

# Correction for measurement errors: how to do it and what is the impact?

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# Correction for measurement errors

How to do it?

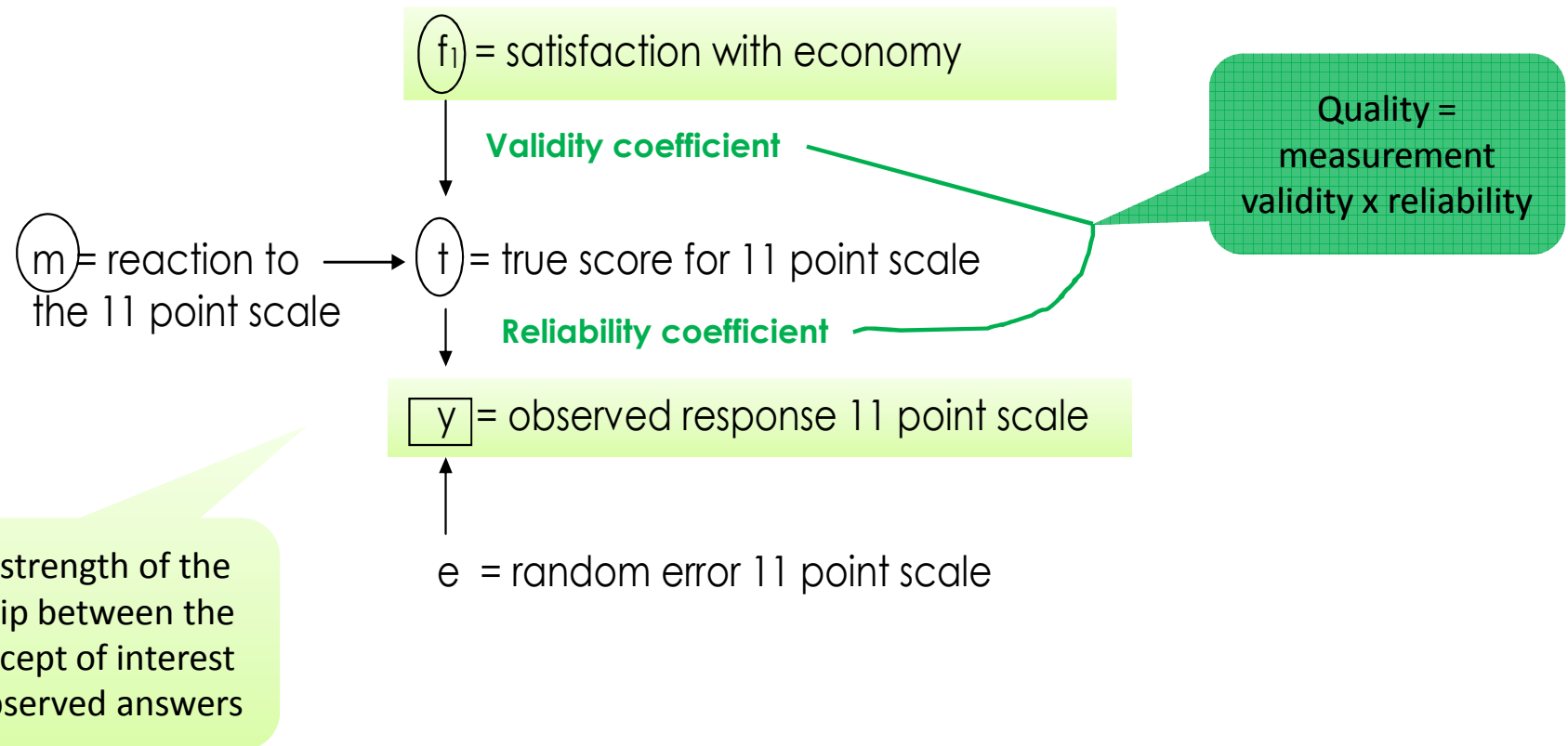
2 steps:

1. Estimate/predict the size of the measurement errors (random and systematic), or of their complement (reliability and validity)
2. Use this information to correct for measurement errors

# Reliability, validity, quality

Quality = part of variance explained by the latent concept of interest

→ complement of measurement errors



# How to evaluate the quality?

2 main alternatives

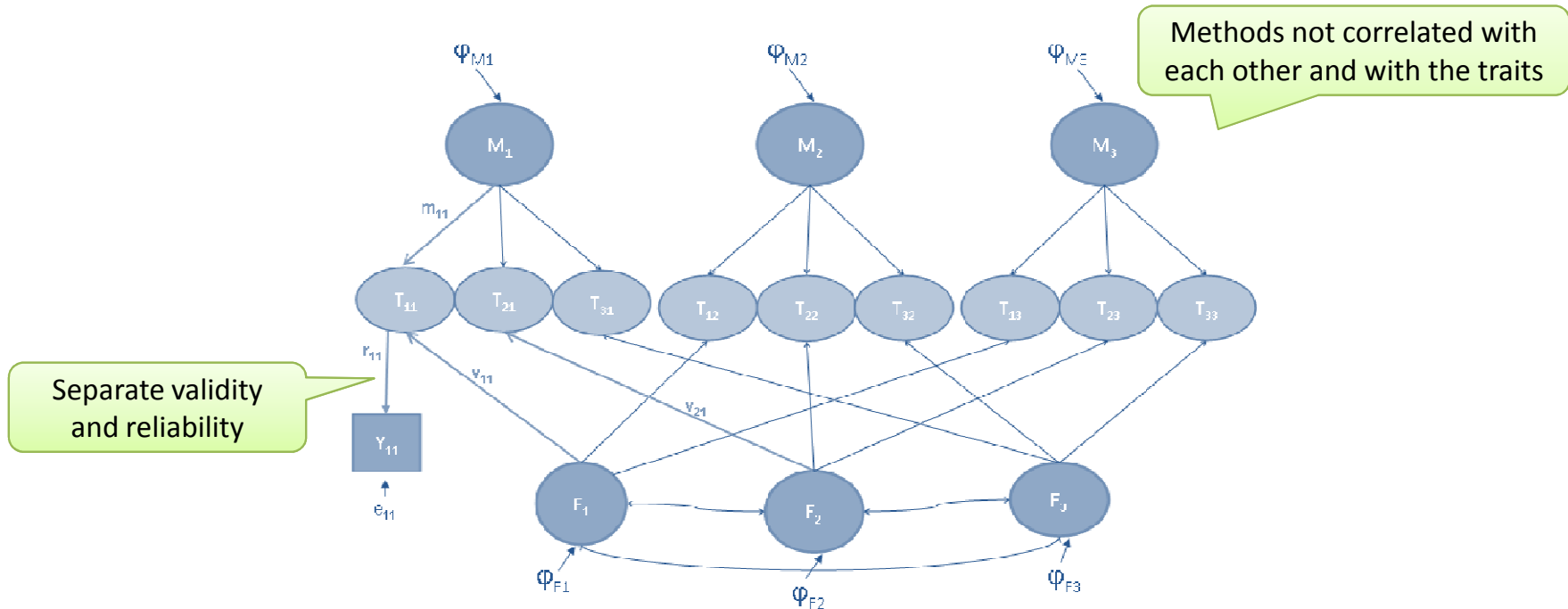
1. Estimation using the **Multitrait-Multimethod** (MTMM) approach
2. Prediction using the **Survey Quality Predictor** (SQP) software

# What is the MTMM approach?

The true score model: Saris & Andrews (1991)

Analyses using SEM

Equations of the model: 
$$\begin{cases} Y_{ij} = r_{ij} T_{ij} + e_{ij} \\ T_{ij} = v_{ij} F_i + m_{ij} M_j \end{cases}$$



# Why do we need SQP?

## Limits of MTMM experiments

Get information only **after data collection**

Results for specific questions

- **Cannot be generalized** to other measures
- Many interactions

Repetitions needed so require **long surveys**

- Time, Cost, Cognitive Burden, Memory effect

**In practice, impossible to repeat all questions**

- Alternative? The SQP software



KEEP  
CALM  
AND  
know your  
LIMITS

# What is SQP?

A survey quality prediction system for questions used in survey research and a database of questions with information about their quality

## What can you get in SQP?

- Reliability, validity, and quality coefficients
- With confidence intervals

## What do you have to do?

- Go to [sqp.upf.edu](http://sqp.upf.edu)
- Consult the information already stored in the database
- Introduce a new question and code its characteristics following the program instructions until you get a prediction

**FREE**

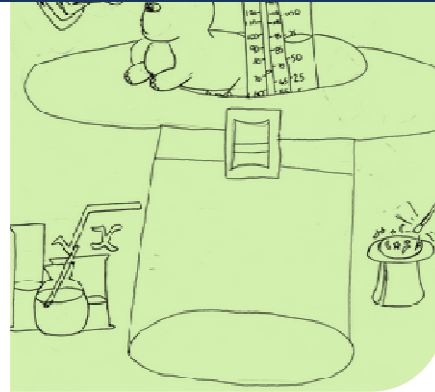
RECSM working paper:

Saris, Oberski, Revilla, Zavala, Lilleoja, Gallhofer & Gruner (2011). "Final report about the project JRA3 as part of ESS Infrastructure".

Tutorials: <https://www.youtube.com/channel/UCpljiQFIE4j5CYI-rqMKDig>

# What is behind the program?

**25 years of cumulative experience**



A meta-analysis of 3,700 quality estimates from MTMM experiments conducted in  $\approx 30$  countries (mainly ESS)

These estimates are explained by up to 60 questions characteristics

Random Forest approach used

Good predictions obtained: explained variance ( $R^2$ ) for reliability of .65 and for validity of .84



# What to do once we know the quality?

## Different uses of the information about quality

### Before the data collection:

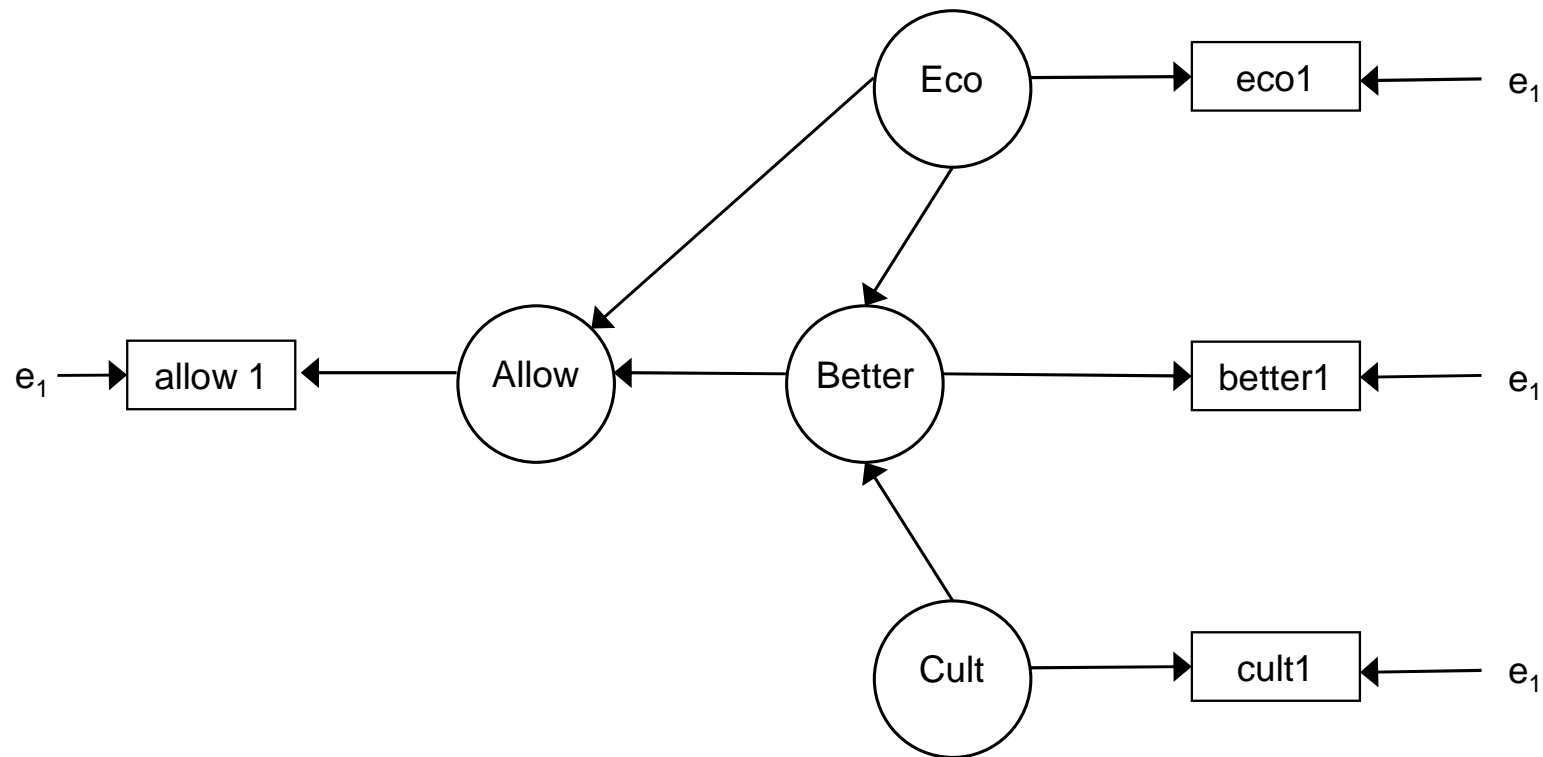
- Compare different formulations of the questions and use this information to improve **questionnaire design**

### After data collection:

- **Correct** for measurement errors

# Correction for ME: an illustration

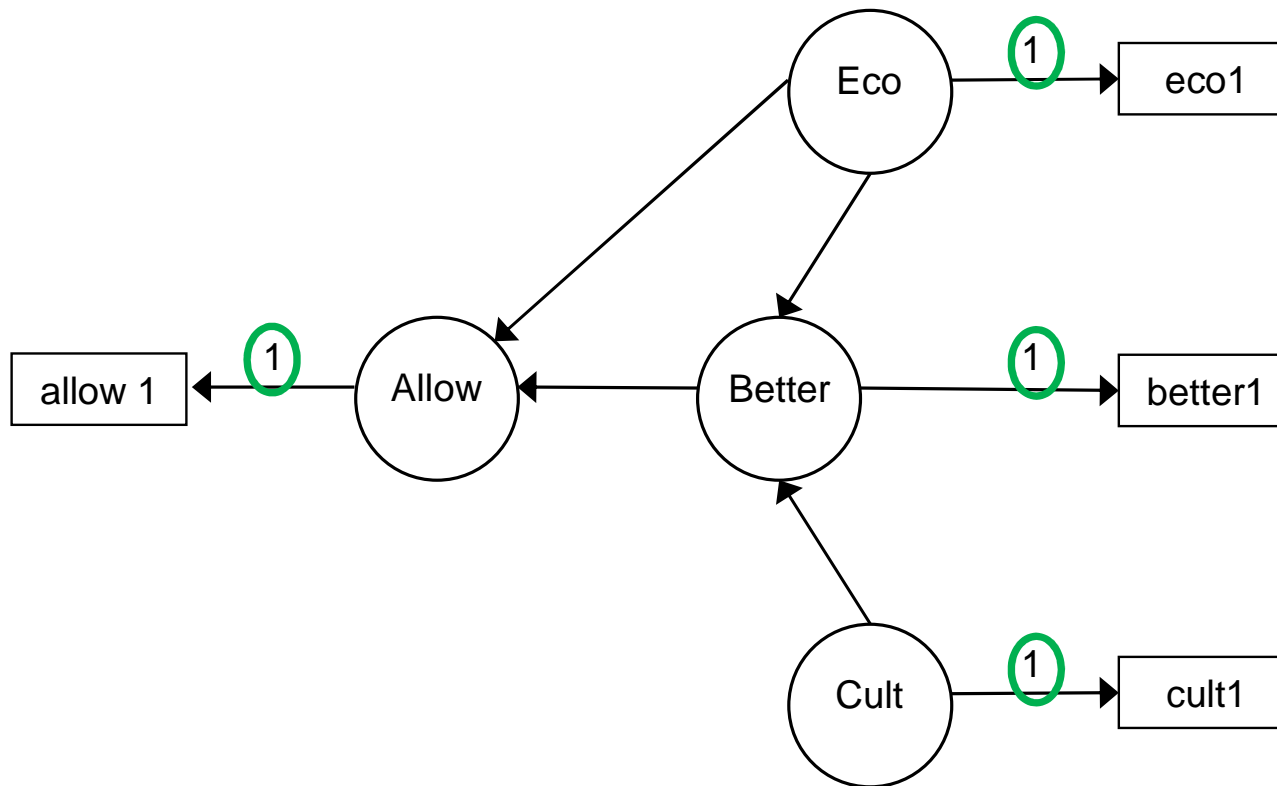
Model we want to study



What is the problem? Model **not identified!**

# Most common way to deal with this

Assuming no ME  $\Leftrightarrow q=1 \Leftrightarrow$  Model without correction



# How to correct for ME?

Fix the loadings to the values of the quality coefficients

Information about quality can be obtained from

- **MTMM** experiments
- **SQP** predictions

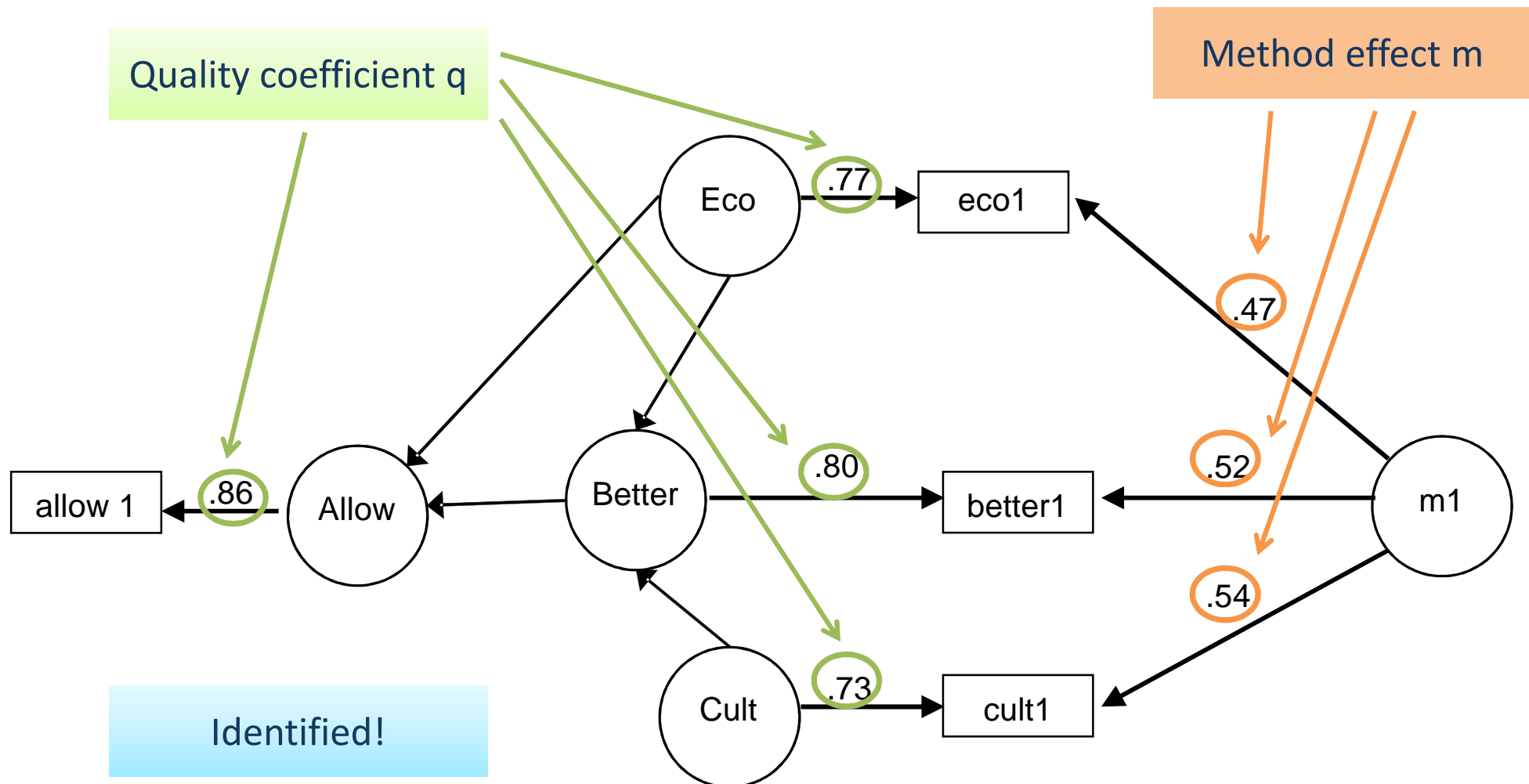
Big advantage:  
Does not require  
to collect  
previous data

Big advantage:  
Can be obtained for  
almost any question

# Correction for ME using quality coefficients

Step 1: get the predictions of quality for each question using SQP

Step 2: fix the loadings to these values

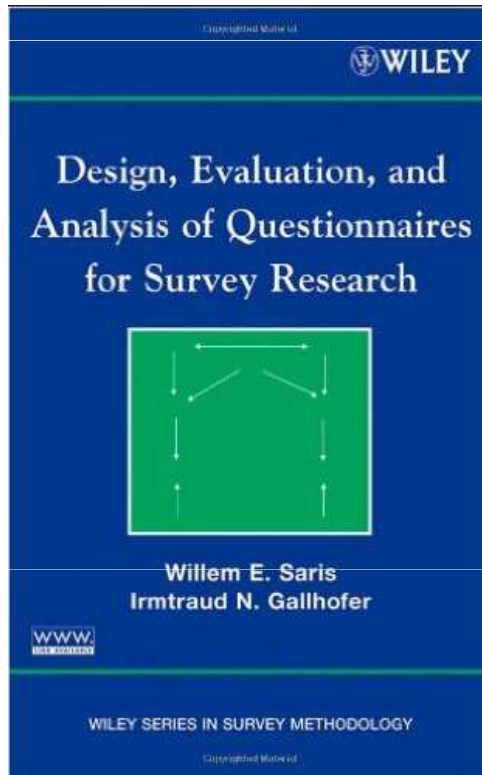


# Estimates of the effects

Rather different conclusions with respect to the size of the effects

<b>Effects</b>	<b>No correction</b>	<b>fix <math>ly_{SQP}</math></b>
Better to Allow	-.23	-.17
Eco to Allow	-.31	-.56
Eco to Better	.45	.52
Cult to Better	.41	.40
Corr Eco-Cult	.66	.82
Expl. var Allow	.25	.50
Expl. var Better	.61	.78

# More information



## ESS EduNet

Countries by Round  
About

## Topics

### Measurement errors

Chapter 1  
Chapter 2  
Chapter 3  
Chapter 4  
Chapter 5  
Chapter 6  
Chapter 7  
Appendix 1  
Appendix 2  
References

Multilevel models

## A simple procedure to correct for measurement errors in survey research

By Anna DeCastellarnau and Willem Saris

### Introduction

Although most applied researchers believe that survey data contain measurement errors, very few correct these errors. In principle, the reason for this omission cannot be that the procedures are not known because they were already developed in the 20th century [Gol73]. One of the reasons for this omission is probably that these procedures make it necessary to collect multiple indicators for all variables in the study in order to correct for measurement errors. This doubles or triples the response burden for the respondents, increases the costs of the research and makes the analysis rather complex. The purpose of this text is therefore to illustrate how corrections can be made in a very simple way and to show that researchers can and should always correct for these errors.

<http://essedunet.nsd.uib.no/cms/topics/measurement/>

Saris, W.E., & M. Revilla (2016). "Correction for measurement errors in survey research: necessary and possible". *Social Indicators Research*, 127(3): 1005-1020. DOI: 10.1007/s11205-015-1002-x

# Conclusions

## 10 main points to remember

1. There is no measurement without errors
2. These measurement errors affect the results and comparisons across groups
3. It is crucial to evaluate the size of these errors for each question
4. This can be done using an MTMM approach, but this approach has limits
5. An alternative is to use the SQP software to predict the quality of the questions
6. SQP can be used to improve questionnaire design
7. Still, there will be measurement errors so it is necessary to correct for this
8. This can be done by fixing the loadings to the values of the quality coefficients
9. There are also other ways of correcting for measurement errors
10. Correction for measurement errors affects the results



**Thank you for your attention!**



# Questions of the illustration

Form of the questions in the Main questionnaire of the ESS  
Country: Ireland

## First question of the battery (not used)

To what extent do you think Ireland should allow people of the **same race** or ethnic group as most Irish people to come and live here?

## Opinion about immigration (**Allow**)

How about people **from the poorer countries outside Europe**? Use the same card

1. Allow many to come and live here
2. Allow some
3. Allow a few
4. Allow none

## Opinion about economic consequences (Eco)

Would you say it is generally **bad or good for Ireland's economy** that people come to live here from other countries? Please use this card.

Bad for the  
economy

0 1 2 3 4 5 6 7 8 9 10

Good for the  
economy

## Opinion about the cultural consequences (Cult)

And, using this card, would you say that Ireland's **cultural life is generally undermined or enriched** by people coming to live here from other countries?

Undermined

0 1 2 3 4 5 6 7 8 9 10

Enriched

## Consequences for the life in general (Better)

Is Ireland made **a worse or a better place to live** by people coming to live here from other countries? Please use this card.

Worse  
place  
to live

0 1 2 3 4 5 6 7 8 9 10

Better  
place  
to live