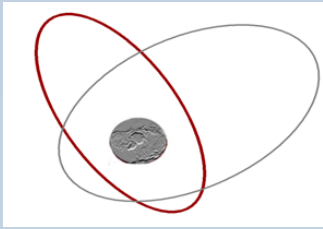
Decomposition of Error Introduced by *Ex-Post* Harmonization



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Introduction

- Integrated Fertility Survey Series at ICPSR
- Differences over time have consequences for survey quality
- Harmonizing imperfectly comparable variables over time produces error
  - 1. Impact on variable selection
  - 2. Impact on harmonized variable specification
  - 3. Analytical concerns

Situating Harmonization in Total Survey Error

- Proposed model for harmonization error (adaptation of Biemer & Lyberg, 2003):
  - $MSE_H = (B_{SPEC} + B_{NR} + B_{FR} + B_{MEAS} + B_{DP} + B_H)^2 + Var_{SAMP} + Var_{MEAS} + Var_{DP} + Var_H$

where:

- MSE_H = harmonization error-adjusted MSE
- B_H = harmonization bias
- Var_H = harmonization variance

Expansion of Harmonization Error

- Harmonization Bias:
  - $B_H = B_{H\_SPEC} + B_{H\_MEAS} + B_{H\_DP}$
- Harmonization Variance:
  - $Var_H = Var_{H\_SAMP} + Var_{H\_MEAS} + Var_{H\_DP}$
- Harmonization introduces specification, measurement, data processing, and sampling error
  - Impact on quality of data
- How to estimate?
  - Example: specification bias

Specified Harmonized Construct: Number of R's Children in Household

Child Type	1955	1988	1995	2002: NCHILDHH	2002: NUMKDHH
Biological	X	X	X	X	X
Adopted			X	X	X
Step				X	X
Partner's				X	X
Legal ward				X	X
Foster				X	X
Nephew/ niece					X
Grandchild					X

Which Variable to Harmonize?

- NCHILDHH or NUMKDHH?

- Two factors to consider:
  - Minimize the introduction of error
  - Substantive comparability over time

- What we need to know:
  - Which variable overestimates the number of biological or adopted children in the household by a greater margin?
  - Problem: It is difficult to estimate the number of over-counted children

Framework Application

- Five different combinations of types of relationships between the respondent and children in the household

- Let E_1, E_2, E_3, E_4, and E_5 denote:
  - E_1 ={biological}
  - E_2 ={biological, adopted}
  - E_3 ={biological, adopted, stepchild, partner's, legal ward, foster child}
  - E_4 ={biological, adopted, stepchild, partner's, legal ward, foster child, nephew/niece, grandchild}
  - E_5 ={all child relationship types}

- We observe:

Extent of Error

- To estimate the number of miscounted children:

  where:
  E_n is the event of all outcomes (child types) in a given study variable
  E_h is the event of all outcomes (child types) in the harmonized construct

- The total bias depends on the extent to which the children in the sample *do not* belong to *both* events E_n and E_h

- Solution: select NCHILDHH to minimize number of miscounted children in 2002

Specifying the Harmonized Construct

- The number of possible ways to specify the harmonized variable depends on the underlying variables

- Four ways of specifying the harmonized variable (assuming selection of NCHILDHH in 2002):

  - 1) Number of biological children (E_1)
  - 2) Number of biological or adopted children (E_2)
  - 3) Number of biological, adopted, step, partner's, legal ward, or foster children (E_3)
  - 4) Number of all children (E_5)

Consequences for Quality

- The dilemma: how to specify a harmonized variable that both minimizes error and has substantive value to users?
  - Our solution: specify the harmonized variable as "all children"

- The specification bias depends on the extent to which the children in the sample *do not* belong to *both* events E_5 and E_1

Guidelines for Specifying Harmonized Constructs

- Specification bias is unknown but can be estimated
  - Use external data to estimate probabilities

- Specification of harmonized variable depends primarily on two factors:
  - Extent of expected specification bias in a given specification of the harmonized variable
  - Substantive considerations

Summary

- Harmonization error must be considered when harmonizing data *ex-post*
- Example: specification bias influences variable selection, guides specification of the harmonized construct
  - Goal to improve quality of data
- Analytical consequences?
- Generalization of specification bias estimation?

Supplementary Examples

- Highest Grade Attended vs. Highest Grade Completed

- Specifying “Religiously-affiliated” vs. “Church-related” in religious school attendance

- R is Hispanic/Latino
  - Recoded origin vs. direct question