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A quality assessment of flash estimates for the income distribution

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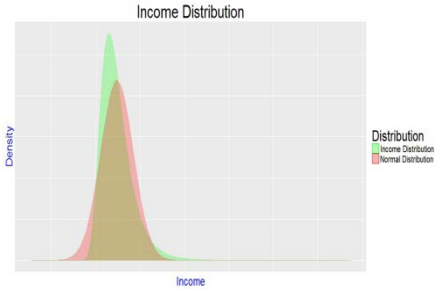
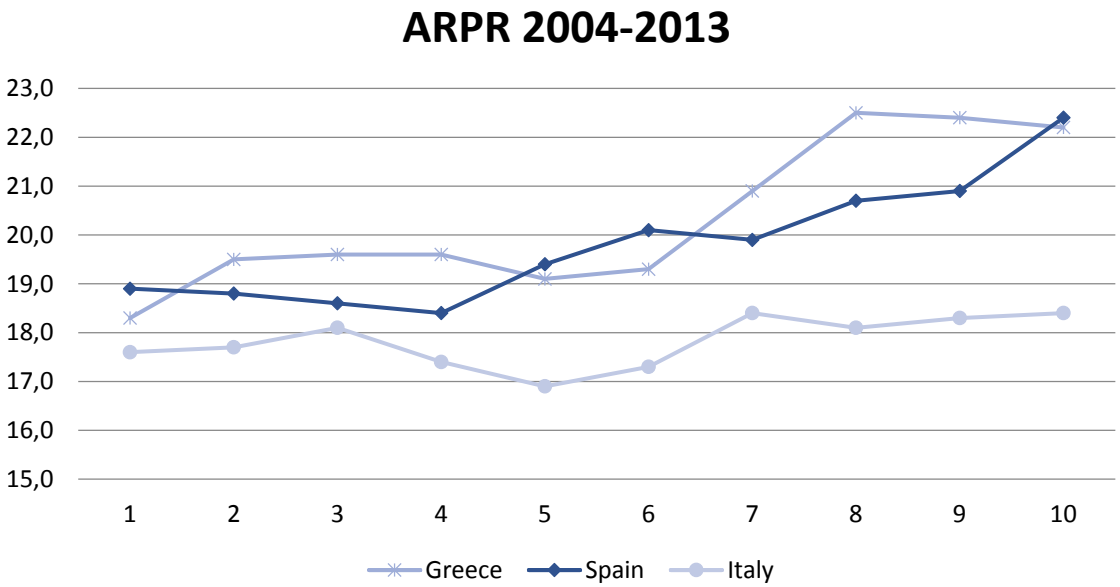
Background

- Raising importance of social indicators and income inequlities for policy-making at EU level
- Indicators needed for social impact assessment at national and EU level
- Integrated in the European Semester
- Main source at EU level is EU-SILC
  - Income as structural information
  - Currently available **end N+2**

Income indicators

Income indicators: deciles, at risk-of-poverty threshold, the at-risk-of-poverty rate, the quintile share ratio and the Gini coefficient





Flash estimates on income indicators

- refer to a **past yearly reference period** (year N);
- refer to **a set of distributional indicators** for equivalised disposable income
- are based on **an information set** that includes the latest income data available from EU-SILC) +auxiliary information from the reference period;
- are based on a set of **statistical techniques:** mainly microsimulation and time series modelling
- are assessed based on a **specific quality framework**

Quality assessment

- Consistency of auxiliary data sources

- **Retrospective performance assessment**
  - ➢ Extensive testing of different methods and sources
  - ➢ Assess ability to reproduce reference values for target years 2012-2013
    - ✓ Performance metrics for different indicators
    - ✓ Tests distributions

- Uncertainty measurement

Performance metrics

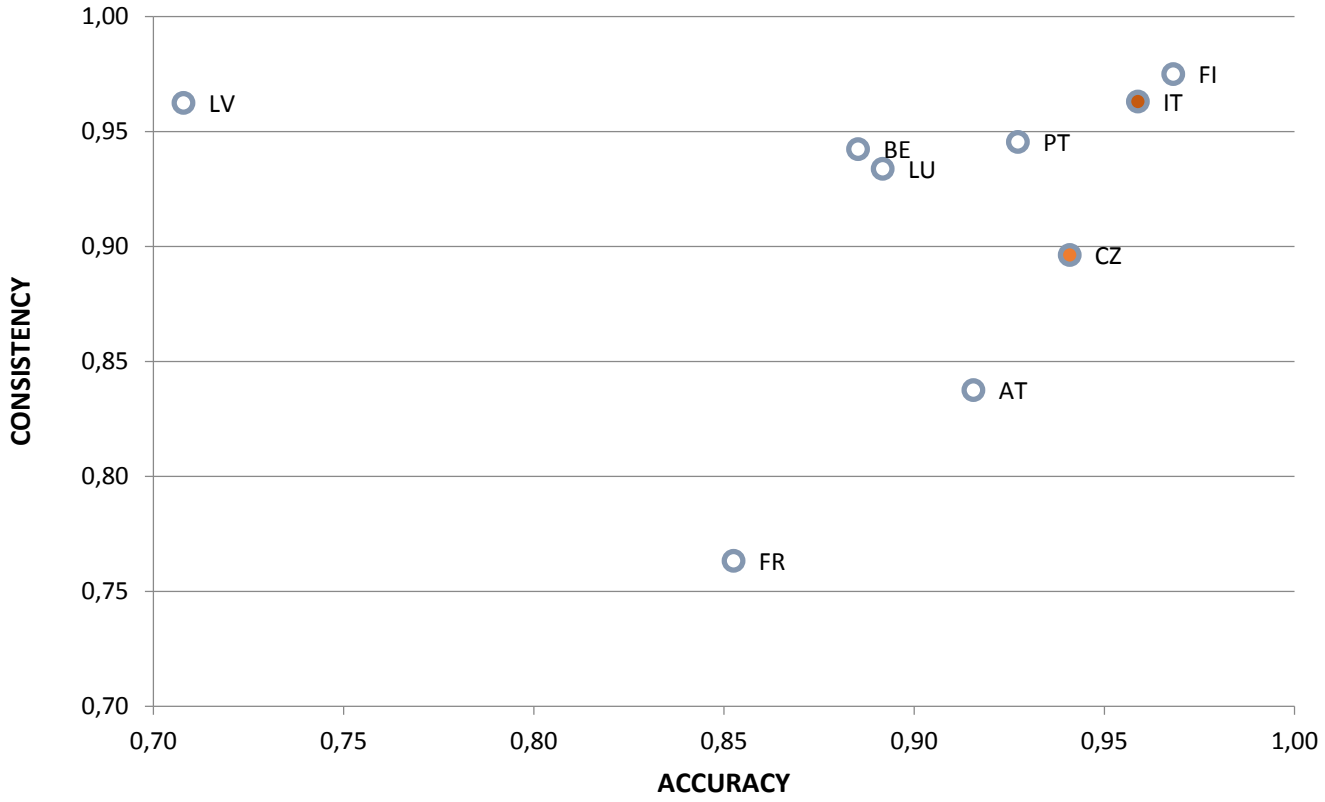
- ✓ ***ACCURACY AND CONSISTENCY***

$$accuracy = 1 - \left(abs\left(\frac{EST_t}{REF_t} - 1 \right) \right)$$

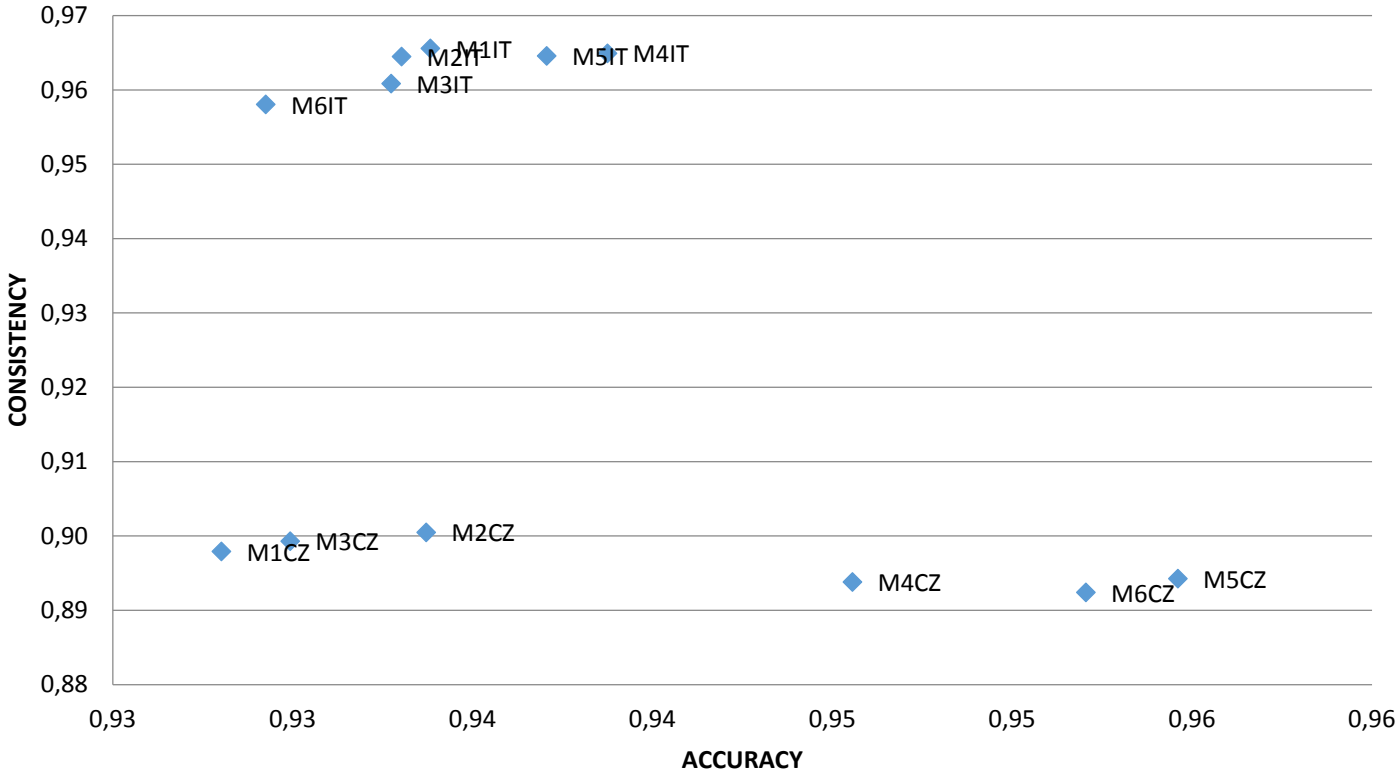
$$consistency = 1 - \left(abs\left(\frac{EST_t}{EST_{t-1}} - \frac{REF_t}{REF_{t-1}} \right) \right)$$

- Mainly for bechmarking and comparative studies
  - ➢ Across methods/countries/indicators
- Filter 'a set of good enough performers' to enter the second stage
- Detect difficult countries or indicators
- Assessing method convergence in terms of estimations
- Weighting methods according to their past performance

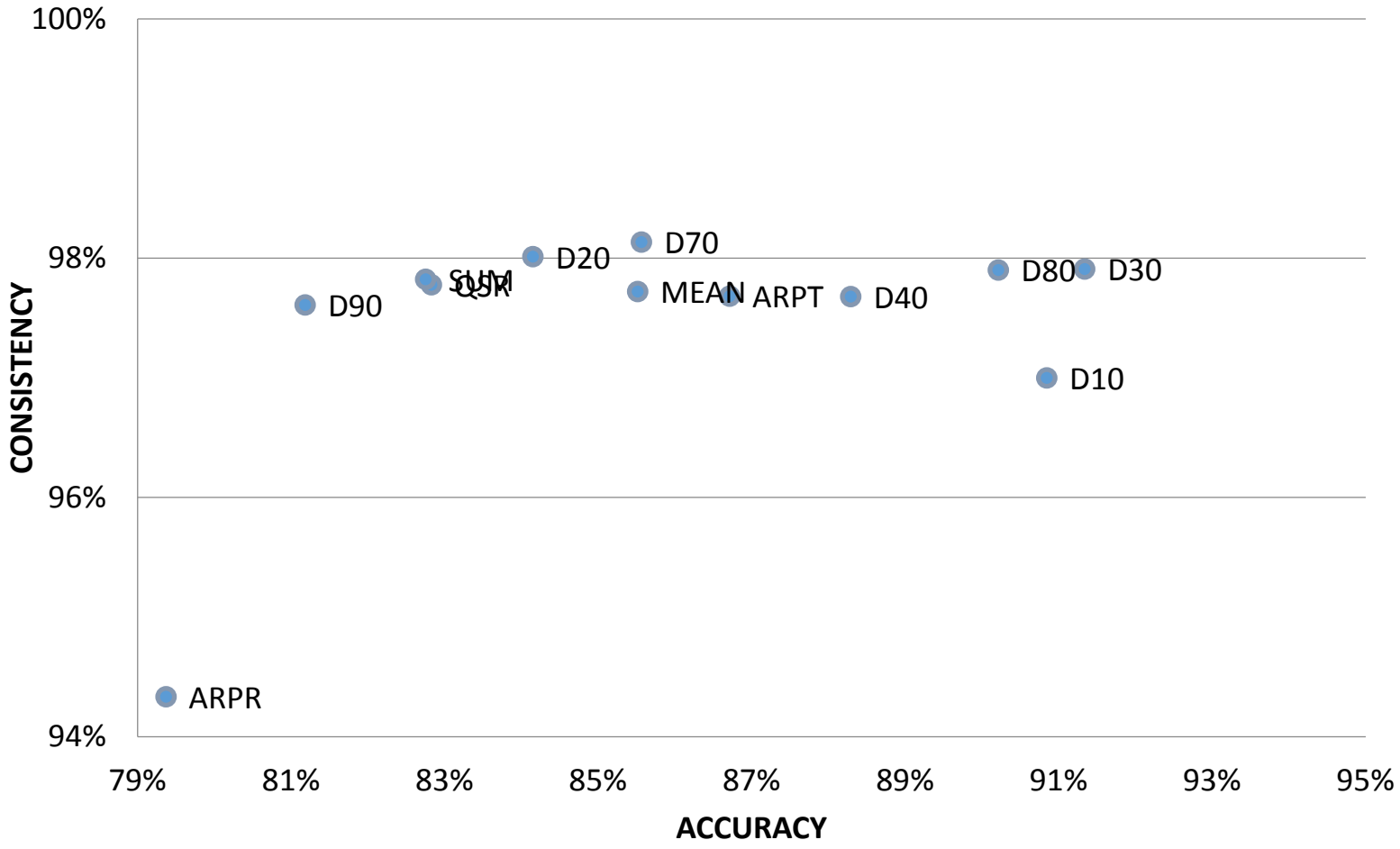
Performance by country (FE 2012-2013)



Performance by method: zoom in on CZ and IT



Performance by indicator (FE 2012-FE 2013)



Distribution Testing

- Denote as $\hat{F}_E(x)$ ($\hat{F}_S(x)$) the nowcasted (sample-based) cumulative distribution function at the target year

- The null hypothesis of distribution tests states that the nowcasted sample and the SILC sample are generated from the same population distribution

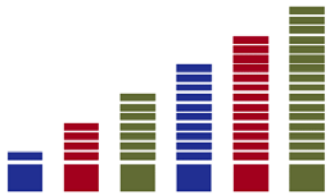
$$F_E(x) = F_S(x) \text{ for all } -\infty < x < +\infty$$

- In the case of the Kolmogorov-Smirnov test the similarity measure

$$D(x) = \sup_x \left| \hat{F}_E(x) - \hat{F}_S(x) \right|$$

Relative Performance: **Rank flash estimation approaches according to $D(x)$**

Absolute Performance: **Compute p-value of a given approach**



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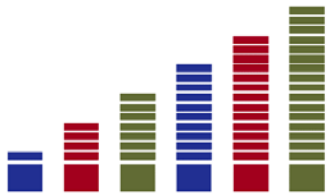
Distribution Testing

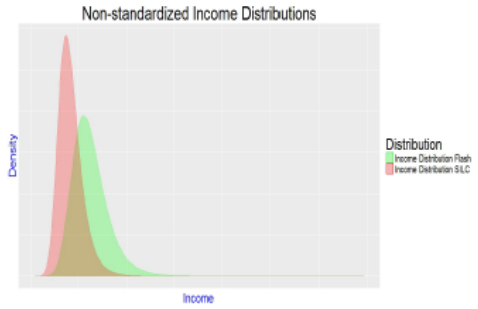
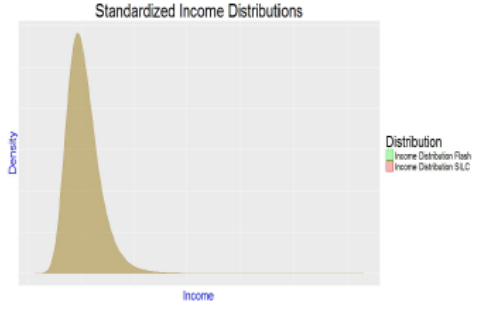
- Two random variables with identical probability distributions have the same set of income indicators
- Two random variables with distinct probability distributions do not necessarily have different sets of income indicators
- Rules of implication

$\bar{R}(H_0)$ $\Rightarrow$ Good performance of the income distribution flash estimate
$\Rightarrow$ Good performance of all the income indicator flash estimates

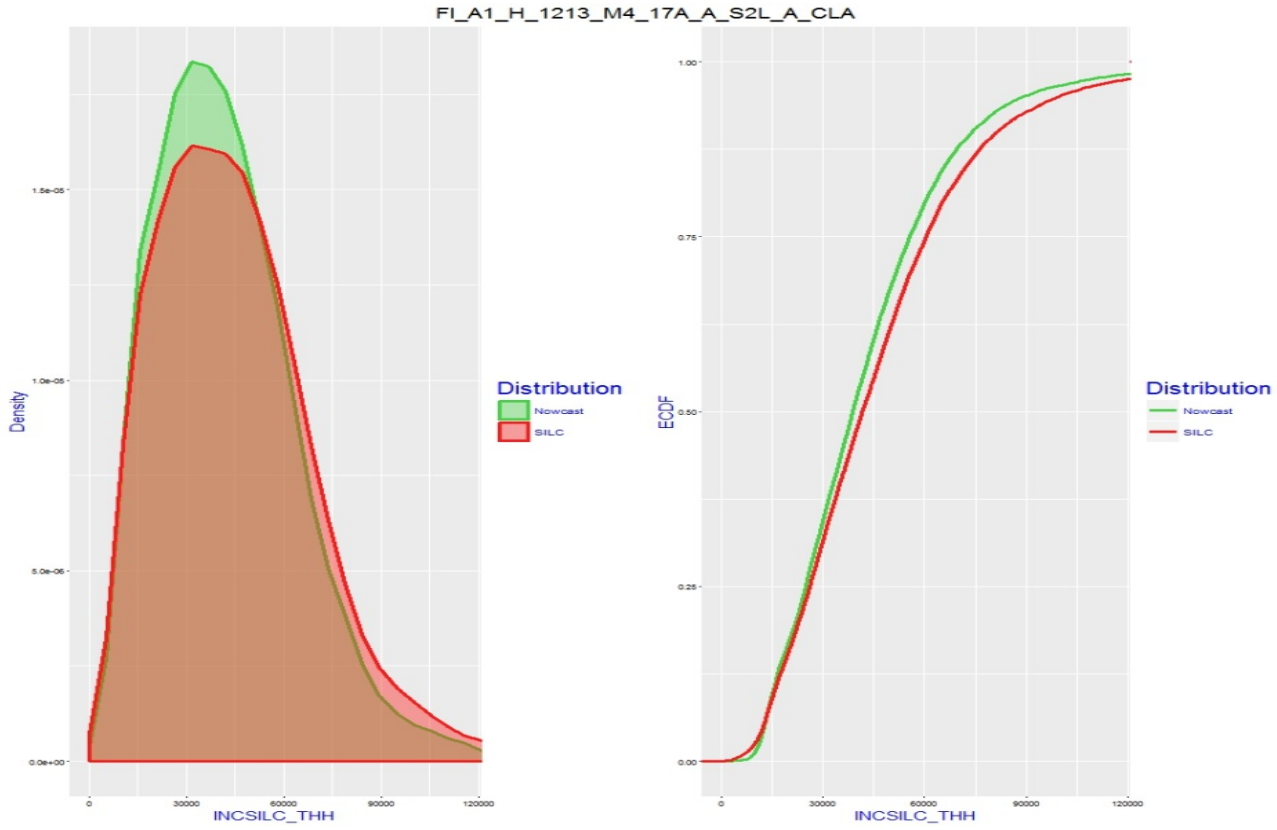
$R(H_0)$ $\Rightarrow$ Low performance of the income distribution flash estimate
$\not\Rightarrow$ Low performance of all the income indicator flash estimates



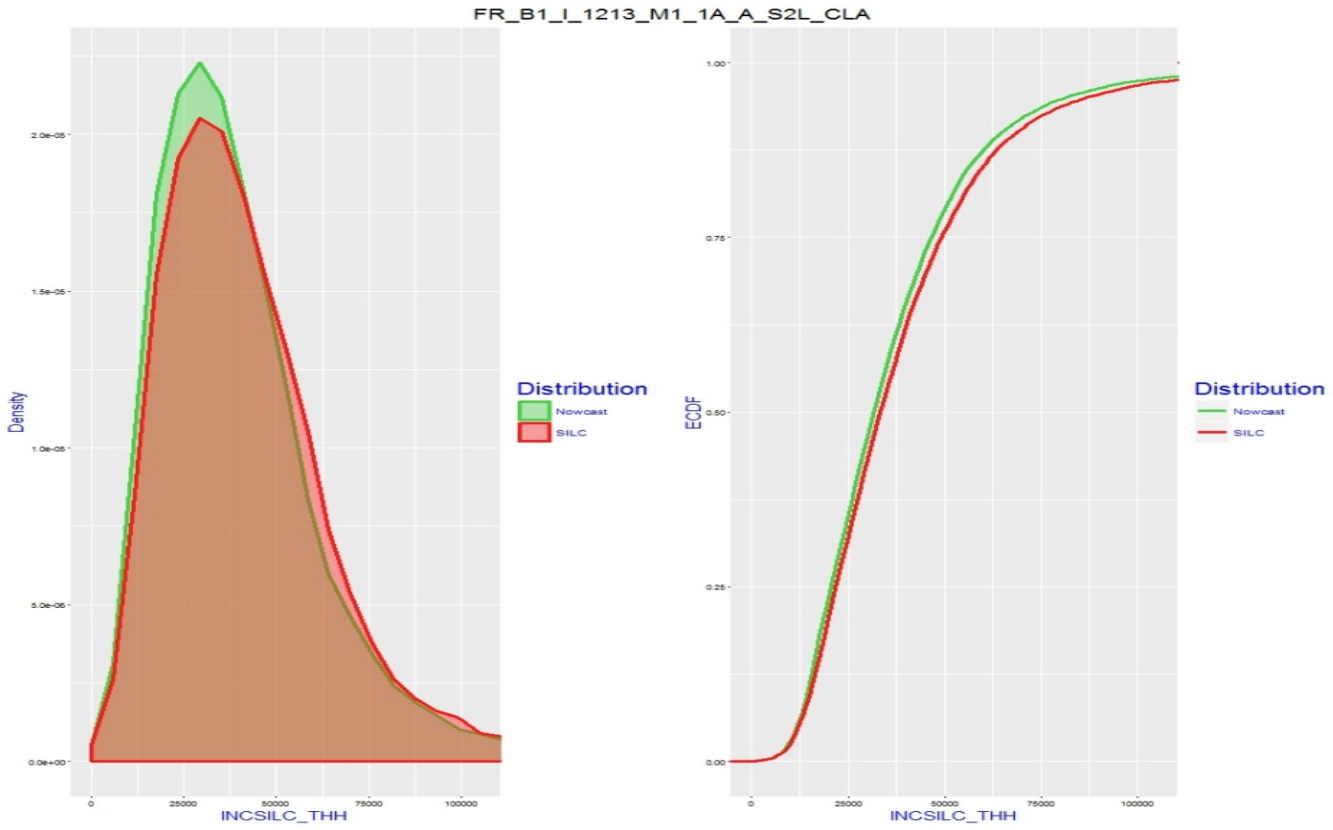
Distribution Testing

Densities	P-Value	ARPT	ARPR	QSR
	0	• 12000 • 15000	• 0.042 • 0.042	• 2.28 • 2.28
	1	• 0.6 • 0.6	• 0.042 • 0.042	• 2.28 • 2.28

Distribution Testing



Distribution Testing



Confidence Intervals for Indicator Flash Estimates

- Denote as $\hat{\theta}_E$ the flash estimate of a given income indicator and as $\hat{\theta}_S$ the corresponding indicator derived from SILC
- $\hat{\theta}_S$ is an unbiased estimator of the population indicator
- We want to test the following null hypothesis

$$H_0 : E(\hat{\theta}_E) = E(\hat{\theta}_S) \text{ and } \mathbf{Var}(\hat{\theta}_E) \leq \mathbf{Var}(\hat{\theta}_S)$$

- If both estimators are uncorrelated, one can use Markov's inequality to define the following confidence interval for $\hat{\theta}_E$ under H_0

$$P\left(\hat{\theta}_S - 2k\mathbf{SD}(\hat{\theta}_S) \leq \hat{\theta}_E \leq \hat{\theta}_S + 2k\mathbf{SD}(\hat{\theta}_S)\right) \geq 1 - \frac{1}{k^2}$$

- $\mathbf{SD}(\hat{\theta}_S)$ can be approximated on the basis of resampling methods