Nonresponse Analysis using Social Security Administration Records

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Motivation

- In order to analyze nonresponse bias, data on nonrespondents is needed
- Panel data: initial nonresponse is different from attrition
- Cross sectional data: data is sparse and/or highly aggregated
- PASS survey: for the first time in Germany, complete individual data from the Social Security System administration\(^1\) could be used for analysis of nonresponse
- We will analyze differences between respondents and nonrespondents to the initial wave of PASS and compare different nonresponse correction techniques

\(^1\) provided by the Institute for Employment Research IAB, Nuremberg (www.iab.de)
Motivation

- Project is a part of the "Priority Program ‘Survey Methodology’ (PPSM)"
- and funded by the German Research Foundation DFG
- Project is in cooperation with the Research Data Centre FDZ
- This enables us to use and analyse non-standard datasets provided by the FDZ: PASS gross data, administration data (IEB)
- all computations had/have to be done at the FDZ
Motivation

Figure 1: data available and used for nonresponse analysis

<table>
<thead>
<tr>
<th></th>
<th>Respondents</th>
<th>Nonrespondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>sampling frame data</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>contact history data</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>interviewer data</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>administration data</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>(x)LHG, BeH, LeH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PASS survey data</td>
<td>✔</td>
<td>✗</td>
</tr>
</tbody>
</table>

1): Also for Respondents no linkage of survey data (without permission of respondents)
**Survey data**

- PASS (Panel Survey Labour Market and Social Security), conducted by the IAB, Nürnberg
- PASS started 2006/2007 to study effects of the reformed German system of social security
- PASS focuses on the life situation of households receiving social welfare benefits
- Of special interest are transitions out and into receipt of unemployment benefits (‘UB-II’)
- PASS consists of two independent samples:
  1. sample of households receiving social security benefits
  2. SES-stratified sample of households of the general population
- We will concentrate on Sample 1
- mixed-mode: CATI and CAPI
- The overall response rate is low: 29% of sample I households

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2Scientific-Use-File available (currently 3 waves) from the Research Data Center FDZ
Administration data

- Administrative data of the German Federal Employment Agency was used.
- ‘LHG’-database + ‘Beh’-database
  - covers all households receiving UB-II
  - individual and household characteristics of welfare receiving unit
  - employment histories of all persons ever employed and liable to social security
  - individual characteristics of head of household
- By a special permission of the data protection agencies, this data was linked to the response status within PASS
- Due to legal restrictions:
  - No further survey data could be linked
  - Administrative data is available only for Sample I
Details of administration data

- time points
  - \( t_0 \): date of sampling
  - \( t_1 \): date of last household contact
- events between \( t_0 \) and \( t_1 \)
  - changes in household size and composition
  - changes in employment or marital status
  - changes in benefit receipt or sanctions
- information by missing data
  - households not in LHG at \( t_1 \): have left receipt
  - persons not in BeH-database at \( t_0 \) or \( t_1 \): not/not yet/never been employed
Individual demographic characteristics

Figure 2: Age (head of household, mean, in years)

- no bias in mean age of head of household
- heads of moved households younger than respondents
- refusals slightly older, but only with small effect size
- nonrespondents due to language (+4) or health problems (+8) are older

overall mean: 39.2 years
source: PASS (sample I), wave 1 2006/2007
Individual demographic characteristics

Figure 3: Time since last job (mean, in days)

- relative bias of 2%
- small effect size of $d = 0.02$
- refusals differ significantly but only with small effect size
- large differences of other categories: deceased, language, health, relocated

Overall mean: 1592 days
Source: PASS (sample I), wave 1 2006/2007
Individual demographic characteristics

Figure 4: Household size

- respondents differ significantly but small in magnitude and effect size
- large differences for nonrespondents due to
  - language problems (+1.2)
  - health problems (-0.6)
- refusals do not differ significantly

![Household size diagram]

- overall mean size: 2.2
- source: PASS (sample I), wave 1 2006/2007
Individual demographic characteristics: conclusions

- significant differences between respondents and nonrespondents
- overall low effect sizes of differences
- different groups of nonrespondents differ considerably
  - respondents with language problems
  - respondents with health problems
  - moved households
- Refusals (about 41% of sample I nonrespondents) show only small differences with small effect sizes
Survival functions of UB-II-receipt for 1st wave PASS households

Figure 5: Survival Functions of PASS Households
Survival functions of UB-II-receipt

Figure 6: overall nonrespondents

- overall Log-Rank test significant
- until 2 years confidence bands do overlap
- after 4 years confidence bands do overlap
- not shown: Curve of refusals do not differ significantly ($p > 0.05$)
Survival functions of UB-II-receipt

Figure 7: Nonresponse due to noncontact

- curves differ significantly from curve of respondents
- differences are small
- again, until 2 years and after more than 4 years, confidence bands do overlap
Survival functions of UB-II-receipt

Figure 8: Nonresponse due to health or language problems

- Health problems: Log-Rank test not significant
- Language problems: nonrespondents leave UB-II less frequent than respondents
- Knowledge of the German language is crucial for transitions into the labour market, but the problematic group might me more often missing in surveys
Survival Functions of UB-II-receipt

Figure 9: Nonresponse due to change of address

- This group differs strongly from respondents
- This group leave UB-II more frequent than respondents
- Younger persons: higher regional and economical mobility
Nonresponse correction techniques

- all techniques rely on assumptions about the nonresponse process, usually MAR (i.e. random, given observable characteristics)
- Most popular technique is weighting (typically used for unit nonresponse): count observed cases \( n \)-times to represent unobserved cases
- Imputation (typically used for item nonresponse): substitute missing values with one (or more) reasonable estimates
Nonresponse correction techniques

1. raking: reproduce *marginal totals* of overall sample or population in two- or more-dimensional tables

2. post-stratification: reproduce *cell counts* of overall sample or population in two or more dimensions (e.g. cell counts of cross tabulation)

3. propensity weighting: estimate contact and cooperation *probabilities* and use the *inverse* of their product as weighting factors

4. multiple imputation via hotdeck (as implemented in Stata "‘hotdeck’")
Nonresponse correction

Table 1: means

<table>
<thead>
<tr>
<th>method</th>
<th>time since last job (days)</th>
<th>household size (persons)</th>
<th>transitions out of UB-II (in %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>full sample</td>
<td>1592.4</td>
<td>2.19</td>
<td>17.8</td>
</tr>
<tr>
<td>respondents</td>
<td>1560.8</td>
<td>2.26</td>
<td>14.8</td>
</tr>
<tr>
<td>raking (psu x age x sex)</td>
<td>1541.7</td>
<td>2.24</td>
<td>15.3</td>
</tr>
<tr>
<td>poststratification (psu x age x sex)</td>
<td>1548.4</td>
<td>2.23</td>
<td>14.6</td>
</tr>
<tr>
<td>propensity weights (12 variables)</td>
<td>1555.8</td>
<td>2.20</td>
<td>17.7</td>
</tr>
<tr>
<td>multiple imputation (psu x age x sex), m=10</td>
<td>1524.1</td>
<td>2.24</td>
<td>14.6</td>
</tr>
</tbody>
</table>

PASS sample I, wave 1 2006/2007
Nonresponse correction: hazard rates

Figure 10: Raking and post-stratification

Cumulative Hazard Rates of UB–II Receipt
households of PASS sample I

Source: PASS (sample I), wave 1 2006/2007
Nonresponse correction: hazard rates

**Figure 11: Propensity weights**

Source: PASS (sample I), wave 1 2006/2007
Conclusions

- bias is small, despite overall low response rates and significant differences
- very small bias due to refusal
- bias is specific to some variables
  - all nonresponse techniques (but propensity weighting) results in
    - underestimation of time since last job
    - underestimation of welfare terminations
  - multiple imputation results in largest underestimation
  - propensity weighting overestimates hazard rates
- Based on this limited data, we would recommend propensity weighting
- We recommend to improve fieldwork procedures for relocated households or persons not able to participate rather than concentrate on refusals
Appendix

- response status: [go to table]
- flowchart contacting households [go to flowchart]
Response status

Table 2: Household count by sample and response code

<table>
<thead>
<tr>
<th>response code</th>
<th>sample I</th>
<th>sample II</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>count</td>
<td>%</td>
<td>count</td>
</tr>
<tr>
<td>interview</td>
<td>6 844</td>
<td>28.7</td>
<td>6 030</td>
</tr>
<tr>
<td>address not found</td>
<td>3 486</td>
<td>14.6</td>
<td>2 189</td>
</tr>
<tr>
<td>no contact</td>
<td>3 091</td>
<td>13.0</td>
<td>3 593</td>
</tr>
<tr>
<td>phys. or mental problems</td>
<td>146</td>
<td>0.6</td>
<td>408</td>
</tr>
<tr>
<td>language problems</td>
<td>469</td>
<td>2.0</td>
<td>99</td>
</tr>
<tr>
<td>refused</td>
<td>7 006</td>
<td>29.4</td>
<td>11 653</td>
</tr>
<tr>
<td>unknown/other</td>
<td>1 544</td>
<td>6.5</td>
<td>1 018</td>
</tr>
<tr>
<td>hh moved/dissolved</td>
<td>915</td>
<td>3.8</td>
<td>220</td>
</tr>
<tr>
<td>deceased</td>
<td>45</td>
<td>0.2</td>
<td>76</td>
</tr>
<tr>
<td>mode switch to CAPI</td>
<td>206</td>
<td>0.9</td>
<td>20</td>
</tr>
<tr>
<td>not evaluable</td>
<td>60</td>
<td>0.3</td>
<td>97</td>
</tr>
<tr>
<td>total</td>
<td>23 812</td>
<td></td>
<td>25 043</td>
</tr>
</tbody>
</table>

PASS wave 1 2006/2007
Response status

- differences between samples visible: e.g. share of refusal, noncontacts, moved households, language problems
- different sampling frame: address sample vs. sample of households
- different target population: welfare receiving households vs. general (low status) population households
Contacting households

Figure 12: Flowchart: contacting households
Contacting households

- same contact scheme for both samples
- different sampling frames
- different proportions of survey modes
- different target population
  - welfare receiving households
  - general population households, disproportional stratified (high sampling fraction of low income groups)