Nonsampling errors in wealth surveys: the Banca d’Italia’s experience

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Objective of the talk

- Describe a framework that could be used when setting up or when trying to improve the quality of a wealth survey
Quality framework

Statistics Canada’s Quality Assurance Framework

Third Edition - 2017

- Relevance
- Accuracy
- Coherence
- Timeliness
- Accessibility
- Interpretability

Quality is multidimensional
Preliminary questions you must ask yourself

• Why do you need a wealth survey? Which statistics do you want to compute?

  Inequality → focus on the very rich
  Financial inclusion → focus on the poor

• Do other surveys or other sources of information already exist?
“Wealth surveys” in Africa: some examples

Household budget survey  Tanzania, Kenya, ...
National Bureau of Statistics

General Household Survey (Panel)  Nigeria
National Bureau of Statistics

FinAccess Household Survey  Kenya
National Bureau of Statistics, Central Bank

South Africa National Income Dynamics Study
Southern Africa Labour Development Research Unit (SALDRU), University of Cape Town
Wealth surveys in Africa: some examples

- Financial inclusion
- Use of financial services
- Use of credit
- Use of insurance, pension and investments
1. What is NIDS and when did it start?

The National Income Dynamics Study (NIDS) is the first national panel study in South Africa. The Southern Africa Labour and Development Research Unit (SALDRU) based in the School of Economics at the University of Cape Town is tasked with implementing this survey. The study began in 2008 with a nationally representative sample of over 28,000 individuals in approximately 7,300 households across the country. The survey continues to be repeated with these same household members every two years and examines the livelihoods of individuals and households over time.
Preliminary questions you must ask yourself

• Why do you need a wealth survey? Which statistics do you want to compute?

• Do other surveys or other sources of information already exist?
If you decide to go for the wealth survey...

- Total survey error approach (Groves et al 2009, Biemer 2010)

- **Basic idea:**
  Think of all the possible sources of errors that may occur in each stage of the survey lifecycle so that you can try to prevent them and to collect auxiliary information to make ex-post adjustments.
Lifecycle of a survey

1. Define research objectives
2. Choose mode of collection
3. Construct and pretest questionnaire
4. Choose sampling frame
5. Design and select sample
6. Recruit and measure sample
7. Code and edit data
8. Make postsurvey adjustments
9. Perform analysis
Life cycle of the 2016 SHIW

0) Selection of the survey agency (tender procedure)  
1) Sample selection  
2) Questionnaire design  
3) Interviewers’ training  
4) Data collection  
5) Editing and imputation  
6) Estimation  
7) Documentation and data dissemination

- June 2016
- January – June 2017
- January 2018
Total survey error framework

- **Total Survey Error**
  - Mean Squared Error (MSE)
    - $\text{MSE} = \text{Bias}^2 + \text{Variance}$
  - Sampling Error
    - Sampling scheme
    - Sample size
    - Estimator choice
  - Nonsampling Error
    - Specification
    - Nonresponse
    - Frame
    - Measurement
    - Data processing

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**TOTAL SURVEY ERROR**
DESIGN, IMPLEMENTATION, AND EVALUATION

PAUL P. BIEMER
Variance

- Variability due to the fact that only part of the population is surveyed
Variance

- Standard measure: Standard Error (SE) of Y

\[(\text{SE} \times 1.96) - \bar{y} + (\text{SE} \times 1.96)\]

- For example: in the SHIW survey the relative SE of household income is around 1.2%
Bias

- The expected value of the variable of interest computed using the survey is different for the true (unknown) value

- For example: in the SHIW survey, according to some studies, the relative underestimation of household income is around 12%
Total survey error framework in the life cycle of the survey

Source: Groves et al. (2009).
Total survey error framework

Source: Groves et al. (2009).
Construct

• Clear definition of what you want to measure:

Suppose you (and your household members living here) were to sell off everything that you have (including your home and vehicles), cash in your investments and pay all your debts – would you have money left over, break even, or be in debt?

<table>
<thead>
<tr>
<th>F2.1.4</th>
<th>How much would your debts amount to?</th>
</tr>
</thead>
<tbody>
<tr>
<td>ownseldb_v</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Amount</th>
<th>Refused</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Measurement

• Choice of data collection method
  • Personal interviews?
  • Self-administered interviews (i.e. mail)?
  • Administrative records?
All the main surveys on income and wealth use interviewers: Survey of Consumer Finances (SCF), Household Finance and Consumption Survey (HFCS), The European Union Statistics on Income and Living Conditions (EU-SILC).
The use of interviewers

Data quality is affected by interviewers' decisions:

1) to apply effort in building sampling frames by listing addresses;
2) to apply effort to contact the selected households in the sample;
3) to apply effort in enlisting cooperation: nonresponse errors;
4) to apply effort in helping respondents to perform their roles in the interview interaction.

Unfortunately, most of their work is difficult or impossible to observe directly!
Potentially negative effects

- **Bias**: systematic errors in generating sampling frames, gaining cooperation, asking questions, recording answers and measurements.

- **Variance**: households recruited (answers collected) by the same interviewer tend to be similar.
Strategies for reducing interviewer-related bias and variance

- Strict contact protocols (i.e. recording of their activity, no decision power about substitutions);
- selection of interviewers according to their performances and experience;
- training;
- supervision and quality controls;
- self-administered modes for sensitive questions.
The cognitive process required to answer a survey question consists of three stages:
• understanding;
• retrieval;
• response production.

In either of these stages there are areas of potential errors.

Q. “How much do you have in your current account?”
• Total response bias for household income is estimated to be about 12% of reported income (Neri and Zizza 2010)

• Relative standard error for the same statistics is about 1.2%
• Questions on income or wealth are generally perceived as sensitive

• This also depends on the degree of informal economy

i.e. Q. “How much do you have in your current account?”
Consequences of asking sensitive questions

- People are less likely to participate in surveys with sensitive topic (Tourangeau et al., 2010)
- People are more likely to NOT provide a response when asked sensitive questions even after they agreed to participate in the surveys
- People are likely to provide an unreliable answer (underreporting)
Asking sensitive questions in 1958

Did you kill your wife?

Did you kill your wife?

3. The Everybody Approach:
   "As you know, many people have been killing their wives these days. Do you happened to have killed yours?"

4. The "Other people" Approach:
   (a) "Do you know any people who have murdered their wives?"
   (b) "How about yourself?"

5. The Sealed Ballot Technique:
   In this version you explain that the survey respects people's right to anonymity in respect to their marital relations, and that they themselves are to fill out the answer to the question, seal it in an envelope, and drop it in a box conspicuously labelled "Sealed Ballot Box" carried by the interviewer.
Did you kill your wife?

A.

B.

C.

D.

6. The Projective Technique:
   “What thoughts come to mind as you look at the following pictures?”

(Note: The relevant responses will be evinced by picture D.)
Asking sensitive questions after 1958

• Use methods to reassure households of the confidentiality of their responses

• Explain the reasons of the questions

• Use unfolding brackets questions

• Use Self-Administered Questionnaires
Q1. This is a list of different forms of saving and investment. Did the household have … *(form of saving or investment)* on 31-12-2016? 
*(1=Yes or 2=No)*

Q2. *(SHOW CARD C25)*
*(For each form of saving or investment held on 31-12-2016)*
What was the value on 31-12-2016? Answer using one of the ranges on this card.
Unfolding bracket questions

Q3 Can you tell us the approximate value on 31-12-2016?

Q4 Could you at least tell me whether the value of the household’s savings or investments was closer to …. (lower bound), to …. (upper bound) or about half way between the two?

(Interviewer, enter the code: I=lower, C=middle, S=upper in column)
Edit responses

• Time-consuming activity to assess the reliability of the individual responses

• Data editing is the application of checks to detect missing, invalid or inconsistent entries or to point to data records that are potentially in error

• Editing is useful to provide information about the survey process, either as quality measures for the current survey or to suggest improvements for future surveys.
Total survey error framework

Source: Groves et al. (2009).
Use observed sample characteristics to estimate population characteristics.
Main sources of error

- Frame errors
  - available list of the population is not accurate

- Nonresponse errors
  - Some households are not willing to participate to the survey
  - Some households are not willing to answer some questions
Types of frame errors

1. Missing population elements:
   some population units can never be selected in the sample

2. Inclusion of nonpopulation elements
   Some units in the frame do not belong to the target population

3. Duplicate listings
   Some units have a higher probability of being selected

4. Accuracy/timeliness of frame information
   The frame information is not detailed enough or not updated to allow access to some population elements
Consequences of frame errors

\[ N = \text{n. units in the population} \]
\[ \bar{y}_U = \text{mean of Y in the population} \]

\[ N_{IN} = \text{n. units in the frame} \]
\[ \bar{y}_{IN} = \text{mean of Y in the frame} \]

\[ N_{OUT} = \text{n. units out of the frame} \]
\[ \bar{y}_{OUT} = \text{mean of Y out of the frame} \]
Consequences of frame errors

**TARGET POPULATION \((U)\)**

**IN THE FRAME (COVERED)**

**OUT OF FRAME (NOT COVERED)**

\[
B\text{I\text{A\text{S}}} = \bar{y}_{IN} - \bar{y}_U
\]

\[
B\text{I\text{A\text{S}}} = \frac{N_{OUT}}{N} \times (\bar{y}_{IN} - \bar{y}_{OUT})
\]

EXAMPLE BASED ON A WEB SURVEY

\[
B\text{I\text{A\text{S}}} = 0.30 \times (€ 31.800 - € 18.300) \approx € 4.000
\]
Nonresponse

• Some households are not willing to participate to the survey (unit nonresponse)
• Some households are not willing to fill the whole questionnaire (item nonresponse)

\[ N_{\text{sample}} = \text{n. units in the selected sample} \]
\[ \bar{Y}_{\text{sample}} = \text{mean of } Y \text{ in the selected sample} \]

\[ N_{\text{resp}} = \text{n. units in the sample of respondents} \]
\[ \bar{Y}_{\text{resp}} = \text{mean of } Y \text{ in the sample of respondents} \]

\[ N_{\text{nonresp}} = \text{n. units in the sample of nonrespondents} \]
\[ \bar{Y}_{\text{nonresp}} = \text{mean of } Y \text{ in the sample of nonrespondents} \]
Consequences of nonresponse

\[ BIAS = \hat{y}_{\text{resp}} - \hat{y}_{\text{sample}} \]

\[ BIAS = \frac{N_{\text{nonresp}}}{N_{\text{sample}}} \times (\hat{y}_{\text{resp}} - \hat{y}_{\text{nonresp}}) \]
Back to the Total survey error framework

TOTAL SURVEY ERROR
DESIGN, IMPLEMENTATION, AND EVALUATION
PAUL P. BIEMER*
BdI’s studies on nonsampling errors

- Attrition (nonresponse of panel)
- Analysis of contacts (efforts in obtaining the interview)
- Follow-up surveys on non respondents
- Collaborations with other institutions
- Matching with other surveys/administrative records
Lessons learned (1)

1. Nonresponse behaviour is NEVER at random!
Response probability and household wealth
Sampling of the rich

- Rich people are a rare population
- They concentrate a high share of total wealth
- They are difficult to be interviewed

- Some countries use specific lists for sampling the rich (income tax information, taxable wealth information)
## Wealth distribution in South Africa

Table 5: Quantile Shares in Net Worth

<table>
<thead>
<tr>
<th>Decile</th>
<th>Share (%)</th>
<th>Median Value (Rands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.10</td>
<td>R3,899</td>
</tr>
<tr>
<td>2</td>
<td>.31</td>
<td>R10,675</td>
</tr>
<tr>
<td>3</td>
<td>.74</td>
<td>R22,503</td>
</tr>
<tr>
<td>4</td>
<td>1.40</td>
<td>R40,599</td>
</tr>
<tr>
<td>5</td>
<td>2.27</td>
<td>R65,000</td>
</tr>
<tr>
<td>6</td>
<td>3.01</td>
<td>R101,104</td>
</tr>
<tr>
<td>7</td>
<td>4.57</td>
<td>R154,725</td>
</tr>
<tr>
<td>8</td>
<td>7.37</td>
<td>R300,000</td>
</tr>
<tr>
<td>9</td>
<td>15.39</td>
<td>R641,567</td>
</tr>
<tr>
<td>10</td>
<td>64.85</td>
<td>R 2,129,878</td>
</tr>
</tbody>
</table>

The measurement and distribution of household wealth in South Africa using the National Income Dynamics Study (NIDS) Wave 4

Reza C. Daniels and Taryn Augustine

Saldru Working Paper 183
NIDS Discussion Paper 2016/10
University of Cape Town. August 2016
Sampling of the rich

Part of the wealth distribution Italy
Sampling of the rich

Log rank of the household and log wealth (Italy)
Sampling of the rich

Estimates of inequality measures are downward biased

<table>
<thead>
<tr>
<th>Country</th>
<th>Regres SURVEY</th>
<th>Regres incl Forbes</th>
<th>Δ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>23</td>
<td>33</td>
<td>+10</td>
</tr>
<tr>
<td>Germany</td>
<td>24</td>
<td>32</td>
<td>+8</td>
</tr>
<tr>
<td>Italy</td>
<td>14</td>
<td>21</td>
<td>+7</td>
</tr>
<tr>
<td>Belgium</td>
<td>12</td>
<td>17</td>
<td>+5</td>
</tr>
<tr>
<td>Netherlands</td>
<td>9</td>
<td>12</td>
<td>+3</td>
</tr>
<tr>
<td>Finland</td>
<td>12</td>
<td>15</td>
<td>+3</td>
</tr>
<tr>
<td>France</td>
<td>18</td>
<td>20</td>
<td>+2</td>
</tr>
<tr>
<td>USA</td>
<td>34</td>
<td>35</td>
<td>+1</td>
</tr>
<tr>
<td>Spain</td>
<td>15</td>
<td>16</td>
<td>+1</td>
</tr>
</tbody>
</table>
Lessons learned (2)

2. Underreporting is probably the most damaging source of error
Results on financial wealth

To misreport or not to report? The measurement of household financial wealth by Andrea Neri and Maria Giovanna Ranalli, Statistics in Transition new series, 2011

Results:

• Underreporting and unit non-response emerge as particularly serious issues for financial assets.

• the bias due to measurement error far outweighs that due to unit non-response.
Ways to prevent nonsampling errors

• advance letters to explain aims of survey and assure all respondents;
• information treated anonymously;
• toll free telephone numbers;
• brochure explaining the reasons and the uses of the survey;
• special identification cards for interviewers.
Lessons learned (3)

3. It is crucial to collect auxiliary information to adjust ex-post for nonresponse and measurement error
### Interviewers’ evaluations

<table>
<thead>
<tr>
<th>Question</th>
<th>Score (1-10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>How do you rate the respondent’s level of understanding of the questions?</td>
<td>0.9</td>
</tr>
<tr>
<td>How do you rate the respondent’s ability to speak Italian?</td>
<td>0.9</td>
</tr>
<tr>
<td>How do you rate the reliability of the information on forms of saving and financial investment provided by the respondent?</td>
<td>0.9</td>
</tr>
<tr>
<td>How do you rate the reliability of the information on the household’s dwelling and other properties provided by the respondent?</td>
<td>0.9</td>
</tr>
<tr>
<td>How do you rate the reliability of the information on income provided by the respondent?</td>
<td>0.9</td>
</tr>
<tr>
<td>How do you rate the general atmosphere in which the interview took place?</td>
<td>0.9</td>
</tr>
<tr>
<td>How easy do you think it was for the respondent to answer the questions?</td>
<td>0.9</td>
</tr>
</tbody>
</table>
Respondent reliability

Distribution of interviewers’ evaluations

Index: 0=R completely unreliable – 10=R completely reliable
### Other examples of paradata collected by interviewers

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Reference Unit</th>
<th>Coding</th>
</tr>
</thead>
</table>
| SC0100| type of dwelling                                  | All sampled households                  | 1 - Individual house  
2 - Semi-detached house  
3 - Flat/apartment  
4 - Other kind of dwelling |
| SC0600| dwelling - rating of surrounding buildings       | All sampled households                  | 1 - Luxury  
2 - Upscale  
3 - Mid-range  
4 - Modest  
5 - Low-income  
6 - Very low income |
| SC0300| dwelling location                                 | All sampled households                  | 1 - Downtown  
2 - Area between city centre and suburbs  
3 - Town outskirts  
4 - Isolated area, countryside |
| SC0400| dwelling - outward appearance                     | All sampled households                  | 1 - Generally clean and sound  
2 - Some peeling paint or cracks in walls  
3 - Needs substantial painting, refilling or repair  
4 - Dilapidated |
Ex-post adjustments

• Calibration methods
Auxiliary information included in the sampling weights.

• Imputation methods
Based on:
1. Statistical model for the measurement error (or for nonresponse)
2. Auxiliary information at household/firm level that are used to estimate the parameters of the model
Conclusions

• Data quality is a multidimensional concept: don’t focus on data accuracy only. (Statistics Canada Guidelines)

• Nonresponse and underreporting are the main threats to data quality in a wealth survey. (Total Survey Error framework)

• It is crucial to collect auxiliary information to have a better understanding of the drivers of quality and to make ex-post adjustments.
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