Responsive Design Using Mahalanobis Distancing: Application on Two National Center for Education Statistics Longitudinal Surveys

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Roadmap

1. Responsive design model choice
2. Application of responsive design models
3. Implications for monetary and non-monetary incentives
4. Substantive and paradata model variables
5. Preliminary results
Responsive Design Model Choice - Background

• The 2012 B&B is the second follow-up of graduates of the Class of ‘08
  – Base year: sample of NPSAS seniors in 2008
  – First follow-up: one year after graduation in 2009

• Relatively high prior response rate (~86%)

• Conducted “response propensity” experiment in 2011 field-test which showed that conversion of late phase nonrespondents didn’t result in bias reduction
Responsive Design Model Choice - Background

- ELS:2002/12 is the third follow-up collection from 16,000+ high schoolers sophomores 2002, now aged ~26
  - Base year: Sophomores in 2002
  - First follow-up: Seniors in 2004 (freshened)
  - Second follow-up: 2 years post modal HS grad date in 2006
- Observable lower prior response rate for cases identified as ever dropping/stopping out of HS (83% vs. 89% overall)
- Typically this round is most difficult for secondary longitudinal studies
  - NELS:88/2000 round: ~78% (Dropouts: ~65%)
Problem: Nonresponse introduces bias but will targeting propensity to respond necessarily reduce bias?

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<th>Low bias and highly likely to respond</th>
<th>High bias and highly likely to respond</th>
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<td>Low bias and less likely to respond</td>
<td>High bias and less likely to respond</td>
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Hypothesis: Bringing in more individuals that introduce higher bias may be more effective way of reducing bias than increasing response rate.
Responsive Design Model Choice – Hypothesis

• Dissimilarity of each nonrespondent, relative to dissimilarity of mean respondent, can be determined
  • I.e., Distances between groups can be calculated
• Based on known variables for all sample members
  • E.g., frame variables, administrative record data collections, and prior response/imputations
• Hypothesis: Dissimilarity is related to an individual case’s contribution to bias were the person not to respond
• Model choice: Variables chosen that are believed to be related to items of interest measured in upcoming collection
Responsive Design Model Choice - Simulations

• Through simulations using 2009 Baccalaureate and Beyond Longitudinal Study (B&B) data, we tested two techniques:
  – R-Indicator – This method calculates distances of *subgroup* of nonrespondents from the characteristics of the respondent group.
  – Mahalanobis Distancing (M) – This method calculates a separate distance for *each* nonrespondent from the characteristics of the mean respondent.
Responsive Design Model Choice - Simulations

The results of the simulations showed the following:

- **R-Indicator**: No significant reduction in nonresponse bias on 23 key variables.
- **Mahalanobis**: Significant reduction in nonresponse bias on five variables:
  - Cumulative total amount borrowed;
  - Cumulative amount owed;
  - Cumulative federal loan amount borrowed;
  - Parent’s highest education; and
  - Graduate school enrollment.
Responsive Design Model Choice - Variables

• Both B&B and ELS models used:
  • **Substantive variables** – Variables we care about, can be demographical or sample member’s status
    • Enrollment status
    • Age, race/ethnicity, gender of sample member
  • **Paradata variables** – Needed because Mahalanobis function incorporates ultimate response propensity measure
    • Response status from previous rounds
    • Number of contact attempts

• Cases selected for treatment received all following treatments until response occurs
Targeting monetary and non-monetary incentives

B&B Treatment of High Distance Cases

1. First three months of data collection: no add’l intervention offered to either treatment or control groups
   » Primarily self-administered web instrument data collection period will cream-skim the low-cost-to-complete cases

2. Treatment 1 – End of Month 3 – Additional monetary incentive

3. Treatment 2 – End of Month 4 – Switch to prepaid incentive, FedEx

4. Treatment 3 – End of Month 5 – Early Abbreviated Interview
Targeting monetary and non-monetary incentives

ELS: Treatment of High Distance Cases

1. Treatment 0 – Entire collection – Dropout cases receive additional monetary incentive
2. Treatment 1 – End of Month 1 – Additional monetary incentive, Intensive tracing
3. Treatment 2 – End of Month 2 – Cases selected for Field Collection
4. Treatment 3 – End of Month 4 – Switch to prepaid incentive, FedEx envelope
B&B Model variables

• Substantive
  – Race/ethnicity
  – Age
  – Parental education
  – Marital status
  – Dependency status
  – Immigrant generation
  – Disability status
  – Undergrad college type
  – Undergrad college region
  – Undergrad college selectivity
  – Undergrad major field of study
  – Expected family contribution
  – SAT/ACT scores
  – Earned income since graduation
  – Undergrad GPA
  – Employment status since graduating
  – Time to undergrad degree
  – Postgrad enrollment history

• Paradata
  – Base-year response status
  – First follow-up (FFU) response status
  – FFU call count
  – Second follow-up call count
  – Sample member “located” in second follow-up
ELS Model variables

- **Substantive**
  - Race/ethnicity
  - Age
  - Gender
  - High school control
  - High school urbanicity
  - SES in 2004
  - Parents’ highest education
  - High school GPA
  - Educational attainment expectation in 12th grade

- **Paradata**
  - Response mode for panel maintenance (web or paper)
  - Ever responded to panel maintenance (this or earlier wave)
  - Previous wave response status
  - Number of calls in previous wave

**Note:** More paradata built into model as data collection progressed (e.g., number of 2012 call attempts)
Implications for monetary and non-monetary incentives

• Treatment matters – no point to a responsive design if no treatment

• Type of treatment should be carefully selected
  – Monetary incentives vs. non-monetary incentives
    • FedEx envelope successful with ELS population
    • Earlier intensive tracing successful in finding more cases
  – Some cheaper treatments may be more effective than expensive ones
  – Timing of treatment within data collection period
Thank you! Questions?

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