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Tobias Baier, Anke Metzler & Marek Fuchs
Darmstadt University of Technology

**Coverage Error in Smartphone Surveys Across
European Countries**

Contact: baier@ifs.tu-darmstadt.de

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Background

smartphone only surveys

- **Advantages** of smartphone only surveys:
 - potential use of randomly generated numbers and text message invitations
 - no differential measurement error
 - no self-selection of respondents to their preferred device
 - use of paradata and sensor data

Background

smartphone only surveys

- **Advantages** of smartphone only surveys:
 - potential use of randomly generated numbers and text message invitations
 - no differential measurement error
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 - use of paradata and sensor data
 - **Challenges** of smartphone only surveys:
 - level of mobile Web penetration lower than non-mobile, landline Internet penetration
 - under-representation of certain socio-demographic subgroups
- Coverage Bias

Research questions

- (1) How do **socio-demographic characteristics** of the smartphone population differ from the general population?

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- (1) How do **socio-demographic characteristics** of the smartphone population differ from the general population?
- (2) **Trend analysis (I)**: How do the bias estimates (Relative Difference and Relative Coverage Bias) of the smartphone population **develop over time**?
- (3) **Trend analysis (II)**: How does **Relative Difference** develop with respect to the increasing **smartphone penetration rate**?

Previous research

- LISS data shows that smartphone ownership is related to technology use, shopping and consumer behavior, alcohol consumption and political attitudes (Antoun 2015).
- Using NSFG data, Couper et al. (2015) find a higher smartphone ownership among younger persons, females, higher educated, persons with higher income, urban residents and households without children.
- For Germany, Keusch et al. (2018) found higher smartphone ownership among younger and higher educated persons, but no difference with respect to gender.
- Bias estimates considerably different between countries but consistently higher for mobile Web than for non-mobile Internet for most socio-demographic subgroups (Fuchs & Busse 2009; Metzler & Fuchs 2014).
- Bias estimates for mobile Web approaching those of non-mobile Internet (except age) up to 2017 (Baier, Metzler & Fuchs 2018)

Data: Standard Eurobarometer 2014-2018

Trend survey of the European Commission



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- 28 European countries, country-weighted data
- 500-1500 face-to-face interviews per year in each country (18 years and older)

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Trend survey of the European Commission



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- 2014
 - W1: $N=26,862$
 - W2: $N=27,053$
- 2015
 - W1: $N=26,847$
 - W2: $N=26,904$
- 2016
 - W1: $N=27,195$
 - W2: $N=27,014$
- 2017
 - W1: $N=27,090$
 - W2: $N=27,212$
- 2018
 - W1: $N=27,254$

Austria
Belgium
Bulgaria
Croatia
Cyprus (Republic)
Czech Republic
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Latvia
Lithuania
Luxembourg
Malta
Netherlands
Poland
Portugal
Romania
Slovakia
Slovenia
Spain
Sweden
United Kingdom

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- **Smartphone population:** smartphone ownership

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- 28 European countries, country-weighted data
- 500-1500 face-to-face interviews per year in each country (18 years and older)
- **Smartphone population:** smartphone ownership
- **Population with non-mobile, 'landline' Internet access** (benchmark): PC/tablet ownership plus Internet connection at home

Data: Standard Eurobarometer 2014-2018

Trend survey of the European Commission

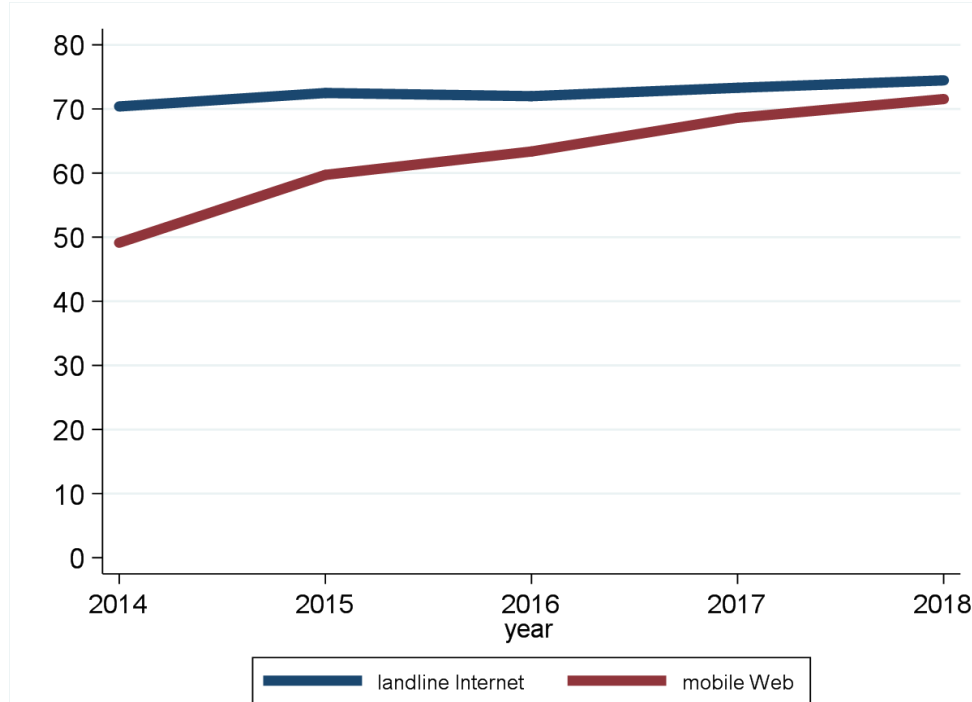


- Bias estimates for six socio-demographic variables:
 - *gender*
 - *age*
 - *education*
 - *type of community*
 - *political attitude*
 - *marital status*



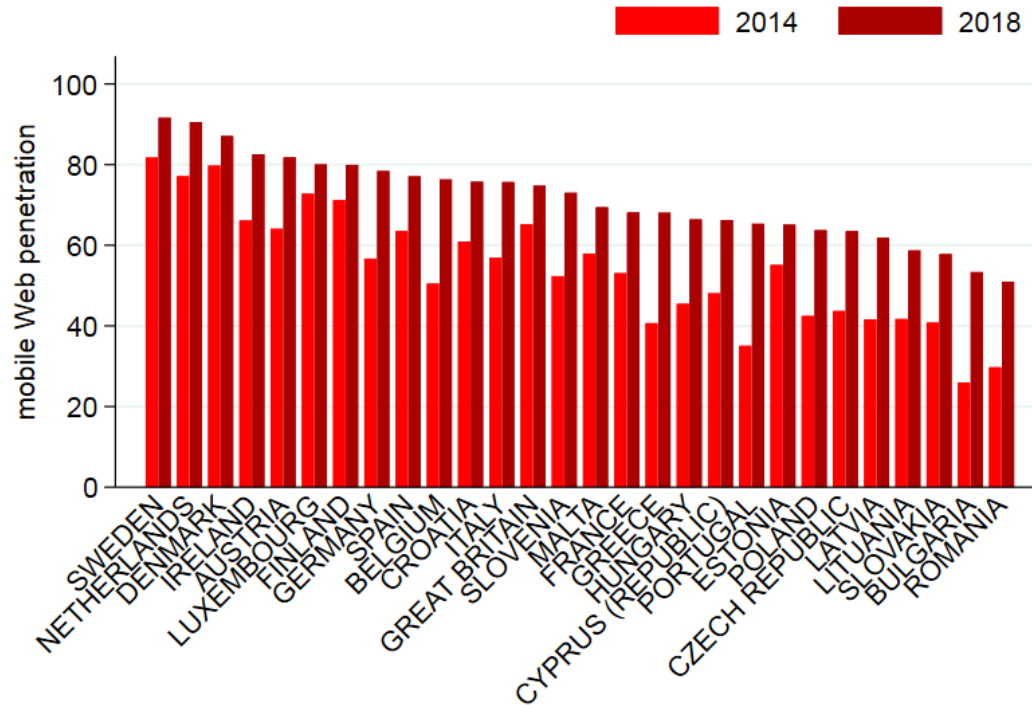
Smartphone Penetration

Smartphone and landline Internet penetration rates 2014-2018



→ Increasing mobile Web penetration approaches landline Internet penetration

Smartphone penetration rates 2014-2018



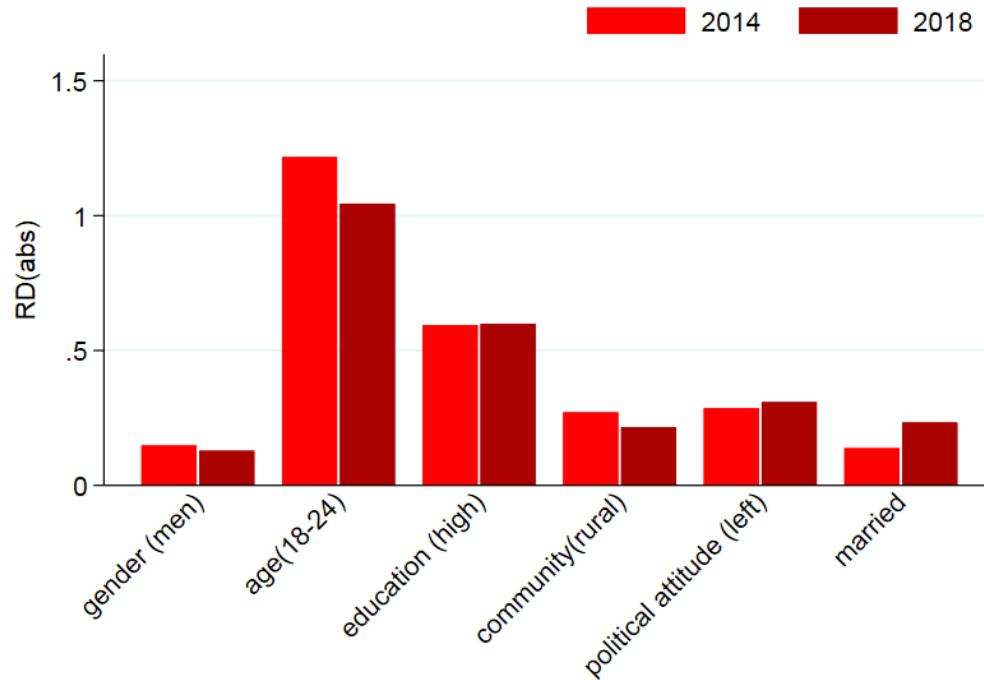
→ Increasing smartphone penetration in all countries



Relative Difference (abs)

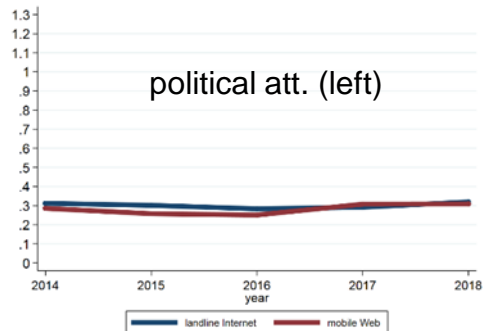
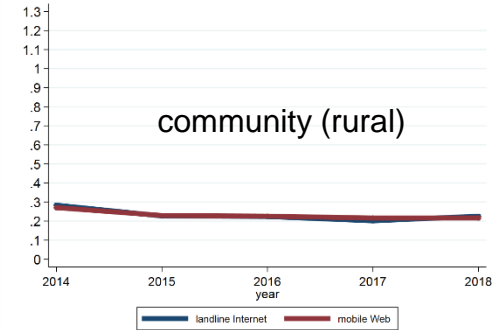
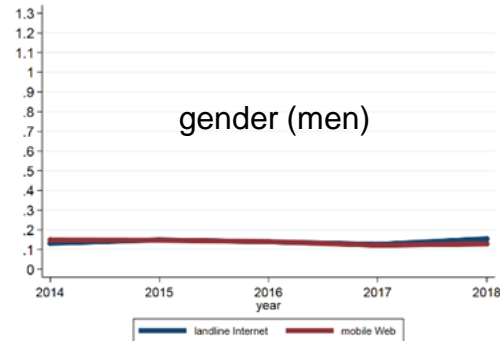
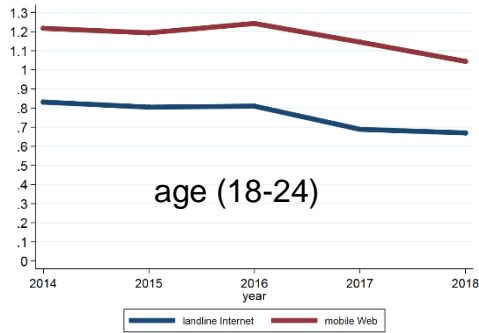
$$|Relative\ Difference| = \left| \frac{p(\text{covered population}) - p(\text{non covered population})}{p(\text{covered} + \text{non covered population})} \right|$$

Relative Difference (abs): Smartphone: socio-demographic variables

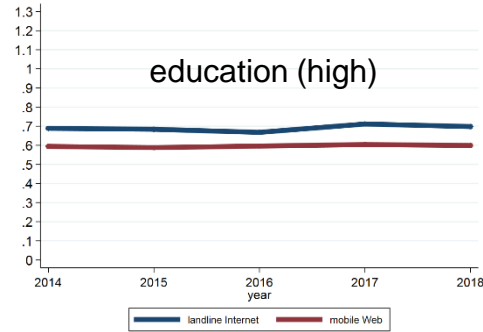
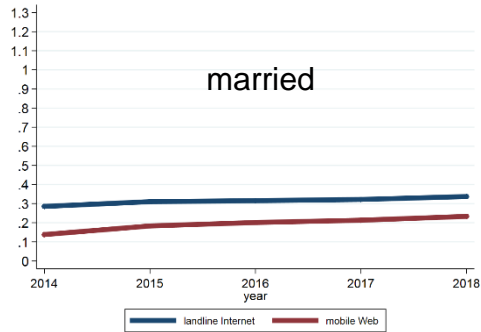


→ challenged by age

Relative Difference (abs): Smartphone vs. non-mobile, landline Internet



Relative Difference (abs): Smartphone vs. non-mobile, landline Internet

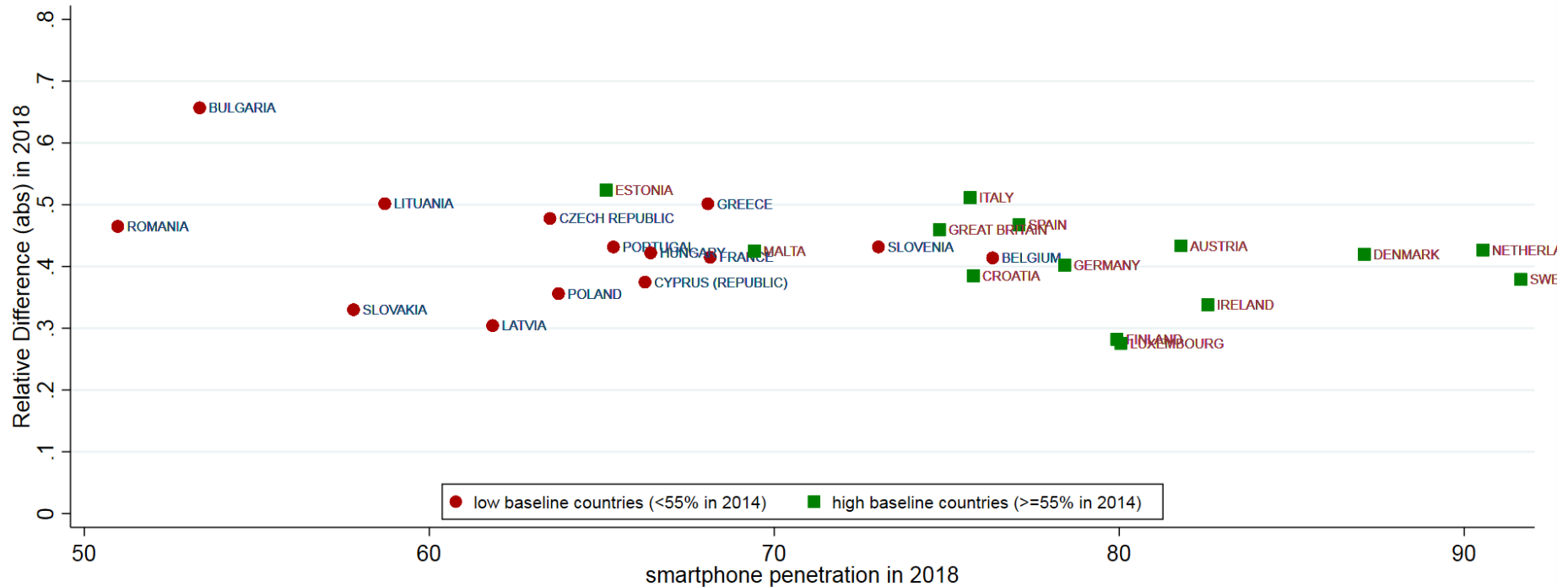




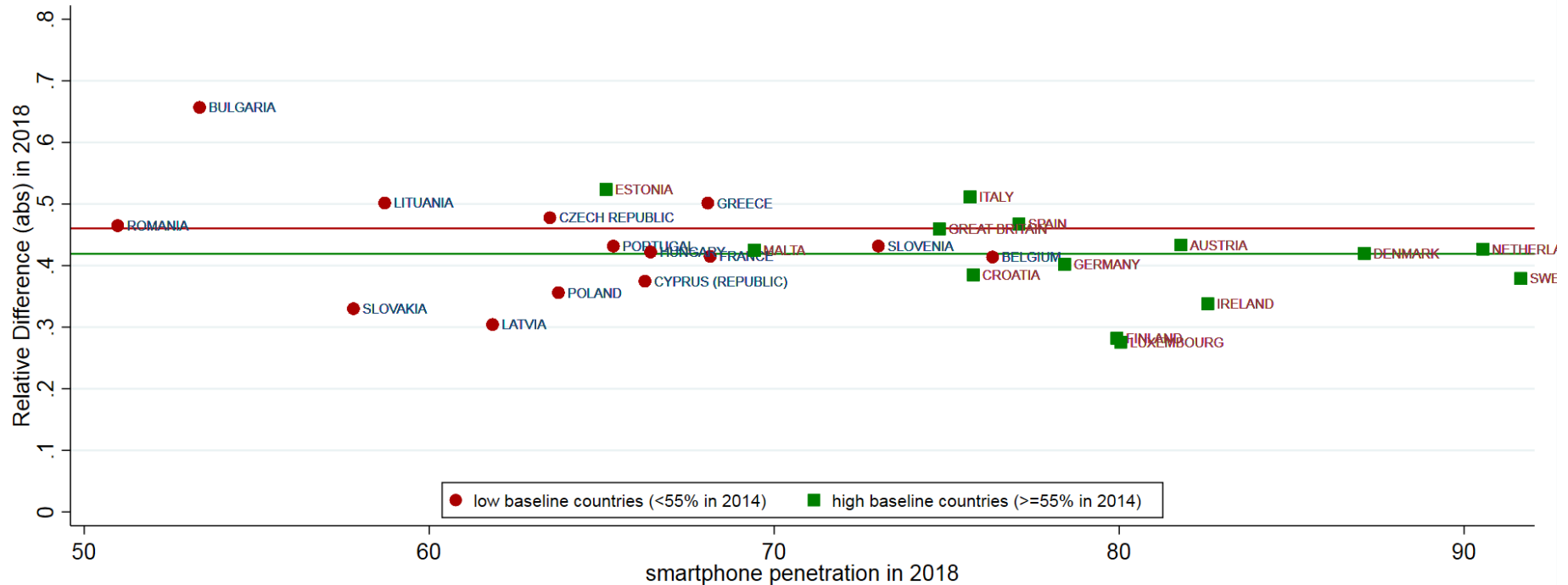
Relative Difference (abs) & smartphone penetration

Country differences

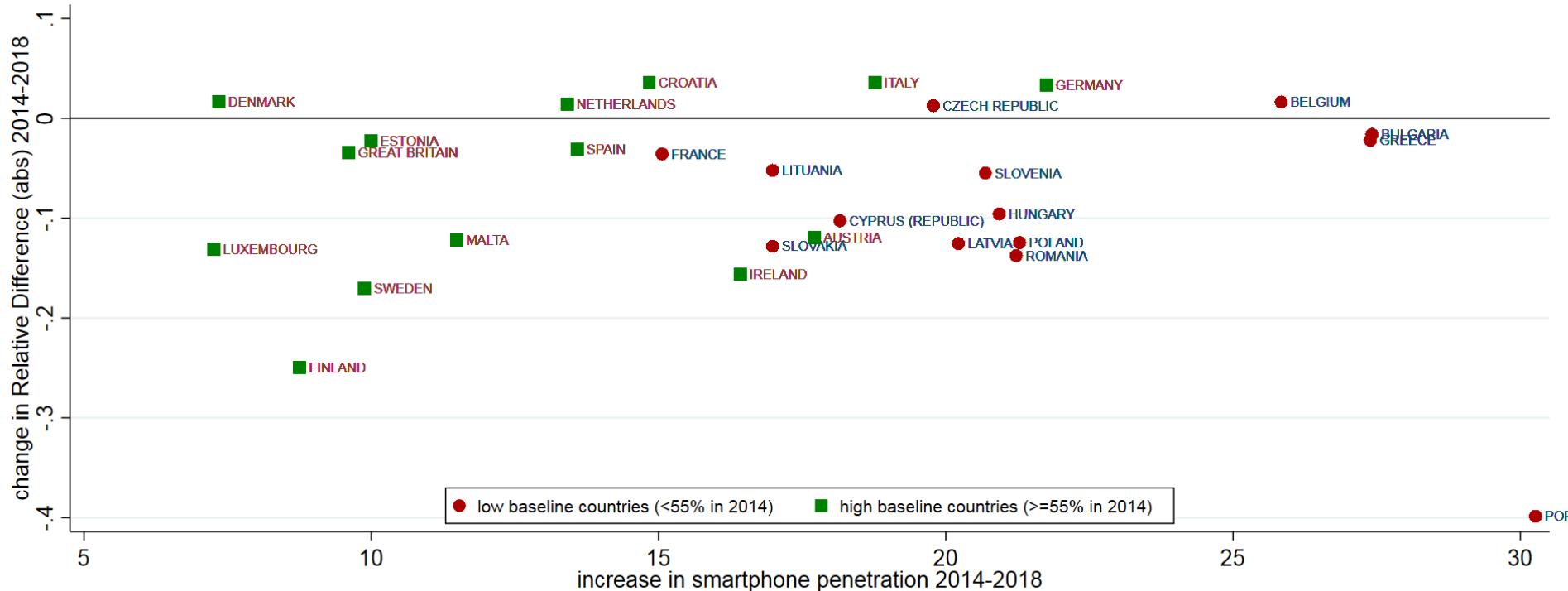
Relative Difference (abs) for mobile Web in relation to the smartphone penetration in 2018



Relative Difference (abs) for mobile Web in relation to the smartphone penetration in 2018



Change in Relative Difference (abs) for mobile Web in relation to the increase in smartphone penetration, 2014-2018



Relative Difference (abs)

Multilevel Analysis

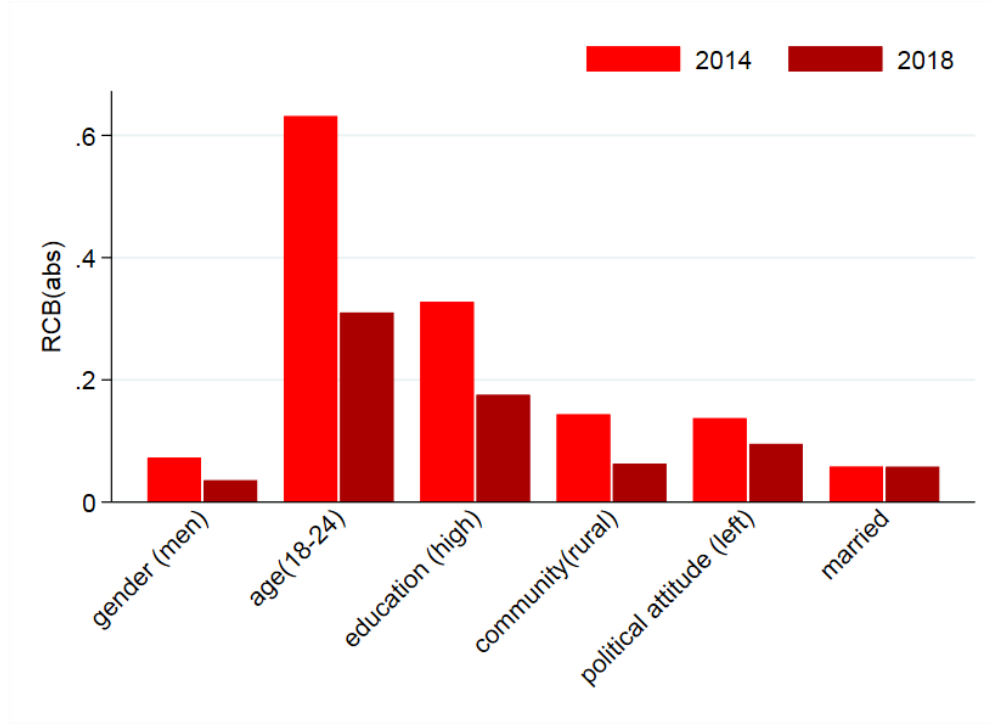
<i>Soc.-dem. variable</i>	<i>Country-level</i>	<i>ICC</i>	<i>Year-dummies (ref: 2014)</i>	<i>Smartphone penetration (country-centered)</i>
<i>Gender (men)</i>	sig.	.1784693	2017 sig. (-)	n.s.
<i>Age (18-24)</i>	sig.	.3831756	2017, 2018 sig. (-)	sig. (-)
<i>Education (high)</i>	sig.	.7436271	n.s.	n.s.
<i>Community(rural)</i>	sig.	.3090335	2017 sig. (-)	sig. (-)
<i>Pol. Attitude (left)</i>	sig.	.613204	n.s.	n.s.
<i>Married</i>	sig.	.74246	sig. (+)	sig. (+)



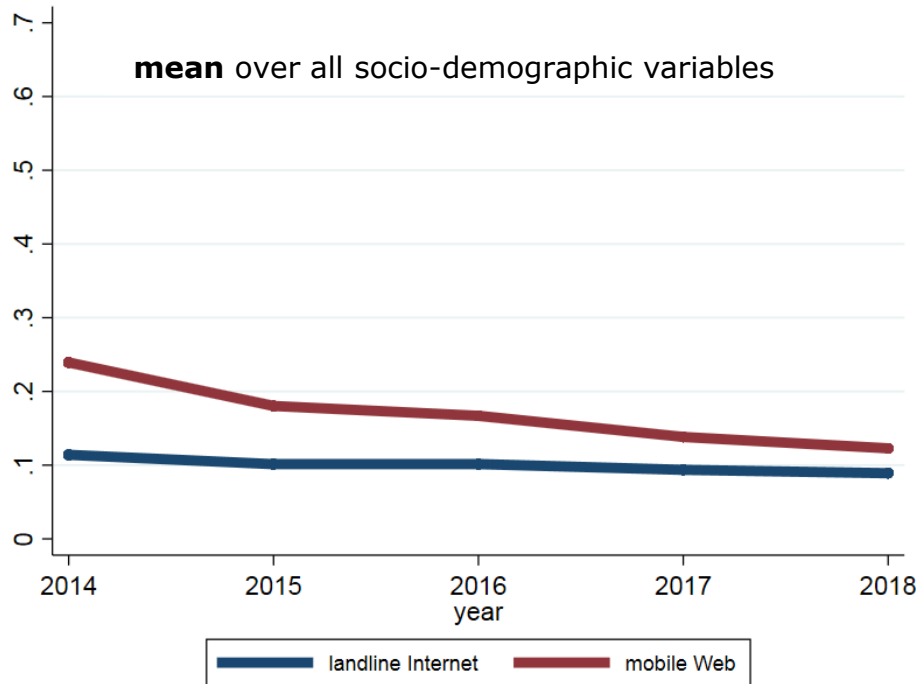
Relative Coverage Bias (abs)

$$|\text{Relative Coverage Bias}| = \left| \frac{N_{(\text{non covered population})}}{N_{(\text{covered+non covered population})}} \times \frac{p(\text{covered population}) - p(\text{non covered population})}{p(\text{covered + non covered population})} \right|$$

Relative Coverage Bias (abs): mobile Web: socio-demographic groups



Relative Coverage Bias (abs): mobile Web vs. non-mobile Internet



- Overall, stronger decline in the Relative Coverage Bias (abs) for mobile Web due to the increasing penetration rate
- Relative Coverage Bias (abs) for mobile Web still higher, but approaching

Summary

- Increasing smartphone penetration in all countries
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 - Overall, countries with a lower smartphone penetration in 2018 do not tend towards a much higher bias
 - Overall, the increase in smartphone penetration is not a predictor for the development of the bias

Summary

- Increasing smartphone penetration in all countries
 - Relatively more increase for countries with a low baseline in 2014
- Relative Difference (abs)
 - Overall, countries with a lower smartphone penetration in 2018 do not tend towards a much higher bias
 - Overall, the increase in smartphone penetration is not a predictor for the development of the bias
 - Except for age, the biases for smartphone are about on the level of non-mobile, landline Internet
 - Young persons still pose a major problem for the application of a pure smartphone survey, but the trend is promising
 - Growing bias for marital status

Summary

- Increase in smartphone penetration leads to an overall reduction of the magnitude of the distortion in terms of Relative Coverage Bias (abs)

- No major obstacles to profiting from the benefits of smartphone only surveys with respect to coverage error
- Limitation: smartphone ownership = mobile Web access & use?
- Further research: other country-level explicatory contextual variables
 - country-specific relative cost of mobile Web access



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Thank you.

Darmstadt University of Technology

Department 2

Institute of Sociology

Research Methods

Tobias Baier (baier@ifs.tu-darmstadt.de)

Anke Metzler (metzler@ifs.tu-darmstadt.de)

Marek Fuchs (fuchs@ifs.tu-darmstadt.de)

Residenzschloss, Glockenbau

64283 Darmstadt

Germany