EUROPEAN COMMISSION
EUROSTAT

Directorate F – Social statistics
F.1 – Social indicators: Methodology and development; Relations with users

Version 1 – June 2024

Flash estimates of income inequalities and poverty indicators for 2023 (FE 2023)

Experimental results

Contents

1. Flash estimates provide early indicators on income and inequality a year ahead of final data

Providing timelier social statistics – especially indicators on income poverty and inequality – is a priority for the Commission and the European Statistical System.

Indicators on poverty and income inequality are based on EU statistics on income and living conditions (EU-SILC). These indicators are an essential tool to prepare the European Semester (the annual cycle of economic policy coordination between EU countries) and to monitor progress for the poverty and social exclusion targets.

While efforts for improving the timeliness of EU-SILC data are ongoing, the collection and processing of EU-SILC data for poverty and inequality will always have a certain time lag, as it collects the income information for the previous year.

In order to better monitor the effectiveness of social policies at EU level, flash estimates (FE) have been developed. These estimates are calculated based on nowcasting and modelling techniques[1] and have a release date appreciably earlier than the survey data: i.e., FE of income year 2023 published in June 2024 complementing EU-SILC 2023 data that refers to income year 2022[2]. These estimates can be used in preliminary discussions and analysis until the final EU-SILC 2024 data for income 2023 will become available in 2025.

2. What are the flash estimates on income distribution?

FE to a set of key income indicators:

a. **At-risk-of-poverty (AROP) & income quintile share ratio[3] (QSR)** are inequality indicators, both high on the priority of the Commission, Eurostat and the European Statistical System (ESS). They are used by policymakers at EU and national level for preparing the European Semester, and for identifying the key social trends.

---

1 Please see also the methodological note for more details.

2 The reference period for most of the information collected in EU-SILC is the survey year. However, income-based indicators refer to the previous calendar year (fixed 12-month period). For more information, please see also Income and Living Conditions (ILC) (europa.eu).

3 S80/S20 ratio.

b. **Evolution of income deciles (D1, D3, MEDIAN, D7 and D9)** can provide useful information on the developments within various parts of the income distribution. The deciles can provide support for assessing yearly changes in the distribution: they are more sensitive to income changes and therefore can be informative as early warnings as well as for better explaining the estimated changes in inequality indicators.

c. Breakdowns of AROP by age as well as the in-work poverty indicator provide further information on the evolution of AROP for particular sub-groups of the populations. In several countries there are different dynamics for particular age groups in comparison with the whole population. At the same time, the in-work poverty FE monitors the poverty risk for people on the labour market (e.g., the evolution of the share of temporary contracts, atypical workers and precarious self-employed).

It is important to note that the FE and EU-SILC values used throughout the paper always refer to income year and not the survey year.

Table 1. Definition of the inequality and income distribution indicators

Indicators	Definition
At-risk-of-poverty rate (AROP)	Share of people with an equivalised disposable income[4] (after social transfers) below the at-risk-of-poverty threshold, which is set at 60 % of the national median equivalised disposable income after social transfers. This indicator shows the percentage of the population whose income is likely to 'preclude them from having a standard of living considered acceptable in the society in which they live'[5].
Income quintile share ratio (QSR)	The ratio of total income received by the 20 % of the population with the highest income (the top quintile) to that received by the 20 % of the population with the lowest income (the bottom quintile). It is a measure of the inequality of income distribution.

[4] The equivalised income takes into account the structure of the household. The income is calculated by dividing the total household income by its size determined after applying the following weights: 1.0 to the first adult, 0.5 to each other household members aged 14 or over and 0.3 to each household member aged less than 14 years old.

[5] See for instance the Joint Report by the Commission and the Council on social inclusion as adopted by the Council (EPSCO) on 4 March 2004, Joint Report on Social Inclusion (europa.eu)

Indicators	Definition
Income deciles	Income deciles groups are computed on the basis of the total equivalised disposable income attributed to each member of the household. Nine cut-point values (the so-called **deciles cut-off points**) of income are identified, dividing the survey population into ten groups equally represented by 10 % of individuals each: The data (of each person) are sorted according to the value of the total equivalised disposable income and then divided into 10 equal groups each having 10 % of individuals. For example, the first decile group represents the 10 % of the population with the lowest income and decile 1 is the cut-off point for this group. Five representative income deciles have been selected in our analysis to show the evolution of the various parts of the national income distribution.
AROP by age groups	AROP by main age groups represents the share of people at-risk-of-poverty in the following sub-groups: 0-17 (child poverty); 18-64 and 65+.
In work poverty	Individuals (18+) who are classified as employed according to their most frequent activity status and are at risk of poverty. For the 'in work poverty risk indicators', an individual is considered as having a particular activity status if he/she has spent more than half of the reference year in that status.

FE aim to nowcast, to the extent possible, the values captured in the EU-SILC[6]. The main target indicators (AROP and QSR) are based on an entire distribution that evolve relatively slowly, except in times of crisis. Survey based yearly changes can be rather small and/or not statistically significant. It is therefore relevant:

- to assess yearly changes together with the trends during a certain period across several years,
- to consider the complete set of indicators as it provides a coherent picture about the evolution of the underlying income[7] distribution in each country. Deciles make it possible to assess the relation between changes in poverty or inequality and the relative movement at different points of the distribution. Deciles can help in answering better policy questions like: is a possible decrease of poverty related to a higher increase of the income for poorer people (left tail of the distribution) or is a possible decrease linked to a decline

6 Income and living condition OVERVIEW
7 Glossary: Equivalised disposable income
Methodology - Income and living conditions - Eurostat (europa.eu)

of the middle class? More generally, the examination of deciles at different points of the distribution helps to answer the questions on who is benefiting from growth and who is affected by recession.

3. How are the flash estimates on income distribution produced?

The FE aim to predict the changes in EU-SILC based indicator using auxiliary information available for the target year. Yearly changes are estimated as described below and combined with the EU-SILC value for the preceding year, which forms the baseline for the analysis.

A variety of approaches was tested, tailored to each country situation, and the most robust methodology for a given country was selected. The status of the FE as experimental statistics allows considering feedback from users and the research community in the methodology and further improving the FE.

The main methodology used for most countries is **microsimulation**. It relies on EUROMOD, the European Union tax-benefit microsimulation model originally maintained, developed and managed by the Institute for Social and Economic Research (ISER). Since 2021, EUROMOD is maintained, developed and managed by the Joint Research Centre (JRC) of the European Commission, in collaboration with Eurostat and national teams from the EU countries.

EUROMOD is used to simulate changes in the income distribution within the period of analysis. All simulations are carried out based on the tax-benefit rules in place in the given policy year.

For the purposes of the FE exercise, standard EUROMOD policy simulation routines are enhanced with additional adjustments to the input data to take into account changes in the evolution of employment and main indexation factors. The microsimulation approach in the frame of the FE exercise is based on earlier work done by ISER, University of Essex (Rastrigina, O., Leventi, C., Vujackov S. and Sutherland, H. (2016)) and is being further developed by Eurostat in collaboration with the task force on ‘Flash estimates on income distribution’. In general, microsimulation is the preferred approach for both main users and the National Statistical Institutes (NSIs) given the possibilities for further detailed analyses and the link with policy changes. For more details, please consult the latest Methodological Note FE 2023.

For Romania, the FE are based on **current income information** that refer to the current reference period (e.g., current month) collected in the Household Budget

Survey (HBS). For Sweden the estimates are based on the national microsimulation model.

An essential point in this exercise was the active participation of the Member States, the support from the JRC and the national EUROMOD teams, in the validation and improvement of the FE methodology and of the FE.

4. How were the flash estimates assessed?

FE income 2023 are produced by Eurostat (unless specified differently) and published as experimental statistics.

The publication as experimental statistics puts the basis for receiving feedback from users and the research community and further improving the FE. However, the accuracy of the indicators depends on the model assumptions and on several factors explained throughout the quality assessment. As with any other flash estimate, capturing perfectly changes in the EU-SILC estimates cannot be expected. Differences can appear, due to inconsistencies in the input datasets, model errors or theoretical assumptions underlying the microsimulation techniques. It is important to also consider a few caveats: incomplete information and model errors for the estimation of income from work; simulation of losses and compensation schemes for self-employed; over-simulation of benefits related to compensation schemes and assumptions of full take-up of benefits.

Developing FE on poverty and income inequalities in the ESS involves that their methods, sources, and output adhere to a common quality framework. It was developed together with the Member States and validated by the NSIs and the academic community.

The quality framework has two main parts:

1. **Quality as an integrated process in the production:** this ensures that quality is considered in the inputs and methods used in all the steps of the production, by analysing inconsistencies in the input data and performing several intermediate quality checks along the process. It is useful for finding possible sources of error and ways of fixing them.
2. **Quality assessment** put in place to ensure a comparable way to assess results stemming from different methods and national estimates within this ESS FE exercise:

    2.1 the plausibility of the estimated change is assessed based on the available information for the target year. Unlike forecasting, for FE several auxiliary

sources in the target year are used either in the estimation process or for validation checks (for plausibility assessment). Connecting the estimated changes in the income distribution with observed evolutions in related indicators (e.g., employment trends, total household income in national accounts, national data) is a key step in the quality assessment framework. This implies the triangulation of the diverse sources, the analysis of inconsistencies and adjustment of the models to ensure to the extent possible a consistent estimation of different income components and indicators. This analysis is further supported by the information on relevant changes in social policies described in EUROMOD country reports. Finally, to enhance the accuracy of our flash estimates, we also produce nowcasts of income indicators at the macro level using benchmark models based on simple time series analyses of EU-SILC data. This approach allows us to identify trends and verify whether deviations in the flash estimates from these trends are supported by changes in policy and labour market conditions.

2.2 the historical performance of the model is defined as the ability to accurately predict the past changes in the main target indicators as captured by EU-SILC. FE were simulated for past years and compared with EU-SILC indicators.

Please see also Annex 2 for more details on the quality assessment.

5. Communicating the FE: size and direction of change using Rounded Uncertainty Interval (RUI) dissemination format

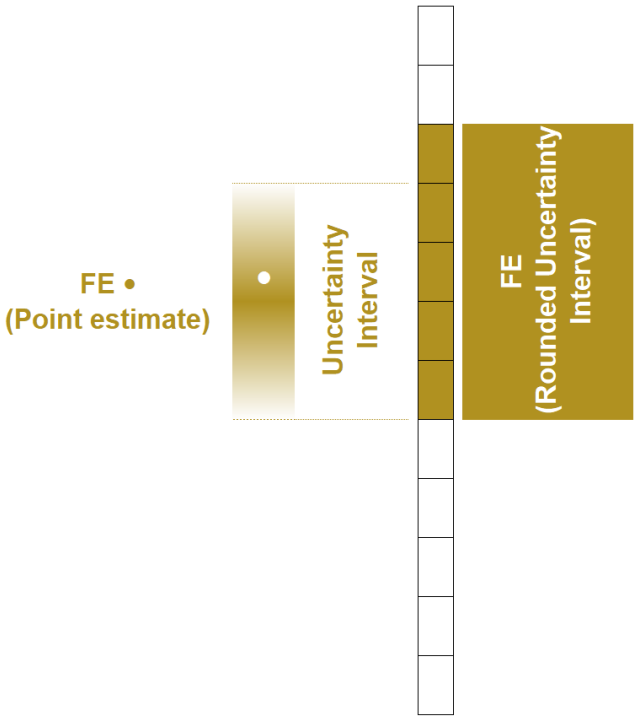
This report presents the figures for the FE relating to the income year 2023 (FE 2023, i.e., EU-SILC 2024 whose results are expected in the first half of 2025).

The FE are subject to several sources of uncertainty: e.g., model bias and variance, the sampling error in EU-SILC, inconsistencies between the different data sources entering the estimation. This raises not only a question of quality, but also of communication of the results. Following in-depth discussions with both users and producers, it was decided that the FE are disseminated using a **Rounded Uncertainty Interval** (RUI)[8]. This format takes into account that the expected changes cover a possible range of values, associated with uncertainty.

[8] This dissemination format is based on a proposal from Thomas Piasecki, Statistics Poland

RUI will give an indication – in terms of intervals – on the type (size and direction) of expected change. It is a way of communicating our estimates without showing the actual value (FE●, the point estimate), to minimise misinterpretation and misuse due to disregarding the uncertainty of the estimate. As the name suggests, it incorporates an uncertainty interval as the core element of the communication.

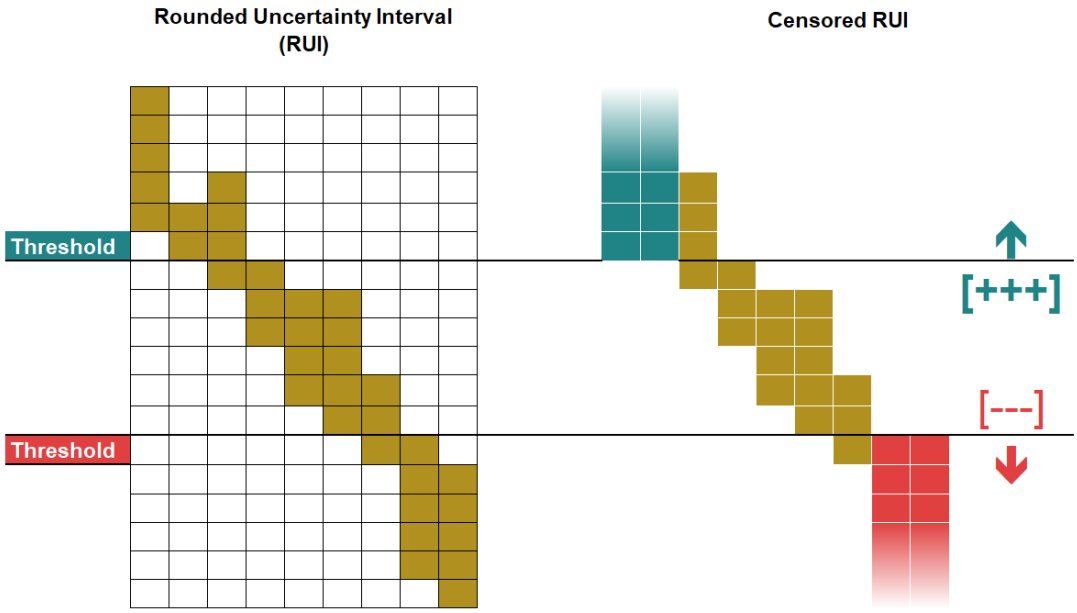
(1) It starts with a fine grid of predefined classes, which are a percentage point or half a percentage point wide (e.g., 1-2, 2-3, 11-12, or 5.5-6, 6-6.5, 6.5-7);
(2) The grid is superimposed on the interval reflecting the uncertainty of the estimate, and the interval is rounded outwards (expanded) to the nearest threshold;
(3) The resulting range – the Rounded Uncertainty Interval (RUI) – is communicated as FE, instead of the FE● (the point estimate).



The centre of RUI is NOT FE● (the point estimate) but is close. Using a single value to represent RUI should be avoided or interpreted as a general indication of the size and direction of the change.

Extreme values, where the uncertainty interval is entirely beyond a certain threshold, are censored, and an open-ended interval bounded by the threshold is shown instead of the RUI, conveying the message that the changes are relatively large. The lower limits that are considered as extreme values are: 2 percentage points (pp.) for AROP, 0.6 pp. for QSR, and 5 % for the deciles. These thresholds were data driven

and chosen based on the size of past changes and performance of the FE that is more imprecise in case of extreme values.



This is applied to the year-on-year (YoY) changes. The RUI of the levels is directly derived from the RUI of the YoY change.

The main advantages of the chosen communication format are that it is guiding the reader, in terms of statistical significance (to avoid over-interpretation of non-significant changes) and is providing useful information for users and policy makers concerning the expected changes and trends for income indicators.

6. Income evolution in 2023: flash estimates

This section presents the figures for FE 2023 in terms of absolute change for AROP and QSR and change in percent for the deciles. Figures 1-4 below show the FE 2023 translated into the RUI. Please note that only those estimates indicated as fit-for-purpose are disseminated.

FE are published as experimental data under the responsibility of Eurostat. All the NSIs have been associated in the validation of the FE 2023. In two countries FE are based on national sources: Sweden and Romania.

6.1. Calculation of the YoY change

AROP & QSR: $\mathrm{YoY}_{\mathrm{Year\ N}} = \mathrm{Indicator}_{\mathrm{Year\ N}} - \mathrm{Indicator}_{\mathrm{Year\ N-1}}$

Deciles (%): $\mathrm{YoY}_{\mathrm{Year\ N}} = \frac{\mathrm{Indicator}_{\mathrm{Year\ N}}}{\mathrm{Indicator}_{\mathrm{Year\ N-1}}} - 1$

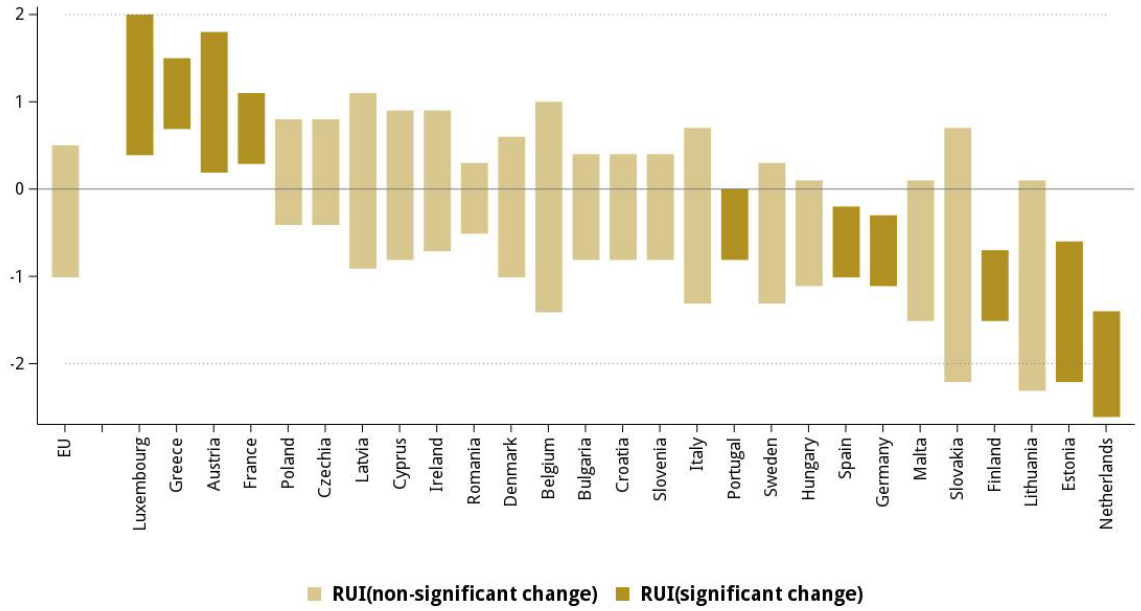
The visual is based on the centre of the RUI. For AROP and QSR, the intervals having large positive values are highlighted with red and the negative with green. For the income deciles 1, 3, 5 (or median), 7 and 9, the intervals having large negative values are highlighted with red and the positive with green.

Figures 1-4 provide the detailed results in terms of RUI for all countries available in the current release. To download the data for all the indicators go to Data for all indicators.

Dark yellow bars indicate the RUI for the FE 2023 in cases where the FE for the year-on-year change (FE●) are statistically significant. Yellow light bars indicate the RUI for the FE 2023 in cases where the FE for the year-on-year change (FE●) are not statistically significant. Dark green fading bars designate the censored RUI for large increases (see previous page).

In a few specific cases the FE is not published, as the estimate is considered not reliable (indicated by “NOT published”).

Figure 1: At-risk-of-poverty rate: year-on-year, income year 2023 vs 2022 (income year), pp. Flash estimates (FE) as Rounded Uncertainty Interval (RUI)

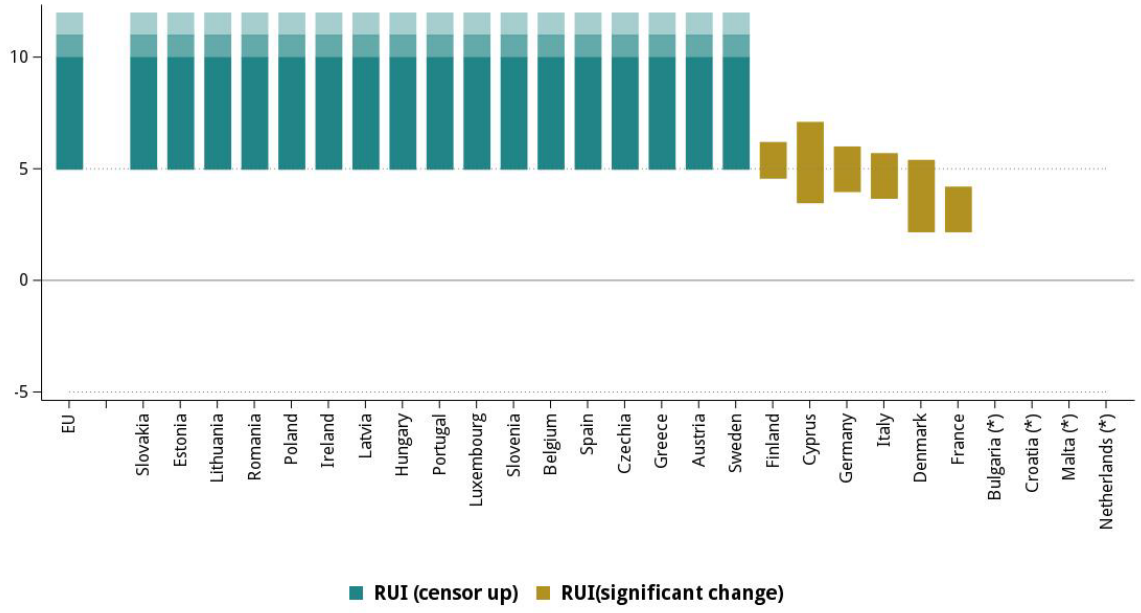


In descending order of year-on-year change
* Not published

eurostat

*Source:*Eurostat

Figure 2: Median equivalised disposal income: year-on-year % change, 2023 vs 2022. Flash estimates (FE) as Rounded Uncertainty Intervals (RUI)

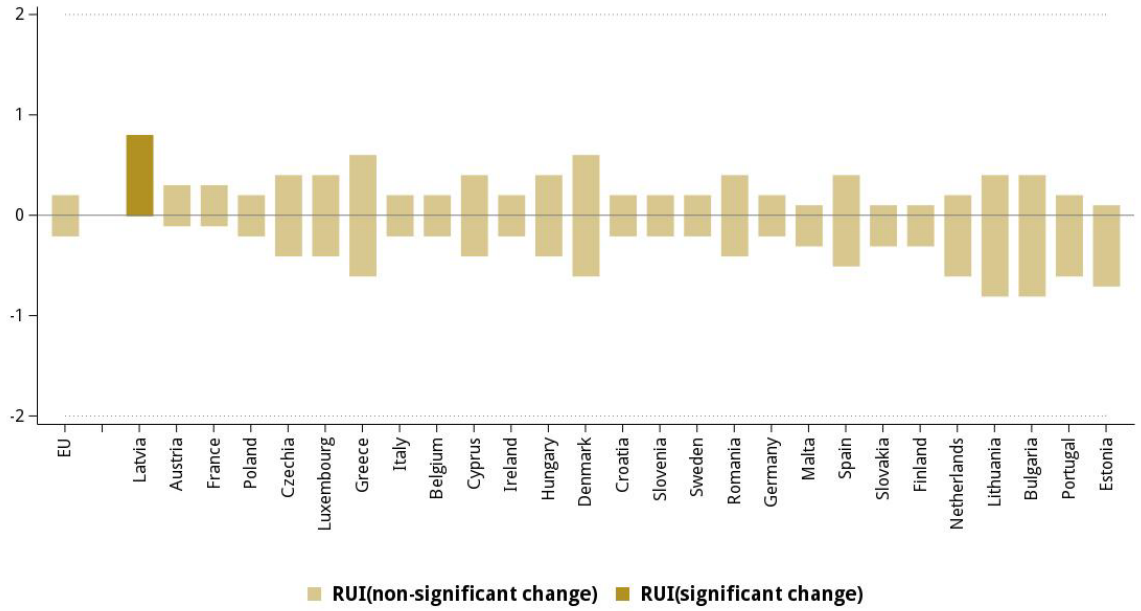


In descending order of year-on-year change
(*) Not published / (:) Not available

eurostat

*Source:*Eurostat

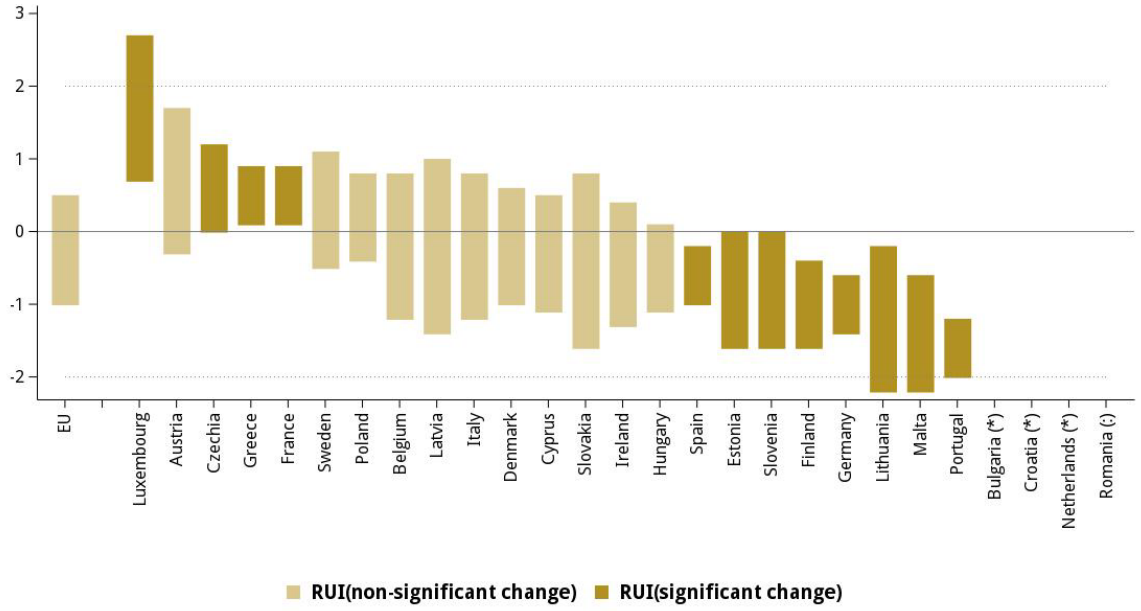
Figure 3: Income quintile share ratio (QSR): year-on-year % change, 2023 vs 2022. Flash estimates (FE) as Rounded Uncertainty Interval (RUI)



In descending order of year-on-year change
* Not published

Source:Eurostat

Figure 4: At-risk-of-poverty rate [18-64]: year-on-year change, 2023 vs 2022 (income year), pp. Flash Estimates (FE) as Rounded Uncertainty Interval (RUI)



In descending order of year-on-year change
(*) Not published / (:) Not available

Source:Eurostat

7. Main messages for the FE 2023

Below are the main messages that can be drawn based on the FE 2023[9] for the countries available in this first partial release:

- At the aggregate EU level, the at-risk-of-poverty rate is estimated to slightly decrease by 0.2 pp. in 2023. It is important to note that the indicator does not take into account the expenditure and cost of living of households. In addition, the evolution of AROP must be read considering the relative movement of the at-risk-of-poverty threshold (ARPT) in comparison with the evolution of income for different sub-groups along the distribution. Most countries show stability or not significant changes. A statistically significant increase is seen for Luxembourg, Greece, Austria, and France, while for Portugal, Spain, Germany, Finland, Estonia, and the Netherlands is estimated a statistically significant decrease. FE on breakdowns is not published when considered unreliable and too volatile.
- In 2023, according to the flash estimates the EU 2023 income is expected to continue to increase by about 6.0 % in nominal terms, while real income is expected to remain stable (0.2 %). At the EU level, 2023 still saw rising prices for food and non-alcoholic beverages (12.6 %), while prices for electricity, gas, and other fuels show a moderate annual average rate of change (1.4 %) following the significant increases in 2022 (42.4 %). Flash estimates in nominal terms show positive changes for all countries.
- In 2023, FE show rather a stable trend in income inequalities, as measured by the quintile share ratio in all country except Latvia where a significant increase as been registered. This can be explained by the joint movement of the deciles, i.e., by non-particularly unbalanced changes along the various parts of the income spectrum.
- At the aggregate EU level, the at-risk-of-poverty rate breakdown for the age class 18-64, is estimated to slightly decrease by 0.3 pp. in 2023. A statistically significant increase is indicated for Luxembourg, Czechia, Greece, and France, while for Spain, Estonia, Slovenia, Finland, Germany, Lithuania, Malta, and Portugal is estimated a statistically significant decrease.

[9] It is important to note that the flash estimates and EU-SILC values used throughout the paper always refer to income year and not the survey year.

Annex 1– Standard deviation and significance

As mentioned, the RUI is based on thresholds dependent on the standard deviation in EU-SILC, which is country and indicator specific. It is important to note that is also communicated if the change is statistically significant. At this stage, the sampling error is considered for the significance of the change. In countries with large standard deviations, higher values of yearly changes are more likely to be considered not statistically different from zero.

For the main inequality indicators, the usual calculation of Eurostat for the standard deviation of the net change[10] is used. It calculates the variance of the net change based on multivariate linear regression technique (Berger and Priam, 2016) that reduces non-linear statistics to a linear form and takes into account the overlap of samples between years. For deciles, Eurostat has developed a bootstrapping procedure for computing the variance of the estimates. 1 000 subsamples of the EU-SILC dataset at the target year have been used, with each individual having a probability of $\frac{w_j}{\sum_{j=1}^{p} w_j}$ to be drawn where w_j denotes the sample weight of the j^{th} individual and the size of the subsamples being equal to the number of individuals in the EU-SILC dataset. Then all indicators of interest for each one of these replicated data sets are computed. The collection of computed indicators can then be used to obtain an estimate of the sampling distribution of the EU-SILC indicators (unweighted). The standard deviation of the change for deciles is likely to be overestimated, as it does not consider the overlap of samples between two consecutive years in EU-SILC. In the future, it is foreseen to apply the same estimation procedure as for AROP and QSR.

Table 2 shows the significance bounds for all countries.

[10] Standard error estimation for the EU-SILC indicators of poverty and social exclusion - 2013 edition

Table 2. Range of values for which the YoY is not statistically significant – main indicators (%)

Country	Income year	AROP	QSR	D1	D3	MEDIAN	D7	D9
EU	2023	+/-0.4%	+/-0.1%	+/-1.2%	+/-0.9%	+/-0.8%	+/-0.7%	+/-1.0%
AT	2023	+/-0.8%	+/-0.2%	+/-2.2%	+/-1.6%	+/-1.4%	+/-1.6%	+/-2.6%
BE	2023	+/-1.2%	+/-0.2%	+/-1.8%	+/-1.4%	+/-1.8%	+/-1.4%	+/-2.0%
BG	2023	+/-0.6%	+/-0.6%	+/-4.6%	+/-2.4%	+/-1.8%	+/-1.6%	+/-4.2%
CY	2023	+/-0.8%	+/-0.4%	+/-1.4%	+/-1.4%	+/-1.8%	+/-1.8%	+/-2.6%
CZ	2023	+/-0.6%	+/-0.4%	+/-1.6%	+/-1.2%	+/-0.8%	+/-1.2%	+/-2.0%
DE	2023	+/-0.4%	+/-0.2%	+/-1.8%	+/-1.2%	+/-1.0%	+/-1.2%	+/-1.4%
DK	2023	+/-0.8%	+/-0.6%	+/-2.0%	+/-1.6%	+/-1.6%	+/-1.4%	+/-2.2%
EE	2023	+/-0.8%	+/-0.4%	+/-2.4%	+/-1.8%	+/-2.2%	+/-2.4%	+/-2.2%
EL	2023	+/-0.4%	+/-0.6%	+/-1.6%	+/-1.0%	+/-0.8%	+/-0.8%	+/-1.0%
ES	2023	+/-0.4%	+/-0.4%	+/-2.8%	+/-1.4%	+/-1.2%	+/-1.0%	+/-1.6%
FI	2023	+/-0.4%	+/-0.2%	+/-1.2%	+/-1.0%	+/-0.8%	+/-0.8%	+/-1.2%
FR	2023	+/-0.4%	+/-0.2%	+/-1.0%	+/-1.0%	+/-1.0%	+/-0.8%	+/-1.4%
HR	2023	+/-0.6%	+/-0.2%	+/-3.0%	+/-1.6%	+/-1.6%	+/-1.6%	+/-2.0%
HU	2023	+/-0.6%	+/-0.4%	+/-1.8%	+/-1.4%	+/-1.2%	+/-1.6%	+/-1.8%
IE	2023	+/-0.8%	+/-0.2%	+/-1.6%	+/-2.2%	+/-1.6%	+/-1.2%	+/-1.8%
IT	2023	+/-1.0%	+/-0.2%	+/-2.0%	+/-1.0%	+/-1.0%	+/-0.8%	+/-1.2%
LT	2023	+/-1.2%	+/-0.6%	+/-3.0%	+/-3.2%	+/-2.4%	+/-2.8%	+/-4.2%
LU	2023	+/-0.8%	+/-0.4%	+/-2.4%	+/-1.6%	+/-1.8%	+/-1.8%	+/-2.0%
LV	2023	+/-1.0%	+/-0.4%	+/-2.6%	+/-2.6%	+/-1.6%	+/-1.8%	+/-2.8%
MT	2023	+/-0.8%	+/-0.2%	+/-2.4%	+/-2.2%	+/-2.2%	+/-1.8%	+/-2.8%
NL	2023	+/-0.6%	+/-0.4%	+/-1.2%	+/-1.0%	+/-1.2%	+/-1.0%	+/-1.2%
PL	2023	+/-0.6%	+/-0.2%	+/-1.8%	+/-1.2%	+/-0.8%	+/-1.0%	+/-1.8%
PT	2023	+/-0.4%	+/-0.4%	+/-2.2%	+/-1.4%	+/-1.0%	+/-1.2%	+/-2.0%
RO	2023	+/-0.4%	+/-0.4%	+/-2.8%	+/-1.8%	+/-1.6%	+/-2.0%	+/-2.2%
SE	2023	+/-0.8%	+/-0.2%	+/-2.0%	+/-2.0%	+/-1.4%	+/-1.4%	+/-1.8%
SI	2023	+/-0.6%	+/-0.2%	+/-1.2%	+/-1.2%	+/-1.0%	+/-1.0%	+/-1.4%
SK	2023	+/-1.4%	+/-0.2%	+/-2.0%	+/-1.4%	+/-1.2%	+/-0.6%	+/-1.4%

Annex 2 – Quality Assessment Framework

FE are assessed on a specific quality framework developed together with the Member States and validated via a dedicated Task Force with the National Statistical Institutes and the academic community. This Quality Assessment Framework (QAF) aims to provide a common platform to assess Eurostat and national estimates.

The QAF is composed of two parts:

- the quality assurance, that ensures that quality, is considered in the inputs and methods used in all the steps of the production, by analysing inconsistencies in the input data and performing several intermediate quality checks along the process. It is useful for identifying possible sources of error and ways of fixing them.
- the quality assessment, which includes A) an extensive ex-ante assessment of the plausibility of the FE given the information available at the production stage and B) the ex-post assessment of the historical performance of different methods.

A.1. Ex-ante quality assessment and validation

For quality assessment and validation purposes, the triangulation of different observed auxiliary sources was essential during the COVID-19 pandemic. Income flash estimates were benchmarked against detailed labour market changes in the Labour Force Survey, additional targets from administrative data on beneficiaries of short-term schemes as well as macro-indicators such as the gross disposable income in National Accounts. In some cases, methodological adjustments were needed to provide a coherent analysis of the current changes in important social and economic factors[11].

Furthermore, bilateral consultations with the Member States are carried out before the estimates are published. The aim of the consultation is to collect feedbacks and comments on the plausibility of the results directly from the national statistical institutes, and in some cases, where available, to compare the results with national flash estimates.

Therefore, there are four main steps in the plausibility analysis:

[11] Such a multi-lateral consultation approach was, for instance, particularly successful for the registration of work compensation schemes during the pandemic. The comparison of hourly labour cost data, total wages and salaries and other labour statistics from the national EUROMOD teams were helpful to feed into the analysis of the changes to employment income during the COVID-19 crisis.

1) An analysis of the plausibility of the FE given the general evolution for related indicators on the labour market (employment, wages).
2) An analysis of the plausibility of the FE given changes in policies. These are calculated using the EUROMOD version I6.0+ model and are supported with the analysis of the country reports by EUROMOD national teams[12];
3) A comparison with the National Accounts data for gross disposable income and main income components at aggregated level (microsimulation countries only);
4) Additional national information provided by Member States (where available).

A.1.1. Labour changes

For FE 2023 we modelled the net employment transitions: overall trends in labour market are translated in distributional information by assessing the probabilities to lose/find employment. These are modelled via a logistic regression at individual level based on EU Labour Force Survey (EU-LFS) longitudinal data. In practical terms it means that individuals in sample are selected for transitions based on their conditional probabilities of losing or finding employment. The main covariates in the model used to identify profiles of workers are age, sex, education, economic sector, occupation and type of contract. Both detailed targets and the probabilistic selection allow to 'distribute' the labour risks for workers and households at distinct parts of the income distribution. The table below shows the degree to which EU-LFS targets are replicated in the baseline EU-SILC file.

A.1.2. Policy changes

Following the labour market changes, the latest social policies and schemes are simulated using EUROMOD. The nowcasting methodology is based on an integrated methodological framework, which aims to combine labour dynamics and social policies. For FE 2023, following the return to work and the end of sanitary restrictions, short term schemes were not simulated anymore.

EUROMOD *I6.0+*, is used to simulate the policies in place in 2023 and the changes in the income distribution within the period of analysis. For 2023, EUROMOD includes income support measures introduced to shield consumers from rising and volatile energy prices, as well as policies that positively impact families and children.

Regarding anti-inflationary measures, compared to 2022, several trends can be observed: (i) discontinued most of the measures in 2023 compared to 2022 (for example Belgium, Bulgaria, Croatia, Lithuania); (ii) the scope of policy coverage has been reduced in 2023 compared to 2022, resulting in a decrease in allowances family/children or housing (for example Austria, The Czech Republic, Estonia, France, Italy); (iii) Policies from 2022 that have been replaced by new ones in 2023

[12] EUROMOD Country reports

to increase individuals' income (for example Germany, Portugal and Slovenia).On the other hand, it is important to note that several measures were not simulated in the model due to lack of data on the household energy consumption or the amounts compensated.

When referring to policies in favour of families and children, EUROMOD analysis revealed a generally positive impact on families and children across most EU countries. There are notable increases in family and children's allowances due to significant increases in specific simulated benefits (e.g., Estonia, Italy and the Netherlands), revised eligibility criteria (e.g., Estonia and Italy), and introduction of supplemental supports (e.g., Portugal and Slovakia). These measures have contributed to reducing significatively AROP for children in these countries. However, for specific countries (e.g., Czechia, Greece, and Latvia) temporary financial aids provided in 2022 are estimated to be reduced or cut, leading to decreased allowances and higher child poverty rates in 2023.

More information on the specific energy measures and families and children allowances simulated in EUROMOD in different countries can be found in the EUROMOD Country Reports.

Further inflation-adjusted indicators using the harmonised index of consumer prices were computed to take into account the cost of living. For more details go to the webpage on treatment of energy price compensation measures in the HICP (Harmonised Indices of Consumer Prices).

Therefore, the FE reflect partially the support measures put in place to support households purchasing power in the context of the sharp rise in prices.

A.1.3. Comparison with National Accounts

Table 3 provides a comparative change in the size for the yearly change of the total disposable income between the FE and the Sector Accounts. In 2023, all the Member States experienced an increase in total income. In general, the direction and magnitude in the FE and in National Accounts are remarkably similar for countries where the data is available, except for Denmark, France, Italy, Netherlands, Slovenia, and Spain. In some cases, there are differences, which should be interpreted considering the underlying comparability of income (trends) from EU-SILC and National Accounts. For more details, please see Eurostat centralized exercise on EU-SILC-National Accounts reconciliation.

Table 3 Comparison with National Accounts: evolution total disposable income

COUNTRY	Magnitude*YOY Total income Flash estimate	Magnitude*YOY Total income National Accounts
Austria	↗	↗
Belgium	↗	↗
Bulgaria[(a)]	↑	
Cyprus[(a),(b)]	↗	↗
Czechia	↗	↗
Germany	↗	↗
Denmark	→	↗
Estonia[(a),(b)]	↑	↑
Greece	↗	↗
Spain	↗	↑
Finland	↗	↗
France	→	↗
Croatia[(a)]	↑	
Hungary	↑	↑
Irland	↗	↗
Italy	→	↗
Lithuania[(a),(b)]	↑	↑
Luxembourg[(a)]	↗	
Latvia[(a),(b)]	↗	↗
Malta[(a)]	→	
Netherlands	↗	↑
Poland	↑	↑
Portugal	↗	↗
Slovenia	↗	↑
Slovakia[(a),(b)]	↑	↑

Magnitude	
0%-5%	→
5%-10%	↗
>=10%	↑

Source: Eurostat calculations, gross disposable income [nasq_10_nf_tr and nasa_10_nf_tr] and FE data.

(a) Represents the countries where National Accounts data for benchmarking our estimation of the disposable income is unavailable.

(b) Represents countries where AMECO data is used to benchmark our estimation of the disposable income.

The table includes only countries for which (1) microsimulation was used and (2) yearly or quarterly data is available for the sector household; non-profit institutions serving households (S14_S15). For BG, HR, LU, MT, there is no available data from the Sector Accounts.
Sweden and Romania are based on national flash estimates and not listed in table 3.

A.1.4. Additional national information provided by Member States

In addition to the aforementioned plausibility analysis, all Member States were consulted concerning the FE and, in some cases, Eurostat received additional information based on national sources or models.

For more information on the models and nowcasting techniques please see also the methodological note.

A.2. Ex-post assessment of historical performance

In general, during the first years of publication of FE, different methodologies were tested and benchmarked according to their historical performance. The historical performance is defined as the ability of FE to capture EU-SILC observed year-on-year changes and is mainly assessed based on mean absolute error (MAE)[13]. This was supported by a much more detailed analysis of income components and labour variables.

The FE are essentially model based and rely on several assumptions and caveats so they cannot perfectly capture changes in the EU-SILC estimates. Although there are still limitations in the current methodology and its ability to replicate the changes in EU-SILC, it can provide an early indication of the direction of change.

Their accuracy depends on several factors that need to be considered:

- model errors and assumptions concerning the evolution of labour market income and simulation of social benefits;
- inconsistencies between different auxiliary sources that enter the estimation process and EU-SILC;
- the standard deviation of the target indicators which are based on surveys: the higher the variance of EU-SILC indicators, the lower the ability of the model to capture exactly the point estimate.
- breaks in EU-SILC data series and revisions: in general, results for the microsimulation when simulating back are based on older files. Results improve for the last years, as more recent files are used for producing the FE and with ongoing efforts to introduce disaggregated benefits in EU-SILC and to improve the precision of simulations in EUROMOD.

[13] $MAE = \text{mean}(\text{abs}(e_y))\ where\ \ e_y\ for\ deciles = \ YoY.REF_y - YoY.EST_y (or\ YoY) = \frac{REF_y}{REF_{y-1}} - \frac{EST_y}{EST_{y-1}}$

Annex 3 – Data sources and availability

The data used in this report for the FE is based on Eurostat estimations. For microsimulation, the **information set** that entered includes the EUROMOD model combined with the latest EU-SILC users' database (UDB) microdata file and/or national SILC microdata[14] available at the time of production. This is enhanced with more timely auxiliary information from the reference period (2023) such as EU-LFS, Labour Cost Index and National Accounts, etc.

The data used for the target indicators for previous income years are primarily derived from data from EU statistics on income and living conditions (EU-SILC). The reference population is all private households and their current members residing in the territory of an EU Member State at the time of data collection. Persons living in collective households and in institutions are generally excluded from the target population.

Main tables

- Income and living conditions (t_ilc)

EU-SILC further information

- Income, social inclusion and living conditions
- EU-SILC methodology

EU-LFS further information

The EU-LFS is the largest EU sample survey covering the resident population aged 15 and over, in private households in the EU. It provides detailed quarterly and annual data on employment and unemployment, broken down along many dimensions. For in-depth information on EU Labour Force Statistics please consult the below links:

- EU-LFS data
- EU labour force statistics - methodology

[14] EU-SILC 2022 UDB, 2021 for Bulgaria and Poland.

For Romania current income from the HBS[15] was used. The HBS is organised as a continuous quarterly survey over a period of three consecutive months.

The survey covered people with permanent residence in Romania, members of households in all counties and in Bucharest. Main variables collected are expenditures, incomes, endowment with durable goods and other demographic variables.

[15] HBS - Current income

Annex 4 – References

Avram, S., Sutherland, H., Tasseva, I. and Tumino, A. (2011) Income protection and poverty risk for the unemployed in Europe, Research Note 1/2011 of the European Observatory on the Social Situation and Demography, European Commission.

Banbura, M., Giannone, D., Modugno, M. and Rechlin, L. (2013) Now-casting and the real-time data flow, ECB (European Central Bank) Working Paper Series, no. 1564, pp. 1-53.

Berger, Y.G., and Priam, R. (2016) A simple variance estimator of change for rotating repeated surveys: an application to the European Union Statistics on Income and Living Conditions household surveys, Journal of the Royal Statistical Society, Series A Statistics in Society, vol. 179, issue, January 2016, pp. 251–272

Bourguignon, F., Bussolo, M. and Da Silva, L.P. (2008) The impact of macro-economic policies on poverty and income distribution Macro-Micro Evaluation Techniques and Tools, The World Bank and Palgrave-Macmillan, New York.

Bourguignon, F., and Spadaro, A. (2006), Microsimulation as a tool for evaluating redistribution policies. The Journal of Economic Inequality, 4(1), 77-106.

Brandolini, A., Rosolia, A., Torrini, R. (2010), The distribution of employees' labour earnings in the European union: Data, concepts and first results. In: Atkinson, AB., Marlier, E. (eds) Income and Living Conditions in Europe. Luxembourg: Publications Office of the European Union, pp. 265–287.

Brandolini, A., D'Amuri, F. and Faiella, I. (2013) "Country case study – Italy", Chapter 5 in Jenkins et al, The Great Recession and the Distribution of Household Income, Oxford: Oxford University Press.

Brewer, M., Browne, J., Hood, A., Joyce, R., Sibieta, L. (2013) The Short- and Medium-Term Impacts of the Recession on the UK Income Distribution, Fiscal Studies, 34(2): 179–201.

Brewer, M. and Tasseva, I. V. (2020), Did the UK Policy Response to COVID-19 Protect Household Incomes? EUROMOD Working Paper Series EM 12/20.

Bronka, P., Collado, D., and Richiardi, M. (2020), The Covid-19 Crisis Response Helps the Poor: The Distributional and Budgetary Consequences of the UK Lock-Down. EUROMOD Working Paper Series EM 11/20.

Bruckmeier, K., Peichl, A., Popp, M., Wiemers, J., & Wollmershäuser, T. (2020), Distributional effects of macroeconomic shocks in real-time: A novel method applied to the Covid-19 crisis in Germany. Available at SSRN 3746763.

Canelli, R., Fontana, G., Realfonzo, R., & Passarella, M. V. (2021), Are EU policies effective to tackle the covid-19 crisis? The case of Italy. Review of Political Economy, 33(3), 432-461.

Christl, M., Poli, S. D., Hufkens, T., Peichl, A., & Ricci, M. (2021), The role of short-time work and discretionary policy measures in mitigating the effects of the covid-19 crisis in Germany.

Christl, M, De Poli, S., Figari, F., Hufkens, T., Leventi, C., Papini, A., Tumino, A. (2021), The cushioning effect of fiscal policy in the EU during the COVID-19 pandemic, JRC Working Papers on Taxation and Structural Reforms, 2-2021.

Deville, J.-C. (1999) Estimation de variance pour des staistiques et des estimateurs complexes: linéarisation et techniques des résidus. Techniques d'enquête, 25, 219-230.

Deville, J.-C. and Särndal, C.-E. (1992). Calibration estimators in survey sampling. Journal of the American Statistical Association, 87, 376-382.

Dornean, A., & Oanea, D. C. (2022), The Effectiveness of Fiscal-Budgetary Measures to Counteract the COVID-19 Crisis. Evidence from EU Countries. Economics, 16(1), 137-151.

Essama-Nssah, B. (2005) The Poverty and Distributional Impact of Macroeconomic Shocks and Policies: A Review of Modelling Approaches, World Bank Policy Research Working Paper 3682, Washington, DC.

EUROMOD (2020) Effects of tax-benefit policy changes across the income distributions of the EU-28 countries: 2018-2019, EUROMOD Working Paper Series EM15/20, Institute for Social and Economic Research, University of Essex

Eurostat (2023) , Latest developments in income dynamics and poverty

Fernandez-Macias, E., Vacas-Soriano, C. (2016), A coordinated European Union minimum wage policy? European Journal of Industrial Relations, 22(2): 97-113.

Fernandez Salgado M., Figari, F., Sutherland, H. and Tumino, A. (2014) Welfare compensation for unemployment in the Great Recession, The Review of Income and Wealth, 60(S1): 177–204.

Figari, F., Iacovou, M., Skew, A. and Sutherland, H. (2012) Approximations to the truth: comparing survey and microsimulation approaches to measuring income for social indicators, Social Indicators Research, 105(3): 387-407.

Figari, F., A. Paulus and H. Sutherland (2015) “Microsimulation and Policy Analysis” in A.B. Atkinson and F. Bourguignon (Eds.) Handbook of Income Distribution, Vol 2B. Amsterdam: Elsevier, pp. 2141-2221. ISBN 978-0-444-59430-3

Figari, F., Salvatori, A. and Sutherland, H. (2011) Economic downturn and stress testing European welfare systems, Research in Labor Economics, 32: 257-286.

Hjort, N. L and Claeskens, G. (2003) Frequentist model average estimators, Journal of the American Statistical Association, 98: 879-899.

Gasior, K. and Rastrigina, O. (2017) Nowcasting: timely indicators for monitoring risk of poverty in 2014-2016, Research Note 1/2016, Social Situation Monitor, European Commission.

Immervoll, H., Lindström, K., Mustonen, E., Riihelä, M., & Viitamäki, H. (2005c). Static data “ageing” techniques. Accounting for population changes in tax-benefit microsimulation. EUROMOD Working Paper, EM7/05.

Immervoll, H., Levy, H., Lietz, C., Mantovani, D. and Sutherland, H. (2006) The sensitivity of poverty rates in the European Union to macro-level changes, Cambridge Journal of Economics, 30: 181-199.

Jara, X.H. and Leventi, C. (2014) Baseline results from the EU27 EUROMOD (2009-2013), EUROMOD Working Paper EM18/14, Colchester: ISER, University of Essex.

Keane C., Callan, T., Savage, M., Walsh, J.R. and Timoney, K. (2013) Identifying Policy Impacts in the Crisis: Microsimulation Evidence on Tax and Welfare, Journal of the Statistical and Social Inquiry Society of Ireland, XLII: 1-14.

MacDonald, J. B. and Xu, Y. J. (1995) A generalization of the beta distribution with applications, Journal of Econometrics, vol. 66, no. 1-2, pp. 133-152.

Makovec, M. and Tammik, M. (2017) Baseline results from the EU28 EUROMOD (2011-2016), EUROMOD Working Paper 6/17, Colchester: Institute for Social and Economic Research, University of Essex.

Massey, J. (1951) The Kolmogorov-Smirnov Test for Goodness of Fit, Journal of the American Statistical Association, vol. 46, no. 253, pp. 68-78.

Matsaganis, M. and Leventi C. (2014) Poverty and inequality during the Great Recession in

Greece, Political Studies Review, 12: 209 -223.

Narayan, A. and Sánchez-Páramo C. (2012) Knowing, when you don't know: using microsimulation models to assess the poverty and distributional impacts of macroeconomic shocks, The World Bank, Washington DC.

Navicke, J., Rastrigina, O. and Sutherland, H. (2013) Nowcasting Indicators of Poverty Risk in the European Union: A Microsimulation Approach, Social Indicators Research, 119(1): 101-119.

O'Donoghue, C. Loughrey, J. (2014) Nowcasting in Microsimulation Models: A Methodological Survey, Journal of Artificial Societies and Social Simulation 17 (4) 12.

O'Donoghue, C., Sologon, D., Kyzyma, I., & McHale, J. (2021), A Microsimulation Analysis of the Distributional Impact over the Three Waves of the COVID-19 Crisis in Ireland. International Journal of Microsimulation, 14(2), 81-105. Available at: https://doi.org/10.34196/ijm.00237

Peichl, A. (2008) The Benefits of Linking CGE and Microsimulation Models: Evidence from a Flat Tax Analysis, IZA Discussion Paper No. 3715.

Rastrigina, O., Leventi, C., Vujackov S. and Sutherland, H. (2016) Nowcasting: estimating developments in median household income and risk of poverty in 2014 and 2015, Research Note 1/2015, Social Situation Monitor, European Commission.

Rastrigina, O., Leventi, C. and Sutherland, H. (2015) Nowcasting: estimating developments in the risk of poverty and income distribution in 2013 and 2014, Research Note 1/2014, Social Situation Monitor, European Commission.

Sutherland, H. and Figari, F. (2013) EUROMOD: the European Union tax-benefit microsimulation model, International Journal of Microsimulation, 6(1): 4-26.

Vanhercke B. and Spasova S. (eds.) (2022), Social policy in the European Union: state of play. Re-emerging social ambitions as the EU recovers from the pandemic, Brussels, European Trade Union Institute (ETUI) and European Social Observatory (OSE).