04/22/2019 Monday

EI index modeliing

# Rasch model

Rasch noted that the probability of an individual answering a question correctly depended upon both **the “ability”** of the individual and **the “difficulty”** of the question.

Unidimensional 🡪 All the questions are trying to measure the same underlying traits, energy insecurity, and this is our index final model result.

## Data Preparation

### Overview of the test\_data. (First 13 variables, there are **55** variables in total)

### We constructed and recategorized the winter bill summer bill variable, and classified these two as low and high dichotomous levels.

## wbill 53 1795 0.71 0.45 1 0.76 0.00 0 1 1 -0.92

## sbill 54 1795 0.69 0.46 1 0.73 0.00 0 1 1 -0.80

### All the categorical variables are in 0-1 scale.

### The household type indicators were included: child, elderly and mix, these three indicators stand for 4 types of households (USDA food insecurity, 1999)

### Assumptions:

### Excluded all the missing values, there remain 1795 obs.

vars n mean sd median trimmed mad min max range skew

## HHI 1 1795 1.91 0.83 2 1.89 1.48 1 3 2 0.17

## HH23r1 2 1795 0.50 0.93 0 0.29 0.00 0 7 7 2.36

## HH23r3 3 1795 0.52 0.78 0 0.39 0.00 0 5 5 1.31

## ESC1ar2 4 1795 0.58 0.49 1 0.60 0.00 0 1 1 -0.32

## ESC1ar3 5 1795 0.04 0.19 0 0.00 0.00 0 1 1 4.92

## ESC1ar4 6 1795 0.03 0.16 0 0.00 0.00 0 1 1 5.93

## ESC2 7 1795 0.63 0.48 1 0.66 0.00 0 1 1 -0.52

## EB2a 8 1795 0.24 0.43 0 0.17 0.00 0 1 1 1.23

## EB4 9 1795 0.85 0.36 1 0.94 0.00 0 1 1 -1.96

## EB5r1 10 1795 0.91 0.29 1 1.00 0.00 0 1 1 -2.87

## Model fitting

### Rasch (1960) created a model based on probability theory to measure latent traits of individuals.

* uses a **logarithmic transformation** of the data (both individual and item) to convert ordinal data into interval data.
* Item difficulty and ability levels are all described in terms of logits around this mean.
* Estimation method: joint maximum likelihood

### Ability

### Difficulty:

### # Model reduction for a more precise questionnaire

Although 51-item instruments may offer satisfactory results, their length often limits the extent to which they are actually applied in survey practice. Thus, efforts to shorten the existing questions should be paid, while most of the tools and statistical procedures are included in the scope of Classical Test Theory, their limitations are salient: (1) Lack of additivity of rating scale data; (2) Unordered continuity of items that are unidimensional-expressed.

The advantages for adopting a Rasch model lie in that the it incorporates detailed consideration of hierarchical structure in the datasets.

In order to show results empirically, Energy Insecurity Scale was independently performed with CTT and Rasch Analysis.

**Results**

CTT resulted in items ( dimension), while Rasch model gives out item results (dimension).

The Energy Insecurity requires a single indicator or index number to describe the health status of the population being assessed. Thus, in our modelling, we would provide a unique summary index for measuring Energy Insecurity, indicating the severity of Energy Insecurity among respondents to the questionnaire with a single number.

**Limitations**

A single health index cannot be a wholly comprehensive measure.

# Classical Sum Score Method

# Appropriate statistical regression model