SQP 2.1 Survey Quality Predictor

# The Program

## What is SQP?

- A survey quality prediction system for questions used in survey research.
- A program available for free at sqp.upf.edu
- A database of questions with information about their quality.

## What can I achieve with SQP?

An indication of the quality of survey questions and suggestions for improving them. The program provides reliability, validity, and quality coefficients, with confidence intervals.

## What do I have to do?

- Consult the information aldready stored in the SQP database regarding the quality of each question.

  or
- Introduce a new question and code its characteristics following the program instructions until you get a prediction for your own question.

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## How can I use the information from SQP?

1- To improve questions before data collection

Example of a suggestion of improvement:

H28 / TEST28 / social trust, careful

ESS Round 1 United Kingdom - English

Request for Answer Text:
Generally speaking, would you say that most people can be trusted, or that you can't be too careful in dealing with people ? Please tick one box.

Answer options:
- You can't be too careful
- Most people can be trusted

MTMM Results (coefficients)

Quality Coefficients

| | | Prediction | Interquartile range | Standard error | MTMM Estimate | MTMM 95% Confidence Interval |
|---|---|---|---|---|---|---|
| Reliability Coefficient | r | 0.801 | ( 0.765, 0.827 ) | 0.113 | 0.781 | ( 0.722, 0.829 ) |
| Validity Coefficient | v | 0.907 | ( 0.882, 0.921 ) | 0.149 | 0.887 | ( 0.809, 0.934 ) |
| Quality Coefficient | q | 0.726 | ( 0.659, 0.755 ) | 0.103 | 0.693 | ( 0.584, 0.775 ) |

Potential Improvement to Question Quality

View the potential for improving this question based on this quality prediction by changing individual characteristics.

View Potential Improvements

Number of categories (ncategories)

| Choice | Average what if-prediction | |
|---|---|---|
| 2 | 0.528 | |
| 4 | 0.551 | + 0.023 |
| 5 | 0.540 | + 0.012 |
| 7 | 0.535 | + 0.007 |
| 11 | 0.562 | + 0.034 |

SQP suggests to increase the number of answer categories to 11.
This will improve the question quality by 0.034.

## 2- To correct for measurement errors

Example of correcting the correlations using SQP predictions:

H29 / TEST29 / social trust, take advantage
ESS Round 1 United Kingdom - English

Request for Answer Text:
Do you think that most people would try to take advantage of you if they got the chance, or would they try to be fair ?
Please tick one box.

Answer options:
a Most people would try to take advantage of me
a Most people would try to be fair

| | | Prediction |
|---|---|---|
| Reliability Coefficient | r | 0.803 |
| Validity Coefficient | v | 0.910 |
| Quality Coefficient | q | 0.731 |

The observed correlation between H28 and H29 is .45.
To recover the true correlation we use equation 2 (cf. next column) and compute:

$m = \sqrt{(1 - v^2)}$ → For H28: $m = \sqrt{(1 - .907^2)} = .42$

For H29: $m = \sqrt{(1 - .910^2)} = .41$

$\rho(f_1,f_2) = (.45 - .801 \times .42 \times .41 \times .803) / (.801 \times .907 \times .803 \times .910) = .64$

The observed correlation is underestimated by almost .2

Example of regression coefficient with and without correction for measurement errors.

| Estimates of the parameters | Without correction On Allow immigration | | With correction for errors On Allow immigration |
|---|---|---|---|
| By Better Life | -.265* | ×2.3 → | -.609* |
| By Better threat | -.133* | becomes not significant → | .001 |
| By Cultural threat | -.154* | | -.140* |
| Total explained ( $R^2$ ) | .254 | ×2.1 → | .547 |

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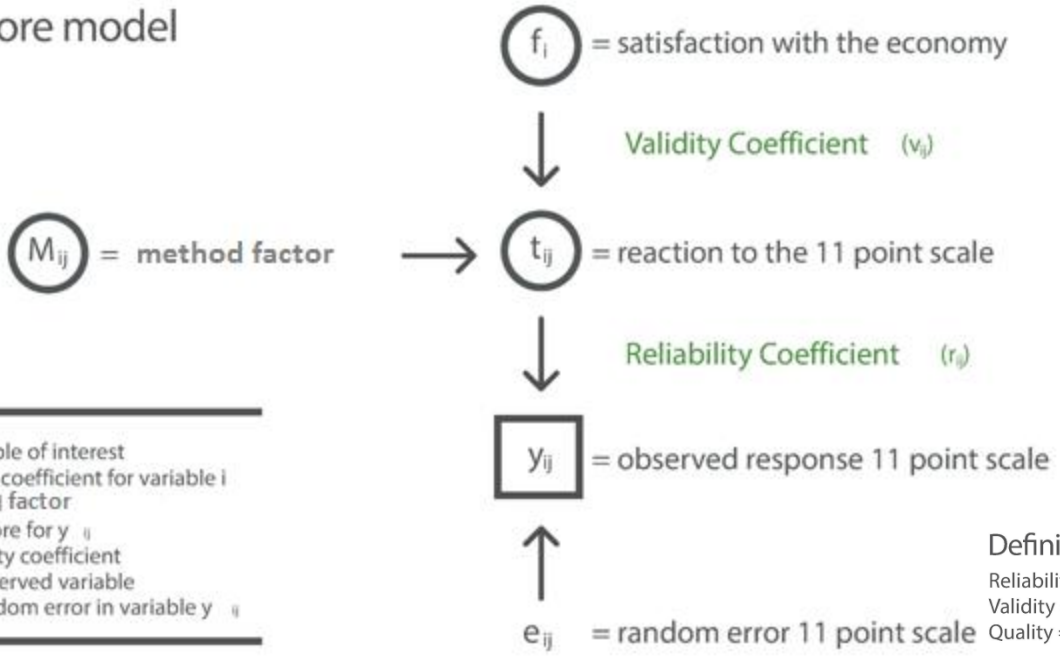
# Behind the program

## True score model

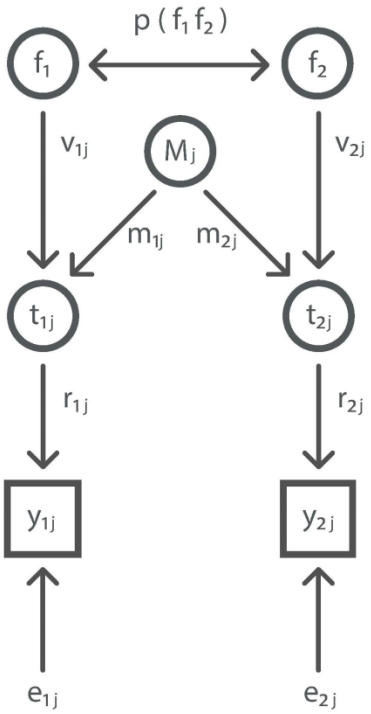



$f_i$ = $i^{th}$ variable of interest
$v_{ij}$ = validity coefficient for variable i
$M_{ij}$ = method factor
$t_{ij}$ = true score for $y_{ij}$
$r_{ij}$ = reliability coefficient
$y_{ij}$ = the observed variable
$e_{ij}$ = the random error in variable $y_{ij}$

### Definitions

Reliability = $r^2$ = strength of the relationship between t and y = 1 - var(e).
Validity = $v^2$ = strength of the relationship between t and f = 1 - var(m).
Quality = $q^2 = r^2 v^2$ = variance in the observed variable y explained by f.

If we have 2 concepts




$f_1$ = satisfaction with economy
$f_2$ = satisfaction with the way the democracy works

We can express the observed correlations as a function of the structural parameters:

$$corr(y_{1_j},y_{2_j}) = r_{1_j}v_{1_j}\,\rho(f_1,f_2)v_{2_j}r_{2_j} + r_{1_j}m_{1_j}m_{2_j}r_{2_j} \quad (1)$$

We can also reverse the formula to compute the true correlation based on the observed correlation:

$$\rho(f_1,f_2) = [corr(y_{1_j},y_{2_j}) - r_{1_j}m_{1_j}m_{2_j}r_{2_j}] / (r_{1_j}v_{1_j}\,v_{2_j}r_{2_j}) \quad (2)$$

In order to recover the true correlation we need estimates of the reliability and the validity coefficients.

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## Estimating reliability, validity, and quality

- Model not identified for 2 concepts and one method.
- It is identified if we have more concepts (typically 3) measured, each using several methods (typically 3 too).
- This is called the MultiTrait-MultiMethod (MTMM) approach.
- Reliability and validity estimated using the True Score model.

## Limits of the MTMM approach

- Necessary to repeat the same questions for the same respondents.
- Cannot repeat all questions from all questionnaires in practice.
- High cognitive burden, long questionnaires to avoid memory effects.

## Solution: SQP 2.0

- Meta-analysis of more than 3,700 MTMM quality estimates explained by up to 73 questions characteristics.
- Random Forest approach used.
- Good predictions obtained: explained variance ($R^2$) for reliability of .65 and for validity of .84.