Understanding Society
THE UK HOUSEHOLD LONGITUDINAL STUDY

Total Survey Error for Longitudinal Surveys

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University of Essex

ISER

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

An initiative by the Economic and Social Research Council, with scientific leadership by the Institute for Social and Economic Research, University of Essex, and survey delivery by NatCen Social Research and Kantar Public

Understanding Society

Sample of c. 100,000 individuals (all ages)

Initially clustered within a sample of residential addresses

Followed over time and data collected annually

Births to sample mothers become sample members

At each wave, all current members of the household of each sample member are interviewed

Primarily CAPI @ waves 1-7 (c. 2% CATI)

Web introduced @ w7; now c.50% interviews are web

Biomarkers collected once so far

Large ethnic minority and immigrant boost samples

10K+ data users; 40K+ data downloads; 4K (known) publications

Understanding Society Waves 13-15

A key challenge for tenderers:

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We identified two types of concerns:

- Imbalances in the total sample;
- Subgroups for which sample size is (getting) too small

Understanding Society Waves 13-15

Approaches:

- Adjusting for existing imbalances;
- Avoiding further imbalances in continuing sample (or depletion of small subsamples);
- Correcting imbalances (or boosting small subgroups) through addition of targeted samples

Understanding Society Waves 13-15

Included in the tender:

- Boost samples of general population at w20, w30, w40, etc;
- Samples of new immigrants at w15, w25, w35, etc
- No boost samples of small subgroups
- Several (targeted) measures to boost participation rates
- Enhanced user guidance: attrition analysis; reporting of weighting models; subsets and components of design weights

Understanding Society Waves 13-15

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➢ Sampling error *vs* coverage error *vs* nonresponse error *vs* estimation error *vs* specification error *vs* costs

Understanding Society Waves 13-15

Diagnosis informed by (and solutions depend on):

- Analysis of data from previous waves;
- Measures of change (as dependent variables or to define subgroups)

Unique aspects of longitudinal surveys – with implications for TSE

- Dependent variables are typically (inferred) measures of change;
- Time plays a particularly important role (defining population, sample, measures; affecting costs, recall, revisions);
- Measurement methods can include bounding and DI;
- Responses can be influenced by panel conditioning (general or topic-specific; behaviour or reporting; beneficial or detrimental);
- Unit nonresponse has complex patterns;
- Cost structures are distinct (initial vs ongoing; legacy and precedent effects).

TSE components in longitudinal surveys

Coverage error:

- For dynamic populations, dynamic sampling methods are needed (coverage error is not a one-time issue);
- Nature of coverage error depends on extent and nature of change amongst the excluded sub-population;
- Over-coverage can occur due to undetected changes in status.

TSE components in longitudinal surveys

Sampling error:

- Dynamic sampling can lead to systematic sampling error unless relative selection probabilities can be estimated;
- Random sampling variance depends on association between sample design parameters and dynamics (cannot be assessed after wave 1);
- and on methods for adding additional samples;
- Sampling based on time-variant characteristics can have unpredictable effects.

TSE components in longitudinal surveys

Nonresponse error:

- Cumulative result of initial non-response, item- and wave-nonresponse and attrition;
- Multiple opportunities to not respond make it particularly important to design procedures that minimize missing data;
- Sample mobility can lead to non-location being a major component of non-response at waves subsequent to the first;
- Experience of previous participation may be a major influence on co-operation after the first wave;
- Reasons for nonresponse can be associated with substantive change of interest (e.g. divorce/separation, moving home)

TSE components in longitudinal surveys

Adjustment error:

- Population dynamics make adjustment particularly challenging;
- Eligibility status can change over time and is not always known with certainty. This can affect weighting;
- Imputation can take into account both earlier and later responses. This can result in imputed values being revised in subsequent data releases. The structure of imputation error may therefore change as more waves of data are collected.

TSE components in longitudinal surveys

Specification error:

- Concepts of interest may change over time;
- Conflict between changing / adding questions to reduce specification error and maintaining consistency for measurement of change.

TSE components in longitudinal surveys

Measurement error:

- When change is inferred from answers to independently asked questions, error will depend on the correlation between errors at each wave (more complex if DI used);
- Validity and reliability of questionnaire items can have very different implications than with cross-sectional surveys, e.g.:
  - Low validity tends to impact bias in CS estimates but can result in unbiased estimates of change if bias is constant;
  - Low reliability tends to impact variance in CS estimates but can result in biased ests of change (change over-estimated);
- Dependent interviewing can reduce error in change measures;

TSE components in longitudinal surveys

Measurement error (ctd.):

- Detrimental panel conditioning:
  - Interview topics can prompt behaviour change
  - Respondents can learn how to shortcut
- Beneficial panel conditioning:
  - Respondents may learn to prepare for the interview (e.g. have pay slips or bank statements to hand);
  - Respondents' trust in interviewer / survey may improve;

Example: Adjustment Error (BHPS)

Standard non-response adjustment models assume eligibility status known (ineligibles are removed from the base). But…

Identification of population exits in sample is not always possible;

e.g. field outcome at wave after a sample member died may be "non-contact" - particularly likely if sample member lived alone;

Sample members may die years after last contact with survey;

Methods needed to deal with the under-identification of mortality;

Otherwise, estimation may be biased (respondents with similar characteristics to those who died will tend to be over-weighted)

Example: Adjustment Error

Estimating mortality to adjust weights

Step 1:

- Estimate probability of mortality for all cases of uncertain mortality

Step 2:

- Use these estimates to adjust the weights

Step 1: Estimating mortality (BHPS)

Use life tables (individual method):

$$\widehat{p_{ij}} = 1 - (\prod_{t=m}^{n}(1 - w_{ijt}d_{jt}))$$

where:

Element *i* in subgroup *j* (e.g age x sex) was last observed (alive) in year *m*;

d_{jt} is mortality rate for individuals in subgroup *j* in year *t*;

w_{ijt} are weights reflecting the relevant proportion of a calendar year

Step 2: Adjusting weights

Three methods:

Impute dichotomous alive/dead indicator,

e.g. $a_{ij} = 1 \; if \; r_{ij} > \widehat{p_{ij}}$; $r_{ij} \sim U(0,1)$ - then usual NR model

Usual NR model and then scale weights for each group *j by* k_j:

$$k_{jn} = \frac{c_{jn} + (1 - \widehat{p_{ij}})u_{jn}}{c_{jn} + u_{jn}}$$

Usual NR model, but with cases weighted by $\left(1 - \widehat{p_{ij}}\right)$

Case Study: BHPS

For each age x gender group, for each survey wave:

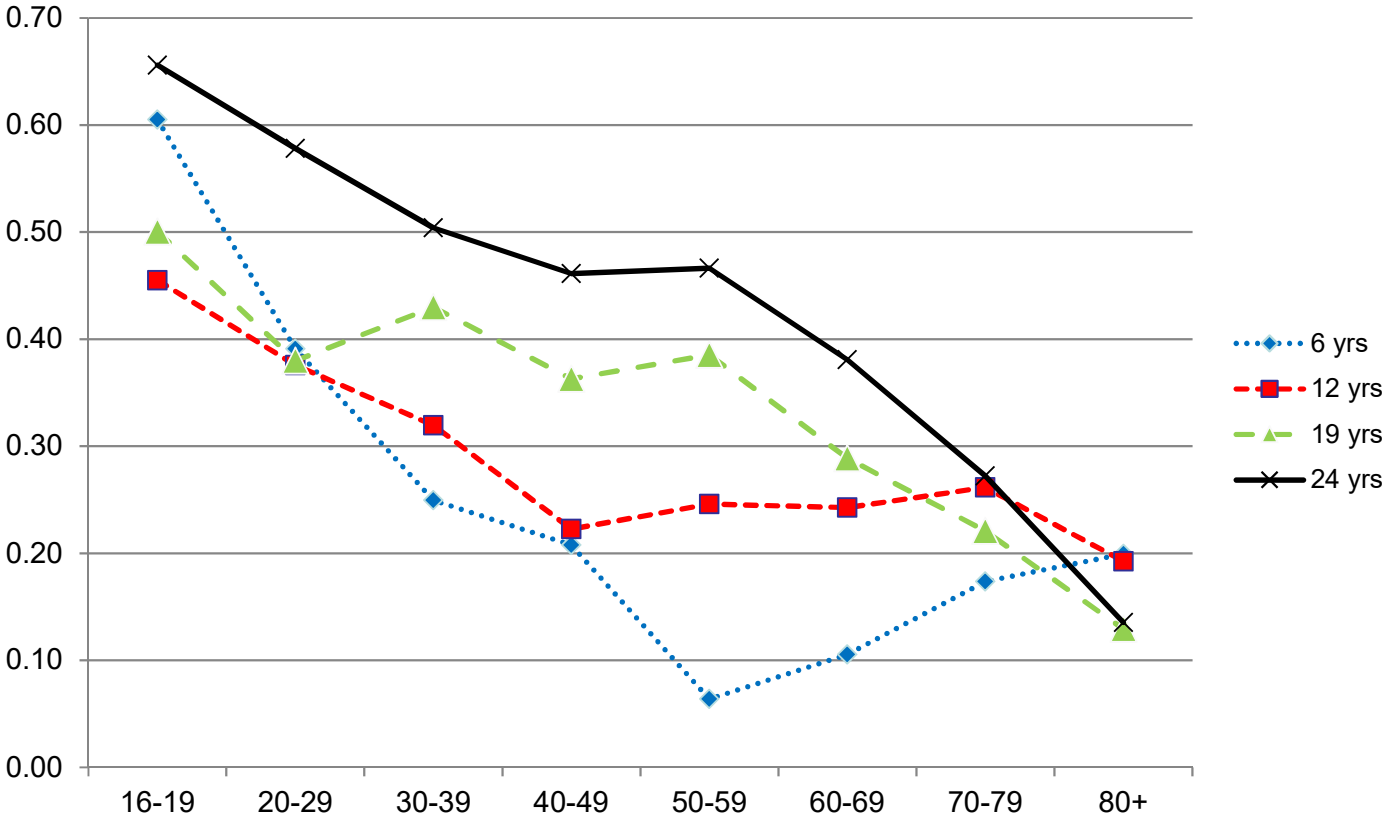
o_{jn} - observed number of deaths in group *j* by year *n*

$e_{jn} = n_j \left(1 - \prod_{t=1}^{n}\left(1 - w_{jt} d_{jt}\right)\right)$ - expected number

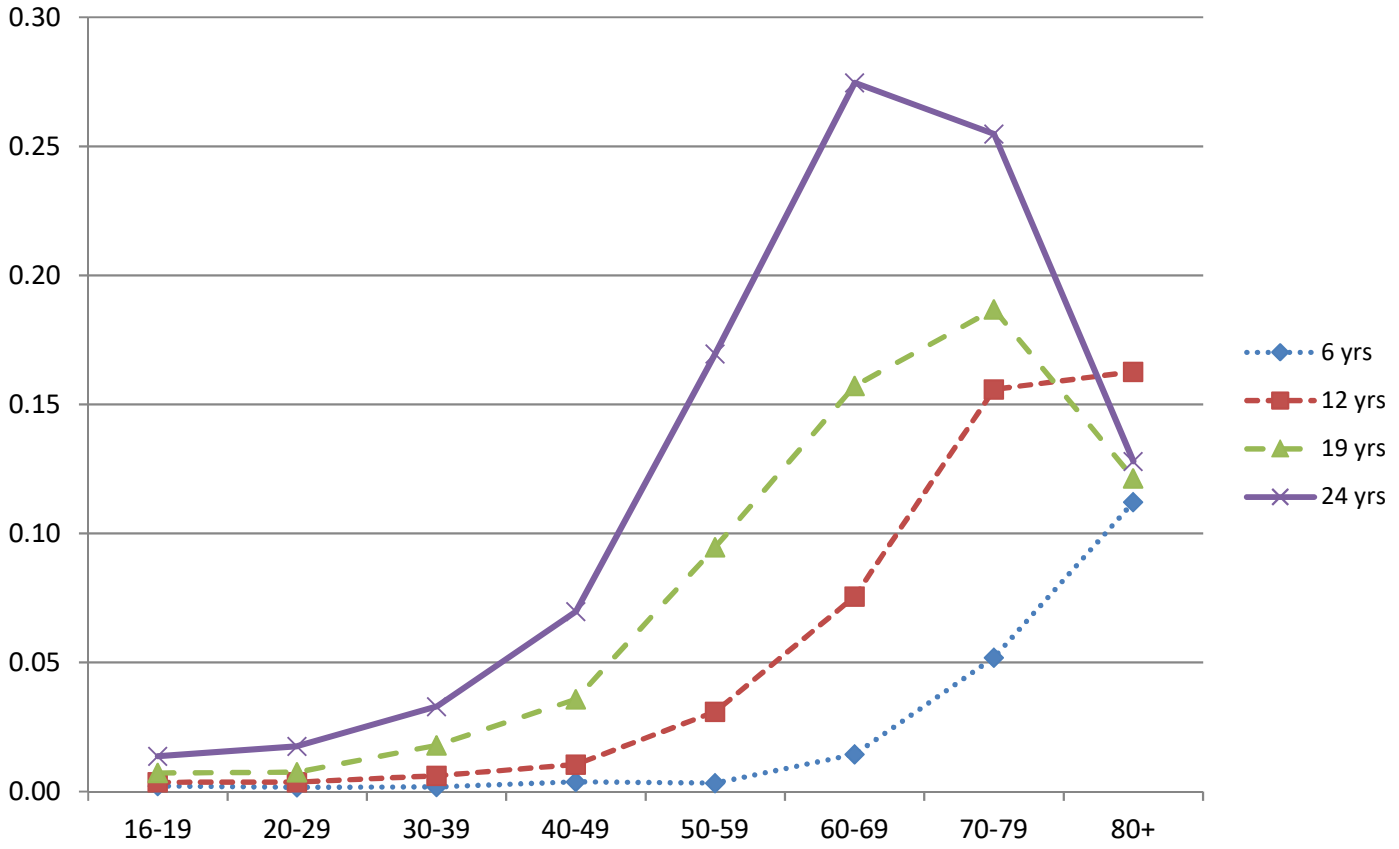
Proportion of deaths not identified: $1 - \frac{o_{jn}}{e_{jn}}$

where n_j is initial sample size in group *j* ;

Proportion of deaths not identified, by age at wave 1 and elapsed years, BHPS



Deaths not identified as a proportion of sample, BHPS



Example: Nonresponse vs Measurement Error (EU-SILC)

Proxy Response:

Data pertaining to one individual (the target individual) is provided by a different individual (the respondent).

In survey practice, proxy response may be:

- not allowed;
- allowed, but only *in extremis*;
- allowed, with few or no constraints;
- preferred / required.

Approach may differ between data items within a survey.

Example: EU-SILC

Proxy Response, Pros and Cons:

Advantages:

- Data collection costs
- Reduced nonresponse

Disadvantages:

- Measurement error (knowledge, recall, perception)

Cobb (2018); Schwarz & Wellens (1997); Bickart et al (2006); Thomsen and Villund (2011)

Proxy Response on EU-SILC

Regulation 1177/2003.

Re income, health and labour measures:

> “Personal information collected from all household members aged 16 or over (proxy as an exception for persons temporarily away or incapacitated) …. ”

The Extent of Proxy Interviews

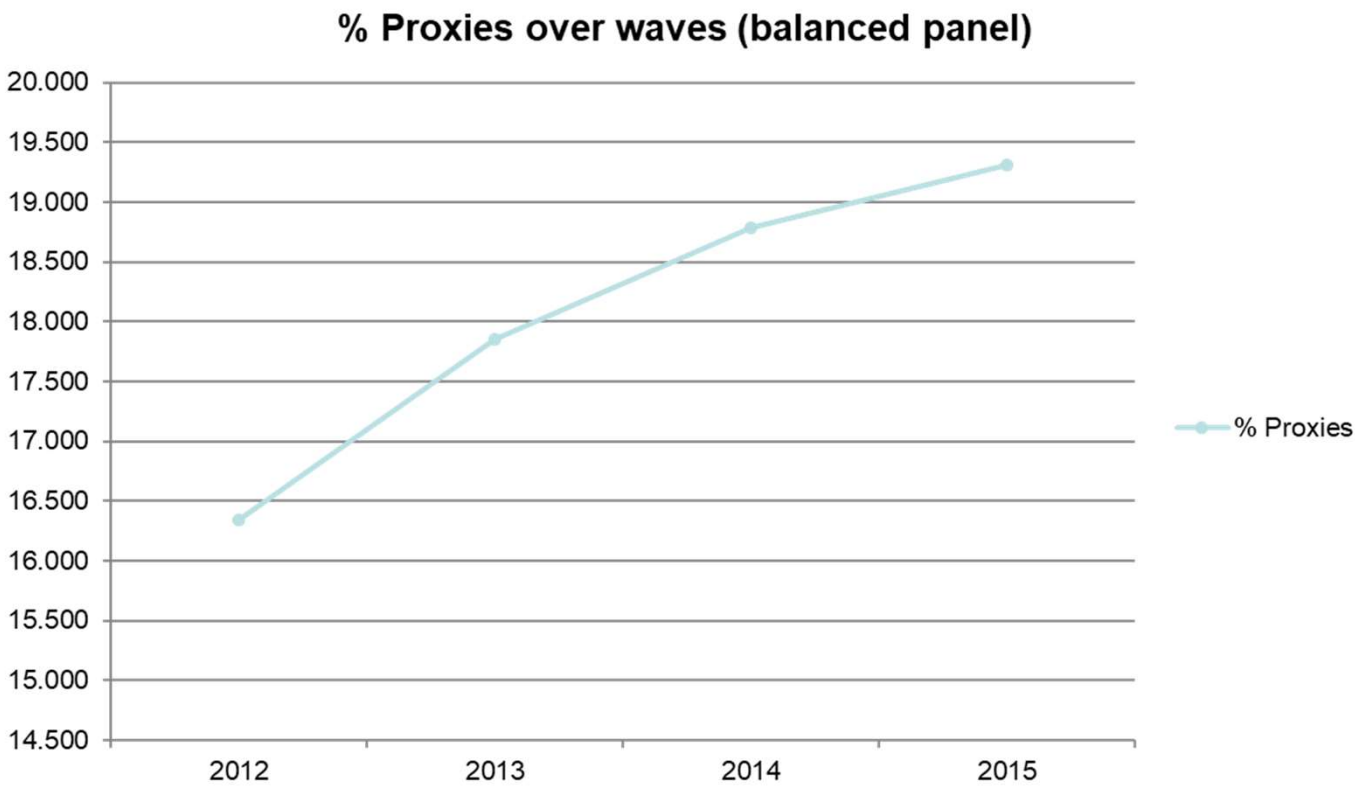
Using Combined R-files for 2004 to 2014

4,781,514 interviews, of which

959,247 were by proxy

i.e. 20.1%

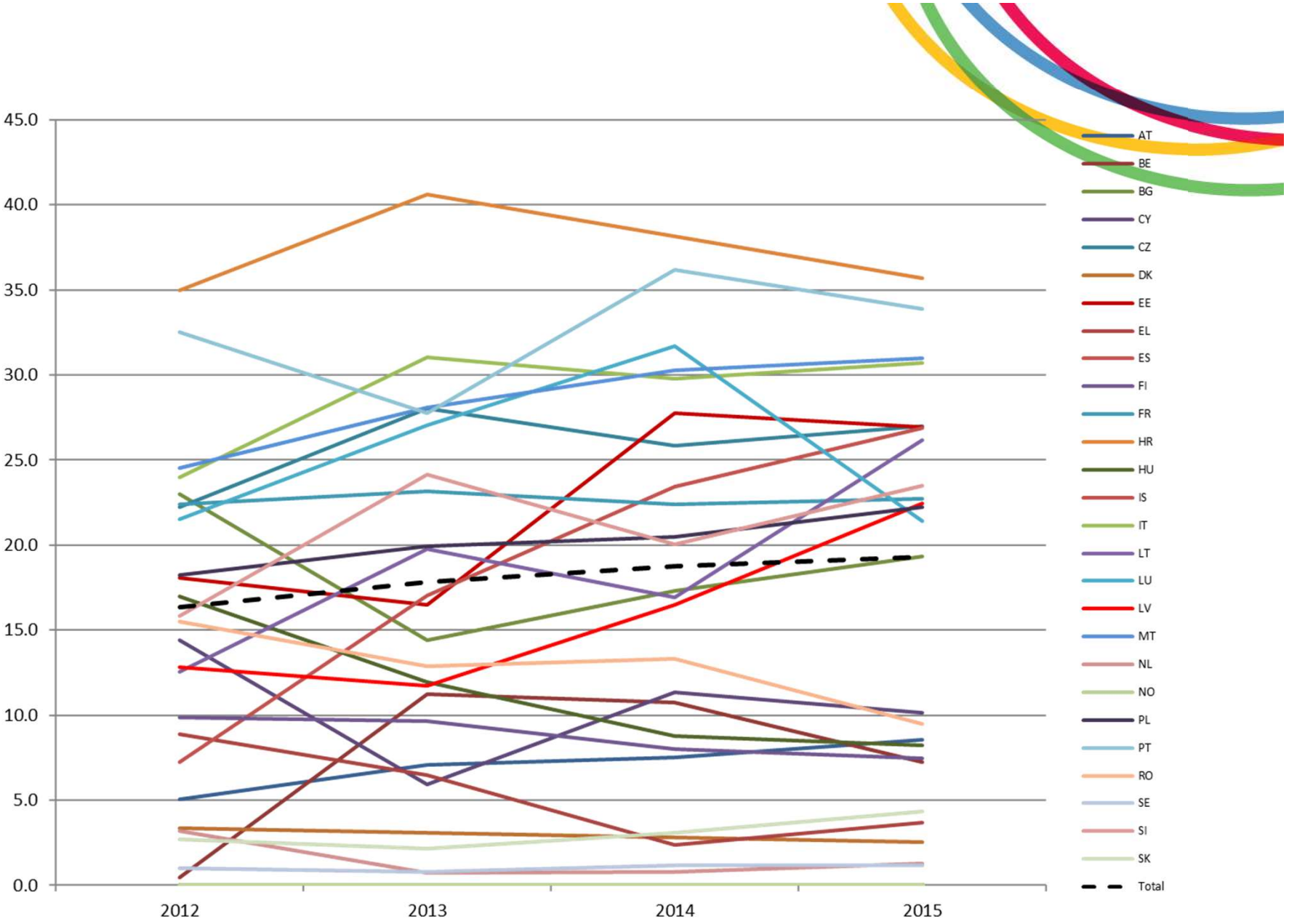
Variation over Waves



Source: 2012-2015 balanced panel (n = 75,107)

Variation over Waves by Country….

(2012-15 balanced panel)


45.0
40.0
35.0
30.0
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20.0
15.0
10.0
5.0
0.0
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2014
2015
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BE
BG
CY
CZ
DK
EE
EL
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IT
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LU
LV
MT
NL
NO
PL
PT
RO
SE
SI
SK
Total

Who Gets a Proxy Interview?

(2012-15 balanced panel)

Proxies, by Main Activity

Main Activity	Personal (%)	Proxy (%)	Base
Full-time employment	80.3	19.7	108,767
Part-time employment	87.7	12.3	15,051
Self-employment	81.2	18.8	21,680
Unemployed	78.2	21.8	20,182
Student	61.2	38.8	21,465
Retired	88.8	11.2	80,750
Disabled	82.5	17.5	9,420
Military Service	65.9	34.1	420
Care/Home	84.8	15.2	22,641
Total	81.9	18.1	300,376

Source: 2012-15 balanced panel;

Main activity derived from PL211F, Proxy status derived from RB260

Proxies, by Age Group

Age Group	Personal (%)	Proxy (%)	Base
16-24	58.3	41.7	32,460
25-34	78.7	21.3	37,264
35-44	82.0	18.0	50,760
45-54	84.4	15.6	56,540
55-64	87.3	12.7	58,164
65-74	89.4	10.6	40,256
75+	87.2	12.8	24,984
Total	81.9	18.1	300,428

Source: 2012-15 balanced panel;

Age derived from PB140, Proxy status derived from RB260

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