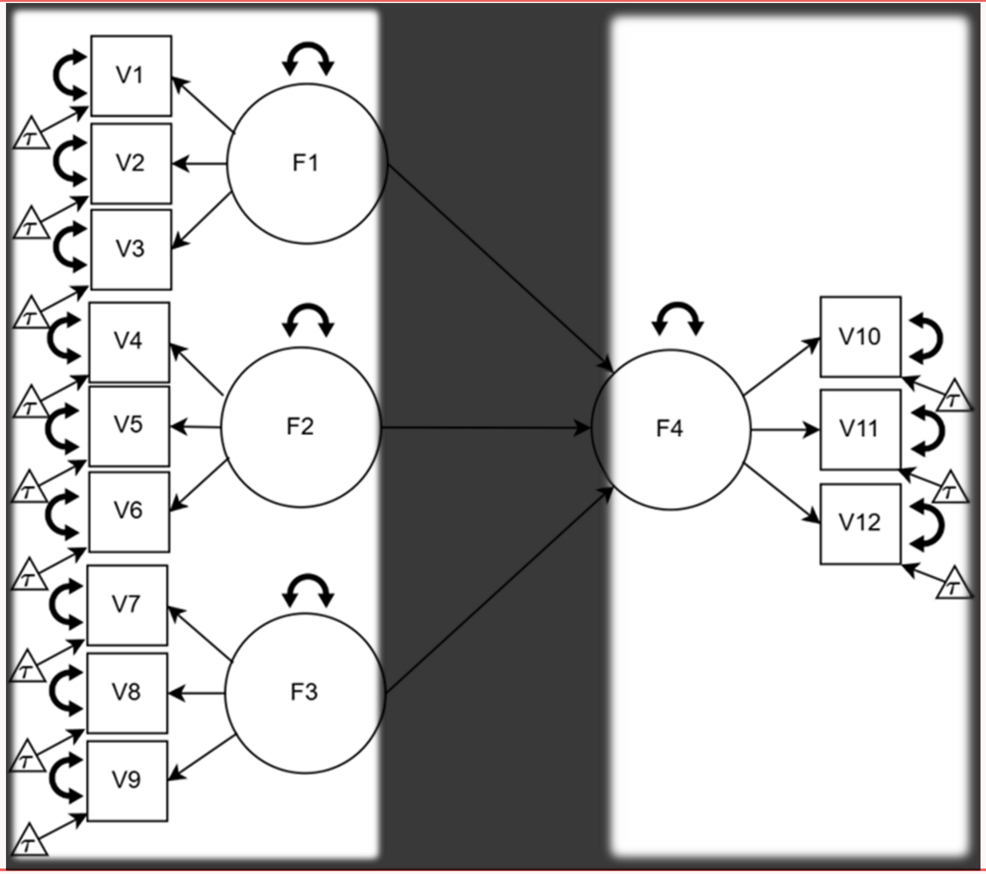
Often okay

Simulation?

Simulation?

- We basically found the same ☺

The perks of stepwise estimation



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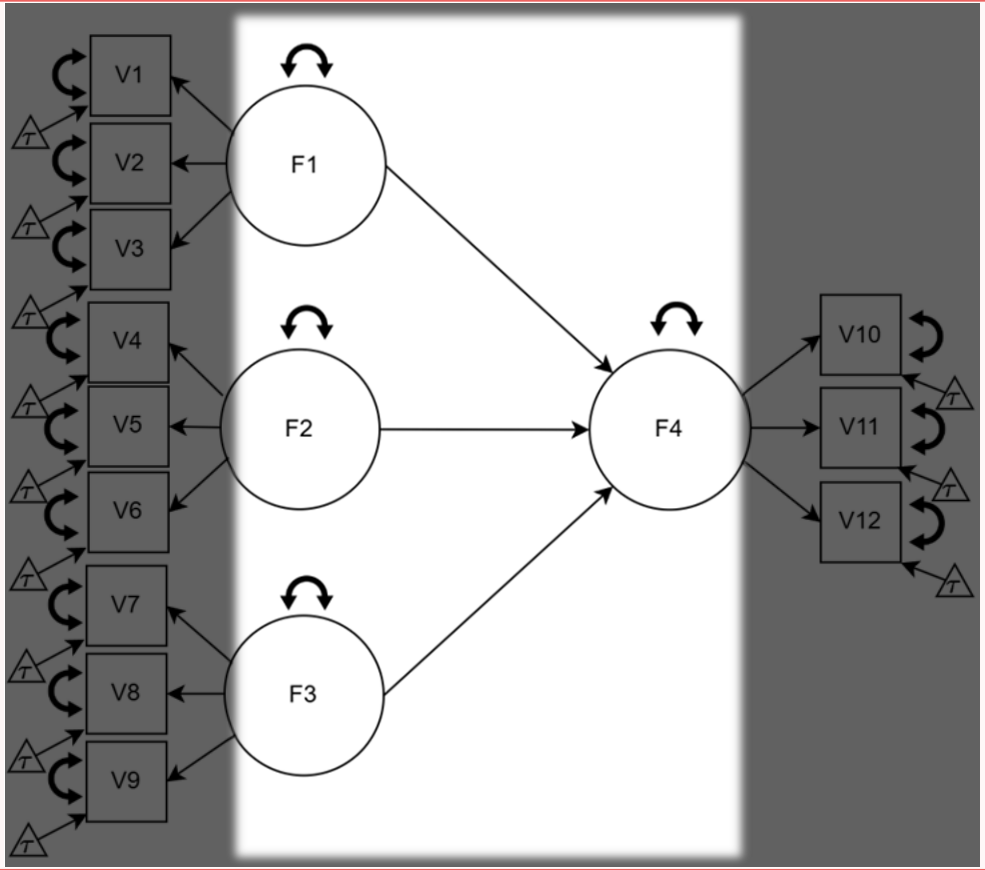

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Why do it?

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- If the measurement model is biased, measurement invariance (MI) is difficult to test.
- MI is necessary for valid comparisons of the regressions!

Thanks!