The Common Cause Model, Coverage, and Key Estimates from the National Crime Victimization Survey

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Outline

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- The Common Cause Model
- Coverage Characteristics (Literature)
- Data
- Methodology
- Results
- Discussion
- Conclusions
Introduction

- Literature on how errors in the address list impact estimates is sparse
  - Direct measurement of errors in the address list and survey outcomes is expensive
- Is there an indirect way to explore the mechanism underlying coverage error and key outcomes?
  - Look to the nonresponse error literature for strategies
- Application to the National Crime Victimization Survey (NCVS)
The Common Cause Model for Nonresponse (Groves, 2006)

Underlying Factor

Response Propensity  Key Survey Measure
The Common Cause Model for Coverage

Underlying Factor (Z)

Literature

Coverage Propensity (P)

Implied

Analysis

Key Survey Measure (Y)
Coverage Characteristics

- Coverage is specific to the frame, with the NCVS frame largely built on the Decennial Census.
- Census coverage studies show net undercounts of:
  - Owner-occupied units
  - Single unit structures and trailers
  - Units outside of large metropolitan areas
- Estimates of coverage components indicate that small multi-unit structures have low estimates of correct enumerations.
- Similar characteristics for coverage of area frames (Eckman and Kreuter, 2013; Montaquila et al, 2009)
Data

- Public use data from the 2009-2011 NCVS
- Person-level and household-level Analysis (Y)
  - Indicator of a person experiencing 1+ personal crimes
  - Indicator of a household experiencing 1+ property crimes
- Coverage covariates (Z)
  - Indicators of gated communities and restricted buildings
  - Housing unit structure type
  - Metropolitan Statistical Area (MSA) status
  - Urbanicity
  - Tenure
- Variables used in poststratification such as age, gender, race/ethnicity
Methodology

- Logistic regression modeling used to describe the relationship between characteristics associated with coverage error (Z) and key measures (Y)
  - Taylor Series Linearization for variance estimation
  - Assumption that units covered by the survey are similar to those not covered by the survey, within groups created by coverage characteristics
- With/without weights & poststratification variables (person-level)
## Results

<table>
<thead>
<tr>
<th>Effect</th>
<th>Property Crime</th>
<th>Person Crime</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large Multi vs Single</td>
<td>↓</td>
<td>--</td>
</tr>
<tr>
<td>Small Multi vs Single</td>
<td>↓</td>
<td>↑</td>
</tr>
<tr>
<td>Trailer/Other vs Single</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Gated Community vs Not</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Restricted Access Building vs Not</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Urban vs Rural</td>
<td>↑</td>
<td>--</td>
</tr>
<tr>
<td>City in MSA vs Non-MSA</td>
<td>↑</td>
<td>--</td>
</tr>
<tr>
<td>MSA not city vs Non-MSA</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Not Owned vs Owned</td>
<td>↑</td>
<td>↑</td>
</tr>
</tbody>
</table>

Significance at $\alpha = 0.10$
Discussion

- Bias depends on the estimate
  - NCVS produces crime totals and rates
  - Crime is a rare outcome
    - Omitting persons who were not victims of a crime would have a small impact on rates, no impact on totals
    - Omitting persons or households who were more likely to be victims of crime is more of a concern
- Common causes identified: structure type, urbanicity, tenure
- Implied bias using the common cause model
Example: Property Crime and Urbanicity

Units and Households in Rural Areas

Likelihood of Omission from the Frame

Small Positive Bias

Property Crime

Higher

Lower
Implied Biases

- **Tenure: Owners are...**
  - More likely to be omitted from the frame
  - Less likely to be a victim of crime
  - Thus associated with small positive bias in crime rates

- **Structure Type: Single units are..**
  - More likely to be omitted from the frame
  - Less likely to have personal crime
  - More likely to have property crime
  - Thus associated with negative bias in property crime and small positive bias in personal crime estimates
Conclusions & Future Work

- Implied biases associated with underlying effects for tenure, urbanicity and structure type were typically small and positive
  - The omission of single unit structures (net undercount in 2010 of about 1 percent), which are associated with higher likelihood of property crime may be of concern
- Future work to quantify these effects in a more rigorous way
  - Sensitivity analyses for CPS
Thank you!

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References