The mobile Web only population – socio-demographic characteristics and potential bias

Presented at AAPOR 2016
Austin, TX, USA
May 13th, 2016
Mobile Web Onlys

Background

- Challenge for Web survey researchers:
  - The number of respondents using a smartphone or tablet computer to complete Web surveys is steadily increasing.
  - Phenomenon of unintended smartphone and tablet respondents in Web surveys
    (Wells et al. 2013; de Bruijne and Wijnant, 2014; Revilla forthcoming)

- Mobile device characteristics:
  - Type of data entry (touch screen vs. computer mouse & keyboard)
  - Screen size

- Two different types of Web surveys:
  - Web surveys permitting desktop, laptop and tablet computers only
  - Web surveys using an adaptive design approach that accommodates all devices
    (Antoun, 2015)
Research Questions

- Does the mobile Web only population differ from the remaining Web population?

- Does omitting mobile Web only users from Web surveys cause considerable bias?

- How do bias estimates arising from the mobile Web only population develop with respect to the mobile Web only penetration rate?
Data Basis
Special Eurobarometer

- Trend survey of the European Commission
- Special Eurobarometer on “Cyber Security”
  
  → What devices do you use to access the Internet?
  
  (SHOW CARD – READ OUT – MULTIPLE ANSWERS POSSIBLE)

- 27 European member states
- 500-1500 face-to-face interviews in each country
  → relatively complete coverage
- European population 18 years and older
What device do you use to access the Internet?

- smartphone only: 4%
- smartphone/tablet: 2%
- smartphone/desktop: 16%
- smartphone/other: 3%
- smartphone/tablet/other: 7%
- smartphone/tablet/desktop: 29%
- smartphone/desktop/other: 4%
- smartphone/tablet/desktop/other: 33%
- desktop only: 0%
- tablet only: 1%
- others only: 1%
- desktop/other: 1%
- tablet/other: 4%
- desktop/tablet: 0%
- desktop/tablet/other: 0%
Mobile Web only rate

Among the whole population

Among the Web population

Darmstadt University of Technology | Institute of Sociology | Research Methods | Anke Metzler & Marek Fuchs
Mobile Web only rates
European countries

2012
2013
2014
Spain
Ireland
Hungary
UK
Italy
Cyprus
Romania
Malta
Austria
Luxembourg
France
Czech
Belgium
Germany
Greece
Slovenia
Portugal
Poland
Slovakia
Lithuania
Bulgaria
Finland
Sweden
Denmark
Latvia
The Netherlands
Estonia
Mobile Web Onlys
Socio-demographics 2014

Gender
- Male: 3% (a)
- Female: 5% (b)

Age
- 18-24: 3% (b)
- 25-34: 5% (a,b)
- 35-44: 7% (a)
- 45-54: 2% (c,d)
- 55-64: 3% (b)
- 65+: 1% (d)

Marital status
- Single: 6% (a)
- (re-)married/single living with partner: 3% (b)
- Divorced/separated: 5% (a,b)
- Widowed: 1% (c)

Education
- No full time education: 10% (a,b)
- 15-19: 5% (a)
- 16-19: 8% (b)
- 20+: 2% (c)

Community
- Rural: 3% (a)
- Small/middle size town: 5% (b)
- Large town: 4% (a)

Household size
- 1: 5% (a)
- 2: 4% (b)
- 3: 3% (b)
- 4+:

Note. Z-test using the Bonferroni correction. Significant differences (p < .05 or less) between the categories of the socio-demographic variable respectively are indicated using different letters assigned to the bars.
### Mobile Web Onlys
#### Socio-demographics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 0</th>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013 (2012)</td>
<td></td>
<td>3.64***</td>
<td>4.13***</td>
</tr>
<tr>
<td>2014 (2012)</td>
<td></td>
<td>2.46***</td>
<td>2.60***</td>
</tr>
<tr>
<td><strong>Socio-demographics:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender (male)</td>
<td></td>
<td>.81**</td>
<td>.81**</td>
</tr>
<tr>
<td>Age (18-34)</td>
<td></td>
<td>2.81***</td>
<td>2.81***</td>
</tr>
<tr>
<td>Education (20+)</td>
<td></td>
<td>.39***</td>
<td>.39***</td>
</tr>
<tr>
<td>Community (rural)</td>
<td></td>
<td>.88</td>
<td>.88</td>
</tr>
<tr>
<td>Marital Status (single)</td>
<td></td>
<td>1.64***</td>
<td>1.64***</td>
</tr>
<tr>
<td>Household size (single-person household)</td>
<td></td>
<td>1.16</td>
<td>1.16</td>
</tr>
<tr>
<td>Log likelihood</td>
<td>-4382.71</td>
<td>-4279.85</td>
<td>-4033.87</td>
</tr>
<tr>
<td>Variance country</td>
<td>.6482</td>
<td>.6594</td>
<td>.5964</td>
</tr>
<tr>
<td>ICC</td>
<td>.1646</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>-.0028</td>
<td>.0132</td>
<td></td>
</tr>
</tbody>
</table>

Note. Hierarchical logistic models with the variable „mobile Web onlys“ (0=no; 1=yes) as dependent variable. The table shows odds ratios with ***p < .001, **p < .01, *p < .05. The variable „country“ was used as a level-2 identifier.
Note. Z-test using the Bonferroni correction: Significant differences (p < .05 or less) between the Internet subgroups are indicated using different letters assigned to the bars.
Mobile Web Only population
Internet activities 2014

Note. Z-test using the Bonferroni correction: Significant differences (p < .05 or less) between the Internet subgroups are indicated using different letters assigned to the bars.
(Relative) Bias
Mobile Web onlys

\[
\text{Bias} = \frac{p_{\text{Internet population w/o mobile Web onlys)}}{- p_{\text{mobile Web onlys)}}}{p_{\text{Internet population)}}
\]

Relative Bias = \[
\frac{N_{\text{mobile Web onlys)}}{N_{\text{Internet population)}}} \times \frac{p_{\text{Internet population w/o mobile Web onlys)}}{- p_{\text{mobile Web onlys)}}}{p_{\text{Internet population)}}
\]

(based on Biemer & Lyberg, 2003)
EU estimates of the bias
Overall & for selected socio-demographic categories

Note. The y-axis scaling differs between the two graphs.

Note. Pairwise comparisons between years using Bonferroni correction: if a pair of values is significantly different at the .05 level (or less), the values have different letters assigned to them. Results of the overall F-test are significant: $F(2, 486) = 8.36$, $p < .001$, $\eta^2 = .033$
Bias estimates on country level

Overall bias (absolute) by country

- Estonia
- Bulgaria
- Latvia
- Denmark
- The Netherlands
- Lithuania
- Luxembourg
- Austria
- United Kingdom
- Slovakia
- Cyprus (Republic)
- Belgium
- Finland
- Portugal
- Sweden
- Slovenia
- Cyprus (Republic)
- Greece
- Czech Republic
- Ireland
- Spain
- Romania
- Hungary
- Malta
- Greece
- Ireland
- Spain
- Romania

Darmstadt University of Technology | Institute of Sociology | Research Methods | Anke Metzler & Marek Fuchs
Hierarchical linear models of bias estimates with country as level-2 identifier

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 0</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Variable (reference group, 2012):</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td></td>
<td></td>
<td>-.13</td>
<td>.09</td>
</tr>
<tr>
<td>2014</td>
<td>-.13</td>
<td>-.12</td>
<td>-12</td>
<td>.00</td>
</tr>
<tr>
<td><strong>Bias estimates (reference group, gender):</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marital status (single)</td>
<td></td>
<td></td>
<td>.85***</td>
<td>.85***</td>
</tr>
<tr>
<td>Education (20+)</td>
<td>.32*</td>
<td>.55***</td>
<td>.55***</td>
<td>.55***</td>
</tr>
<tr>
<td>Age (18-34)</td>
<td>.29*</td>
<td>.77**</td>
<td>.77***</td>
<td>.77***</td>
</tr>
<tr>
<td>Type of community (rural)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household size (single-person)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Country variables (% of Web population):</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Singlea</td>
<td></td>
<td></td>
<td></td>
<td>-.15**</td>
</tr>
<tr>
<td>20 years and older at highest educationa</td>
<td>.0844</td>
<td>.0846</td>
<td>.0897</td>
<td>.0308</td>
</tr>
<tr>
<td>Malea</td>
<td>.9135</td>
<td>.9097</td>
<td>.8187</td>
<td>.7956</td>
</tr>
<tr>
<td>18-34 yearsa</td>
<td></td>
<td></td>
<td></td>
<td>.17**</td>
</tr>
<tr>
<td>Rural communitya</td>
<td></td>
<td></td>
<td></td>
<td>-.22***</td>
</tr>
<tr>
<td>Single-person householda</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mobile Web only ratea</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log likelihood</td>
<td>-680.85</td>
<td>-679.88</td>
<td>-655.69</td>
<td>-641.18</td>
</tr>
<tr>
<td>Variance country</td>
<td>.0844</td>
<td>.0846</td>
<td>.0897</td>
<td>.0308</td>
</tr>
<tr>
<td>Unexplained variance</td>
<td>.9135</td>
<td>.9097</td>
<td>.8187</td>
<td>.7956</td>
</tr>
<tr>
<td>ICC</td>
<td>.0846</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td></td>
<td>.0036</td>
<td>.0897</td>
<td>.1719</td>
</tr>
</tbody>
</table>

Note. Hierarchical linear models with the variable "country bias estimates" as dependent variable. The table shows standardized coefficients with ***p < .001, **p < .01, *p < .05. The variable "country" was used a level-2 identifier.
EU estimates of the relative bias
Overall & for selected socio-demographic categories

Note. The y-axis scaling differs between the two graphs.

Overall relative bias (absolute)

Relative Bias for selected socio-demographic categories

Note. Pairwise comparisons between years using Bonferroni correction: if a pair of values is significantly different at the .05 level (or less), the values have different letters assigned to them. Results of the overall F-test are significant:

\[ F(2, 486) = 88.59, p < .001, \eta^2 = .268 \]

Note. The y-axis scaling differs between the two graphs.
Mobile Web Onlys

Summary

- From 2012 to 2014 the mobile Web only rate increased steadily in Europe, but was still on a low level in 2014 (4%).

- The mobile Web only population is more likely female, younger, more often single, less educated, less likely living in rural communities and in multi-person households compared to the remaining Web population.

- European estimates of the overall bias increased from 2012 to 2013 but remained stable from 2013 to 2014.

- In 2014, the European estimate of the bias for marital status was the largest followed by age and education. The European estimate of the bias for household size was at a moderate level and for community and gender close to zero.

- However, trends of overall bias estimates differ on country level and it is not clear whether bias estimates due to the mobile Web only population will increase or decrease.

- European estimates of the relative bias steadily increased from 2012 to 2014 but were still on a low level in 2014.

- As a consequence, even if the mobile Web only population and the remaining Web population converge, relative bias estimates may further increase due to increasing mobile Web only rates.
Mobile Web Onlys
Discussion

Conclusion:

- Web survey questionnaires should use an adaptive design approach that accommodates all devices since exclusion or underrepresentation of the mobile Web only population causes considerable bias.

***

Further Research:

- We defined mobile devices in terms of their screen sizes. Is our definition of mobile devices too narrow? Do we need a joint definition of mobile devices or does it depend on the respective research intention?

- Is the mobile Web mostly population similar to the mobile Web only population and what influence may mobile Web mostly users have on bias estimates?

- Did we adress a nonresponse or coverage problem?

- Who are the mobile Web onlys - late Internet adopters or Internet device changers?
Thank you.