RISQ

Representativity Indicators for Measuring Survey Quality

ITACOSM09

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SEVENTH FRAMEWORK PROGRAMME

RISQ

REPRESENTATIVITY

INDICATORS

SURVEY

QUALITY

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SEVENTH FRAMEWORK PROGRAMME

RISQ

National Statistical Institutes of

- Netherlands
- Norway
- Slovenia

and

Universities of

- Leuven
- Southampton

NO RESPONSE

- Source of non random errors
- Originates biased estimates
  - Response rate
  - Contrast between respondents and non respondents

INDICATORS

- Measure the degree to which a survey is representative of the population under investigation

- Supports the comparison of quality of different surveys and facilitates an efficient allocation of data collection resources

- **R-Indicators** – represents the closeness to representative response as a function of fully observed auxiliary information only

- **Partial R-Indicators** – measure the impact of the auxiliary variables on deviations from representative response

- Partial R-Indicators
  - **Unconditional** – measure the contribution of single variables to a lack of representative response
  - **Conditional** – measure the contribution of single variables to a lack of representative response *given* other variables
- Should supplement R-indicators

R-Indicators (Schouten et al 2008)

ρ_i - response propensity

- typically estimated through a logistic model

$$\rho_i = \rho_X(x_i) = E(R_i \mid x_i)$$

$x = (x_1, x_2, \ldots, x_m)'$ is known for all sample units

$$R_i = \begin{cases} 0 \quad if \quad i \quad is \quad non\ respondent \\ 1 \quad if \quad i \quad is \quad respondent \end{cases}$$

R-Indicators

$$R(\rho)=1-2S(\rho)$$

$$S(\rho)=\sqrt{\frac{1}{N-1}\sum_U(\rho_i-\bar{\rho}_U)^2}$$

$$\bar{\rho}_U=\frac{1}{N}\sum_U\rho_i$$

$$0\leq R(\rho)\leq 1$$

The population variance is estimated by a design-weighted sample variance

- ## Partial R-Indicators
  - **Unconditional (variable Z is used to model response propensities)**

$$P_1(Z,\rho_{X,Z})=\sqrt{S_b^2(\rho_{X,Z}\mid Z)}$$

where

$$S_b^2(\rho_{X,Z}\mid Z)=\frac{1}{N-1}\sum_k N_k(\bar{\rho}_{X,Z,k}-\bar{\rho}_{X,Z})^2\cong\sum_k\frac{N_k}{N}(\bar{\rho}_{X,Z,k}-\bar{\rho}_{X,Z})^2$$

Z **is a categorical auxiliary variable with**

$k=1,2,\ldots,K$

Population variances can be estimated by:

$$\hat{S}_b^2\left(\rho_{X,Z} \mid Z\right) = \sum_K \frac{\hat{N}_k}{N}\left(\hat{\bar{\rho}}_{X,Z,K} - \hat{\bar{\rho}}_{X,Z}\right)^2$$

$$\hat{S}_b^2\left(\rho_{X,Z} \mid Z = k\right) = \frac{\hat{N}_k}{N}\left(\hat{\bar{\rho}}_{X,Z,K} - \hat{\bar{\rho}}_{X,Z}\right)^2$$

With $\hat{N}_k = \sum_{i \in s_k} d_i$ being the estimated population size of stratum k .

If variable Z is not used to model response propensities, replace $\rho_{X,Z}$ with ρ_X .

Partial R-Indicators

- **Conditional (the auxiliary variable in study Z must be included in the model)**

$$P_2\left(Z,\rho_{X,Z}\right)=\sqrt{S_w^2\left(\rho_{X,Z}\mid X\right)}$$

where

$$S_w^2\left(\rho_{X,Z}\mid X\right)=\frac{1}{N-1}\sum_{l=1}^{L}\sum_{U_l}\left(\rho_{X,Z}\left(x_i,z_i\right)-\bar{\rho}_{X,Z,l}\right)^2$$

and

$$\hat{S}_w^2\left(\hat{\rho}_{X,Z}\mid X\right)=\frac{1}{N-1}\sum_{l=1}^{L}\sum_{s_l}d_i\left(\hat{\rho}_{X,Z}\left(x_i,z_i\right)-\hat{\bar{\rho}}_{X,Z,l}\right)^2$$

Simulation Study:

- dataset from 1995 Israel Census Sample of Individuals aged 15 and over (size=753.711)
- Probabilities of response were defined according to: child indicator, income group, age group, sex, number of persons in household and locality type

- Using the response indicator as dependent variable, a logistic regression model was fitted on the population with the above explanatory variables

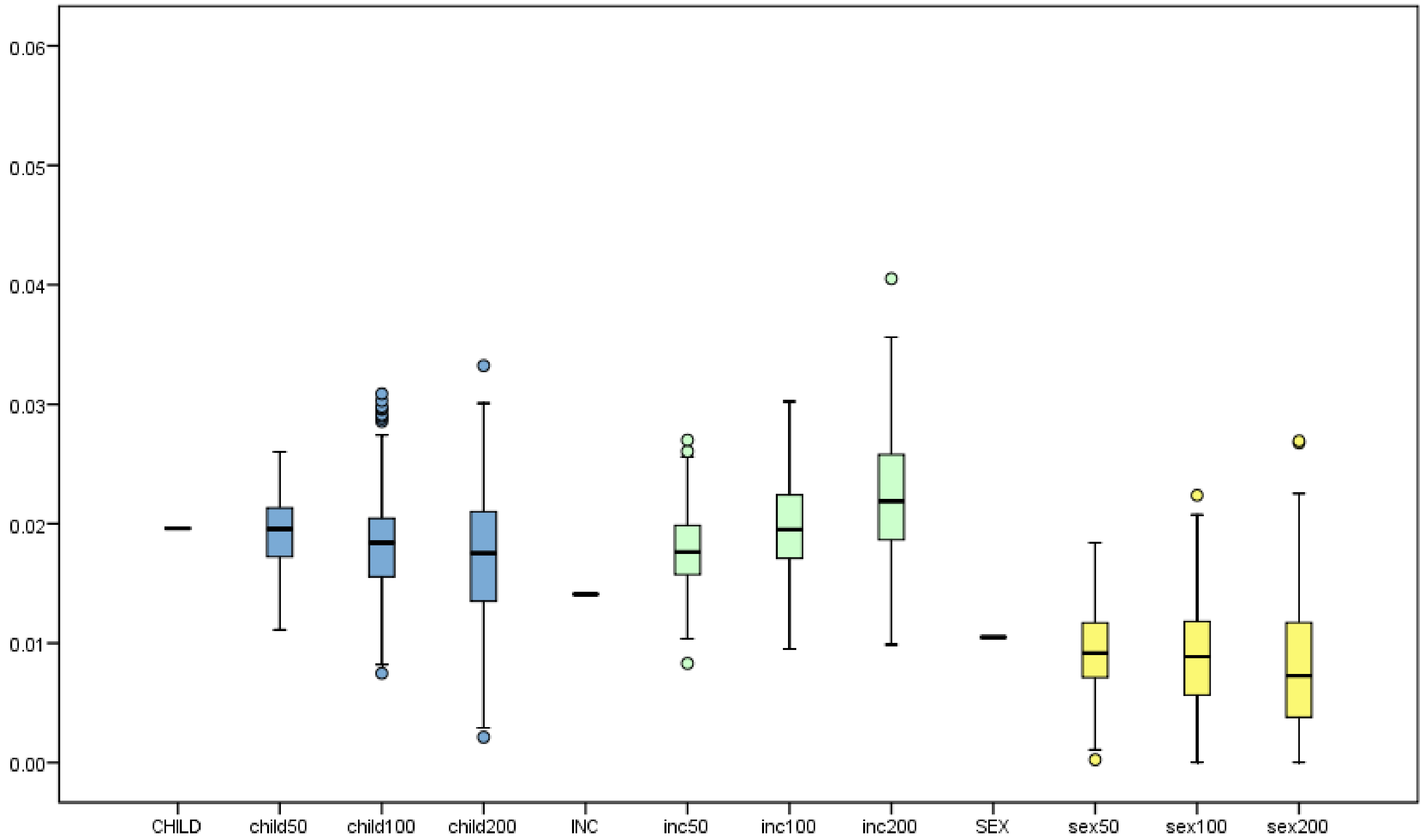
- The predictions from this model serve as the “true” response propensities for our simulations

- **400 samples were drawn**
- **Three sampling fractions:**
  - **1:50 (sample size of 15.074)**
  - **1:100 (sample size of 7.537) and**
  - **1:200 (sample size of 3.679)**

- **Boxplots show the “true” population value for each variable, the mean, the median and the spread of the distribution for each partial R-indicator.**

Representativity Indicators for Measuring Survey Quality

Partial Indicator P1 (between variance)



RISQ

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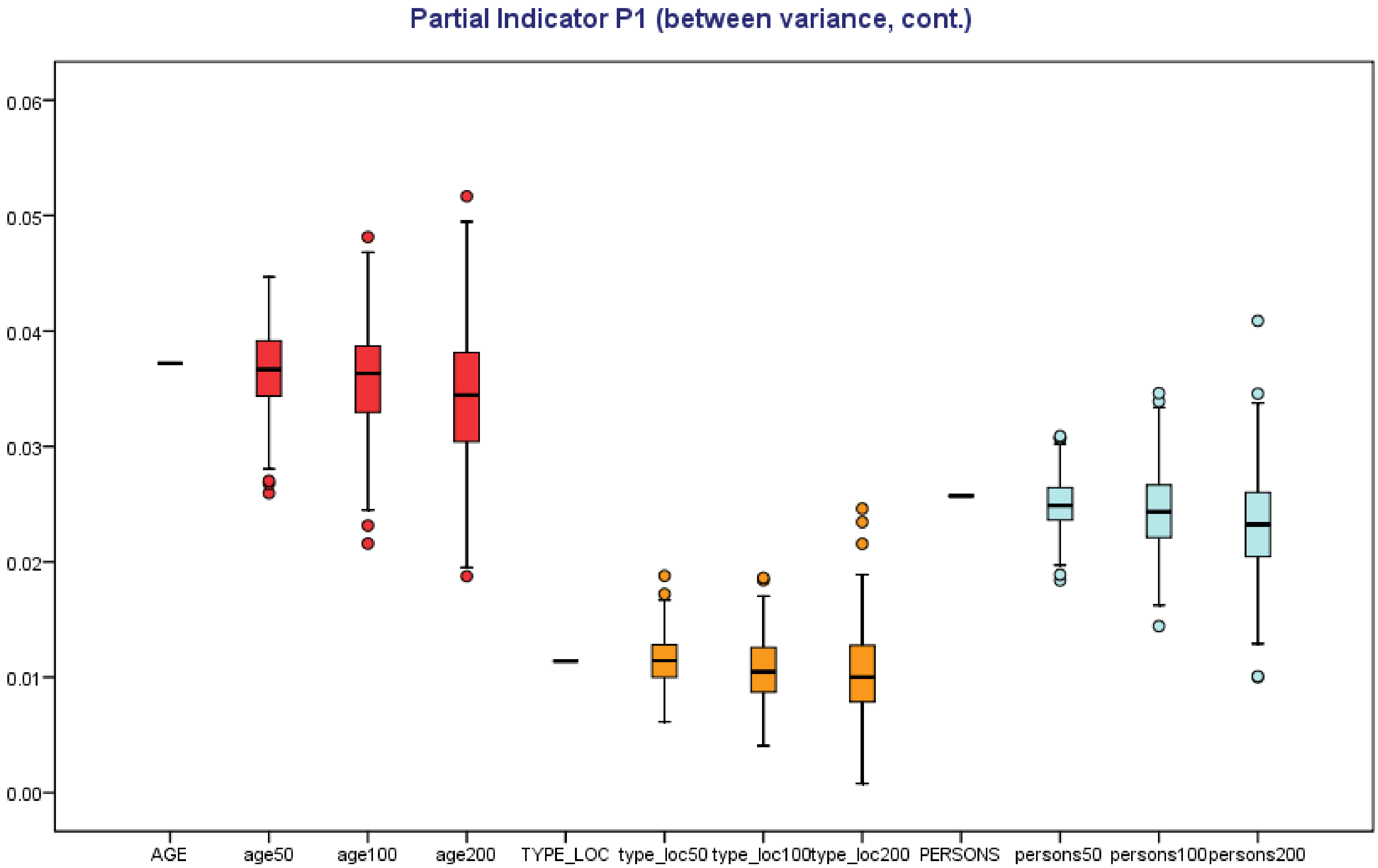

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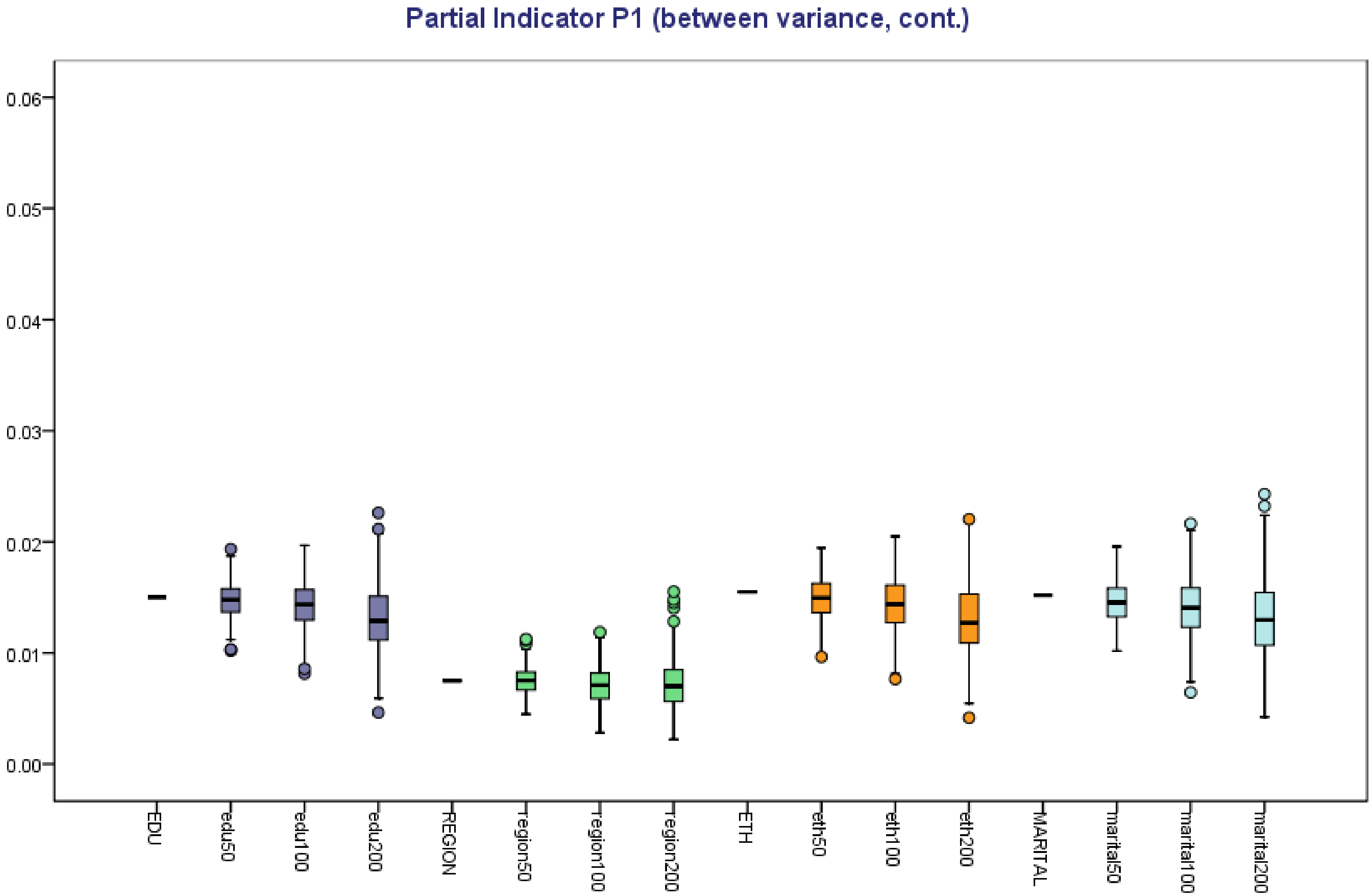

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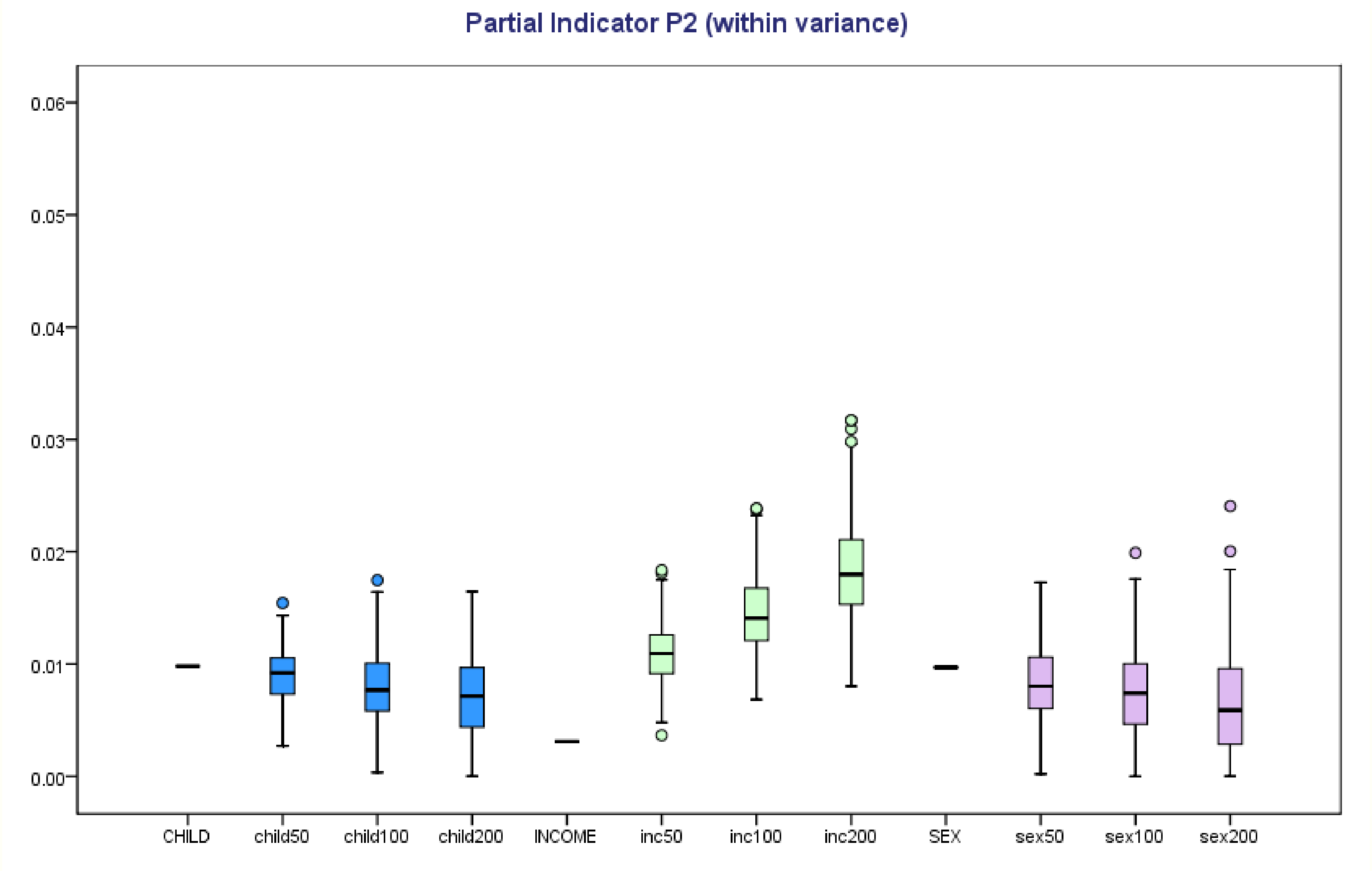

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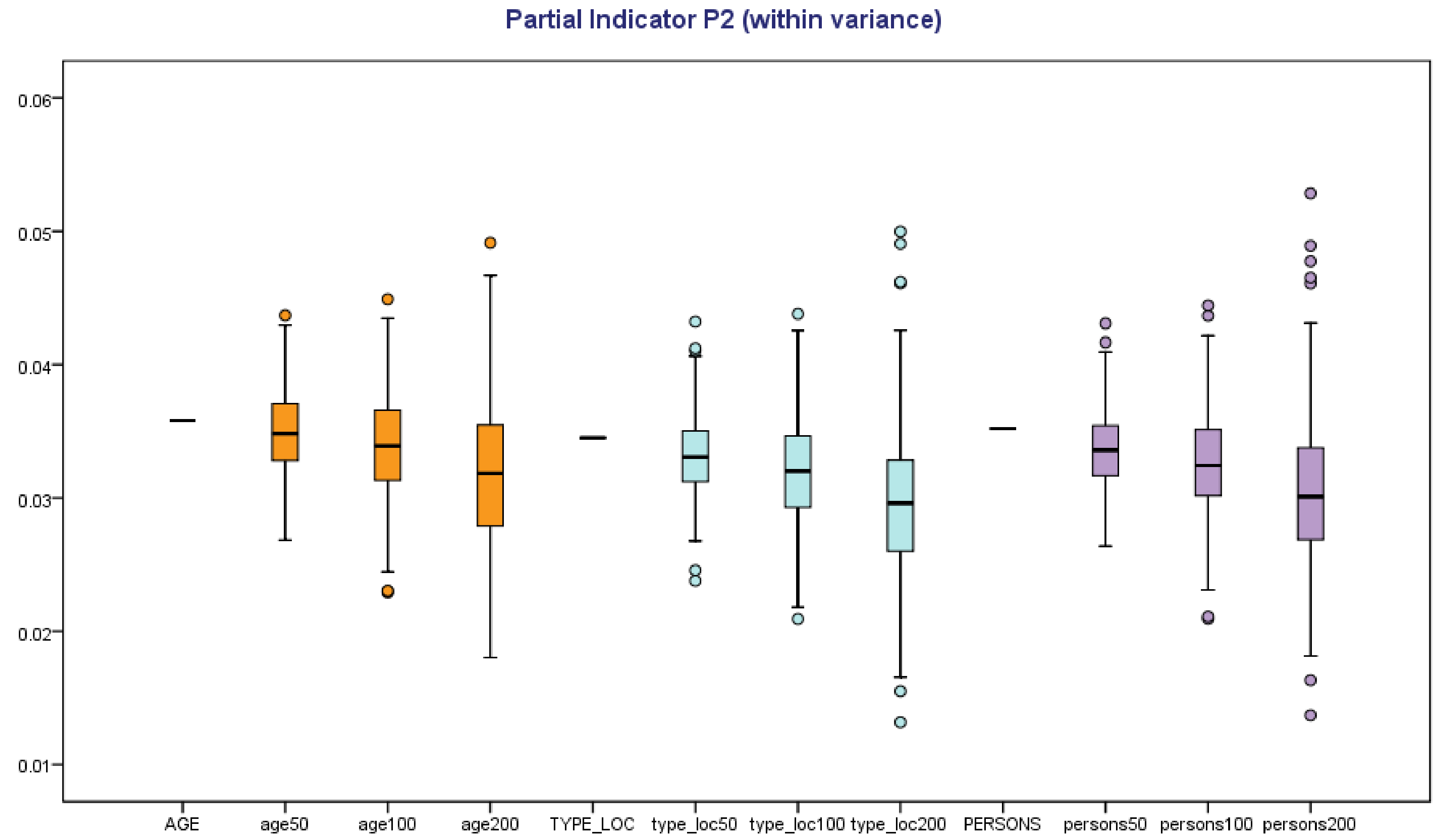
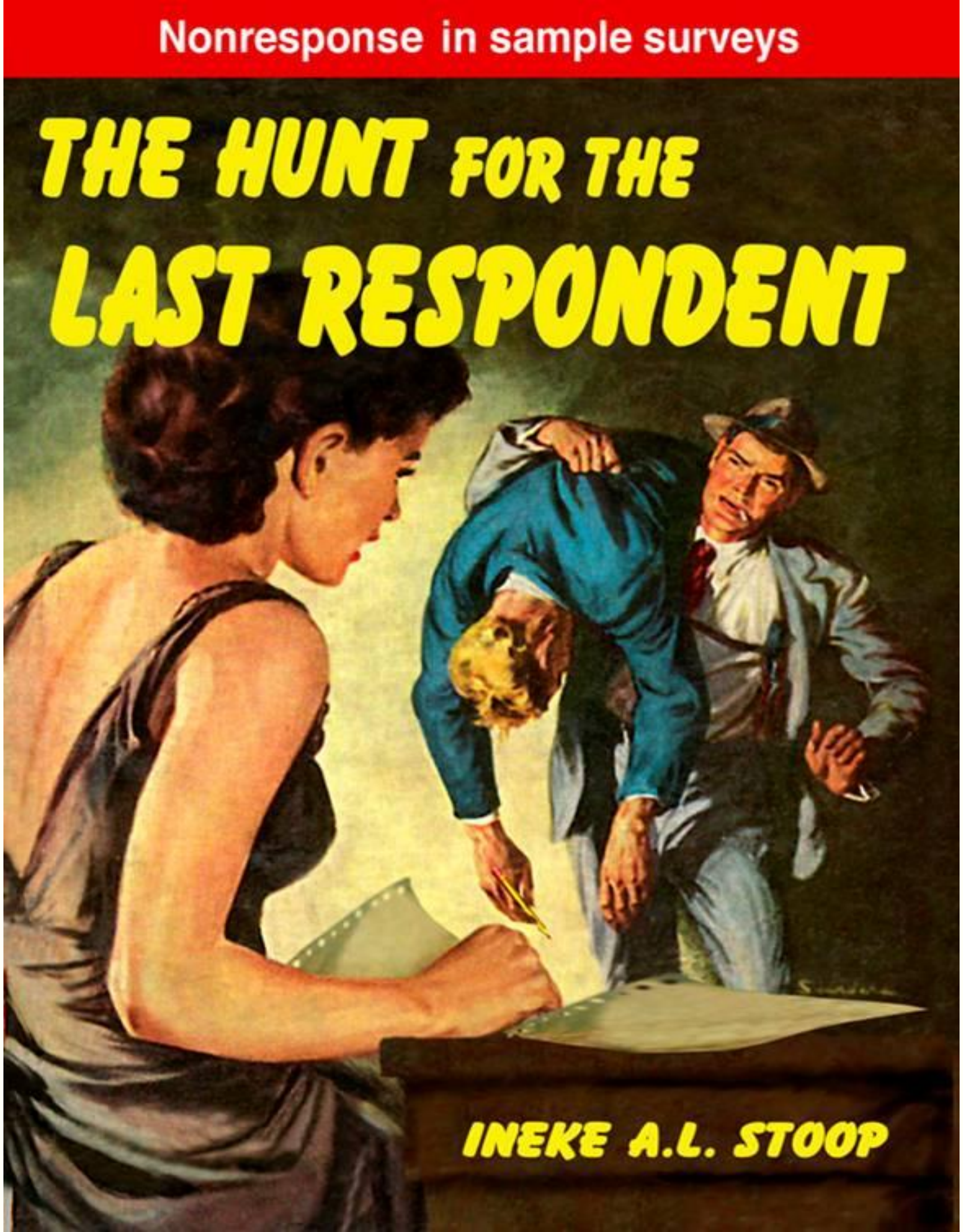


Conclusions

- This is a first exploration of partial indicators
- Partial indicators are useful to test survey methods, field monitoring and for weighting classes
- Identify variables that contribute to representativity
- Must be tested in real data sets in order to assess their impact on identifying variables and categories of variables that contribute to the lack of representativity

Conclusions

- Together with R-Indicators and response rates, survey managers can target data collection resources to specific sub-groups contributing to the lack of representativity, identify variables that might be used in survey estimation procedures to reduce non-response bias.



Nonresponse in sample surveys

THE HUNT FOR THE LAST RESPONDENT

INEKE A.L. STOOP