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12th INTERNATIONAL CONFERENCE

Estimation of population parameters in EL-SILC with the R packages: the experience of ELSTAT

Irene Sarantou, Anastasia Mnimatidou

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Key Points Covered in the Presentation

- Overview of the survey scope and methodology
  (compliance with the new stringent requirements of the 2019/1700 IESS Regulation)
- Contribution to bridge a gap in estimation of population parameters using entirely R software
- Key benefits
- The significant achievement of Transition from the SAS macro “Calmar” to the R package “icarus”

Overview of the survey scope and methodology

1. **Survey Methodology**: SILC is an annual household survey targeting all private households in Greece, using a stratified two-stage area sampling design with rotating panels. The sample consists of four subsamples, each used for four years.

2. **Sampling Design:**

   Stratification: stratified by region + degree of urbanization

   Sampling Frame: Based on Census, with PSUs selected proportionally to their size.

   Rotating Sample Structure: Four panels rotate annually, ensuring a 75% overlap between consecutive years.

   Sample Size and Allocation: ~15,300 households, with 3,820 households per panel.

Overview of the survey scope and methodology
Cross and Long scheme

Stages of Sampling:

- **First Stage**: Random selection of PSUs within each stratum.
- **Second Stage**: Systematic sampling of households within selected PSUs.

Weighting:

- **Design Weights**: Inverse of the probability of selection.
- **Adjustments**: For nonresponse, attrition, and combining panels to improve estimate precision.
- **Calibration**: Adjusting weights to match known population totals for certain variables.

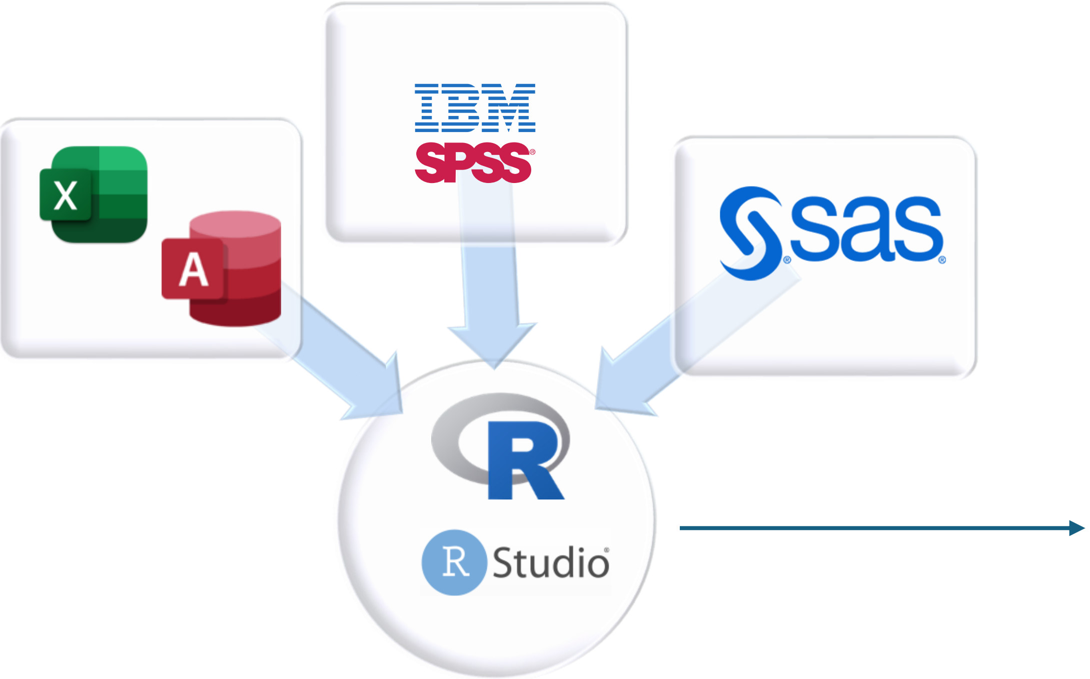
Survey year				
2020	1			
2021	1	2		
2022	1	2	3	
2023	1	2	3	4

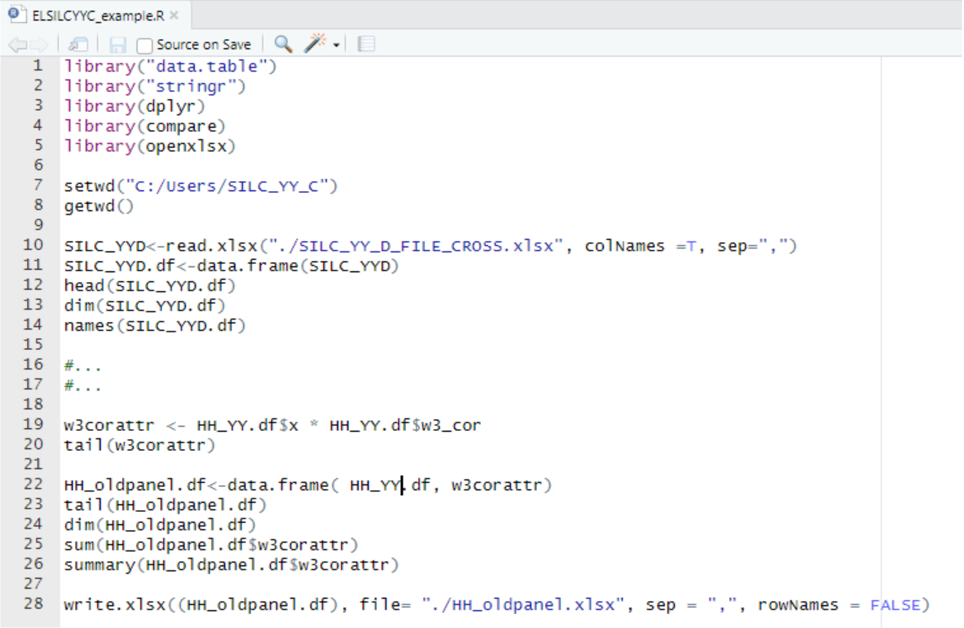
□ Cross –sectional weights (1,2,3,4 panels)

▨ Longitudinal weights (panels 3,2,1 of duration two, three and four years respectively)

⚠ Transmission of the cross data collection of year N, 11 months earlier .

Contribution to bridge a gap in estimation of population parameters using entirely R software





```r
library("data.table")
library("stringr")
library(dplyr)
library(compare)
library(openxlsx)

setwd("C:/Users/SILC_YY_C")
getwd()

SILC_YYD<-read.xlsx("./SILC_YY_D_FILE_CROSS.xlsx", colNames =T, sep=",")
SILC_YYD.df<-data.frame(SILC_YYD)
head(SILC_YYD.df)
dim(SILC_YYD.df)
names(SILC_YYD.df)

#...
#...

w3corattr <- HH_YY.df$x * HH_YY.df$w3_cor
tail(w3corattr)

HH_oldpanel.df<-data.frame( HH_YY.df, w3corattr)
tail(HH_oldpanel.df)
dim(HH_oldpanel.df)
sum(HH_oldpanel.df$w3corattr)
summary(HH_oldpanel.df$w3corattr)

write.xlsx((HH_oldpanel.df), file= "./HH_oldpanel.xlsx", sep = ",", rowNames = FALSE)
```

KEY BENEFITS:

- flexibility in reading, manipulating, processing datasets and writing data,
- availability of recent statistical methodology,
- a particularly economical solution (Matthias Templ & Valentin Todorov, 2016),
- a significant reduction in the time needed to estimate and disseminate the national results,
- in the case of a correction, when all the work is done, the corrected file is loaded, and the code is re-run,
- allows communication to all users.

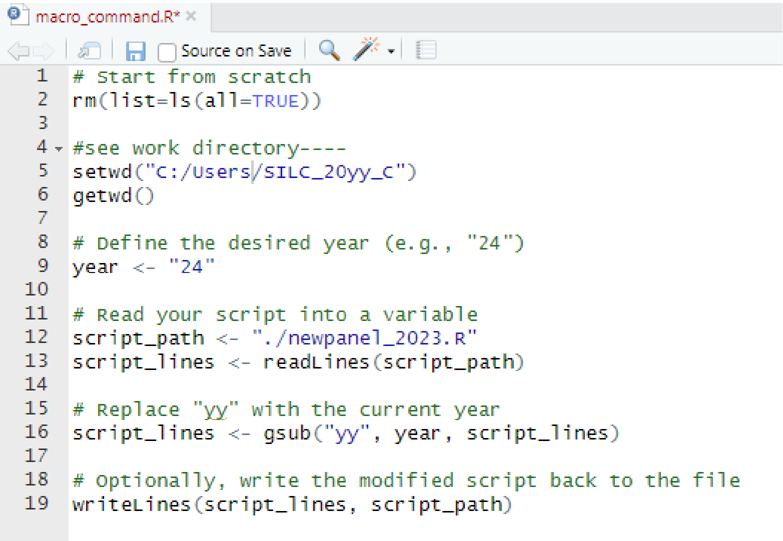
Contribution to bridge a gap in estimation of population parameters using entirely R software(2)

Main packages:

data.table; stringr; dplyr; laeken; tidyverse; foreign; sampling; haven; compare; openxlsx

Advantage of using macro scripts / functions in R.

The main target is increasing efficiency, thus saving time and effort by automating repetitive tasks.



```
# Start from scratch
rm(list=ls(all=TRUE))

#see work directory----
setwd("C:/Users/SILC_20yy_C")
getwd()

# Define the desired year (e.g., "24")
year <- "24"

# Read your script into a variable
script_path <- "./newpanel_2023.R"
script_lines <- readLines(script_path)

# Replace "yy" with the current year
script_lines <- gsub("yy", year, script_lines)

# Optionally, write the modified script back to the file
writeLines(script_lines, script_path)
```

Future Challenges:

Develop an overarching process that includes all the stages of the survey using R eg. Design, Sample, Collect, Analyse, Disseminate and Evaluate.

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CALIBRATION

Part I

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“Integrative” Calibration

- EL-SILC follows Eurostat’s recommendation using an ‘**integrative’** calibration.
- The calibration variables are defined at both household and individual level and the process ensures that the survey estimates are more accurate and reflective of the actual population characteristics.
- The calibration is done at the household level using the household variables (hh size, tenure status, Region - NUTS II) and the individual variables (distribution of population by five-year age group and sex in their aggregate form).

Advantages

- This technique ensures «consistency» between household and individual estimates, by making the household and the individual weights equal.
- Both household and individual information is taken into account in a single calibration.

Successful switch from SAS CALMAR to R icarus

It permits the calibration of a sample by re-weighting the units, using auxiliary information from external sources (eg Estimated Population on the 1st of January for each reference year, Population-Housing Census).

Aim: Increase the precision of the estimates.

EL- SILC uses the « LOGIT » method (M=3)

Advantages:

The ratio between the new weights and the former weights are bounded (by L and U)

The calibrated weights always take positive values

References

- [1] EUROSTAT. (2023). Methodological Guidelines and Description of EU-SILC target variables, 2023 operation (Version 6: Draft), Eurostat.

- [2] Merkouris, P. (2018). Study of the current sampling design of the Survey of Income and Living Conditions with the objective to increase/adjust the sample at regional (NUTSII) level (Part I & II), Athens: AUEB Research Center.

- [3] Merkouris, T. (2001). Cross-Sectional Estimation in Multiple Panel Household Surveys, Canada: Statistics Canada, Vol. 27, No. 2, pp. 171-181.

- [4] Templ, M., & Todorov, V. (2016). The Software Environment R for Official Statistics, Austrian Journal of Statistics(45), 97–124.

- [5] Verma, V., Betti, G., & Ghellini, G. (2017). Cross-sectional and longitudinal weighting in a rotational household panel: Applications to EU-SILC, Statistics in transition-new series, 8(1), 5-50.

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CALIBRATION

Part II

The significant achievement of transition from the SAS macro “Calmar” to the R package “icarus”

Version 0.3.2 May 27, 2023

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Implementation of ‘icarus’ in EL-SILC

The second part of the presentation, which deals with the implementation of the "icarus" R package and the comparison of the results with the corresponding results of the SAS Calmar software, is illustrated in the following pdf file.

uRos-2024_Mnimatidou.pdf

CONCLUSIONS

The successful and exclusive use of R software:

✓ **marks** a major step forward in bridging gaps in the estimation of population parameters for the EL SILC survey,

✓ **offers** significant advantages in terms of both functionality and time savings,

✓ **provides** an up-to-date and effective framework for handling complex sampling surveys,

✓ **represents** a noticeable reduction in the time needed to estimate and disseminate national results,

✓ becomes more efficient,

✓ **facilitates** better communication with users,

✓ **making** the system more economical and user-friendly.