Flash estimates

of income inequalities and poverty indicators for 2019 (FE 2019)

Experimental results

Version 2 – October 2020

EUROSTAT
Directorate F: Social statistics
Unit F1: **Social indicators; methodology and development; Relations with users**

http://ec.europa.eu/eurostat

Contents

1. Providing flash estimates one year earlier

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 represent an essential tool to prepare the European Semester (the annual cycle of economic policy coordination between EU countries) and to monitor progress towards the Europe 2020 poverty and social exclusion target.

In 2020, EU-SILC income indicators for 2018 (SILC 2019) will be available for all countries by autumn, which is late for the EU's policy agenda. Efforts for improving the timeliness of EU-SILC data are ongoing but the collection and processing of EU-SILC data based on both survey and administrative sources, will always have a certain time lag.

In order to better monitor the effectiveness of social policies at EU level, it is important to have timelier indicators. A new approach was therefore proposed, which consists in the development of flash estimates (FE). These are calculated on the basis of a statistical or econometric model and have a release date appreciably earlier than the survey data: i.e. flash estimates of income 2019 (SILC 2020) were available for 17 countries in September 2020 and the rest were published in October 2020[1]. FE 2019 cover essentially the period before COVID. The full release of FE 2019 will include an extension to potential risks and implications for the income of households of the current crisis. These will **complement** the EU-SILC data and can be used in preliminary discussions and analysis until the final EU-SILC data become available in the summer 2021 for most countries.

2. What are the flash estimates on income distribution?

Flash estimates refer to a set of key income indicators:

a. **At-risk-of-poverty (AROP) & Income quintile share ratio[2] (QSR)** are inequality indicators, both high on the priority of the Commission, Eurostat and the European Statistical System (ESS). They are used by policy makers at EU and national level for preparing the European Semester, for monitoring of progress towards the Europe 2020 poverty and social exclusion target, and for identifying the key social trends.

b. **Evolution of income deciles (D1, D3, MEDIAN, D7 and D9)** can provide useful information on the developments within different parts of the income distribution. The deciles can provide support for assessing the 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

[1] According to the availability of SILC 2019 (income 2018). Data for Italy and Ireland is not available
[2] S80/S20 ratio

several countries there are different dynamics for particular age groups in comparison with the whole population. At the same time, the in-work poverty flash estimate 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 flash estimates and EU-SILC values used throughout the paper always refer to income year and not the survey year[3].

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.
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 containing 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 different parts of the national income distribution. For more details on the calculation of the indicators please see EU-SILC notes on the calculation of indicators.
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.

Flash estimates should estimate to the extent possible the values captured in the EU-SILC[6] survey. The main target indicators (AROP and QSR) are based on an entire distribution that evolve relatively

[3] IE is the only country where the survey year is considered the same as the income year for EU-SILC. For all the others the income year is equal to survey year minus 1.

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, http://ec.europa.eu/employment_social/soc-prot/soc-incl/final_joint_inclusion_report_2003_en.pdf

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 whole 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 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 Flash estimates should anticipate the changes (that will appear later in EU-SILC) based on auxiliary information already available for the target year. Yearly changes are estimated as described below and combined with the EU-SILC value for the preceding year, which constitutes the baseline for the analysis.

A variety of approaches were tested, tailored to each country situation, and the most robust methodology for a given country was selected. The publication as experimental statistics puts the basis for receiving feedback from users and the research community and further improving the flash estimates.

The main methodology used for most countries is **Microsimulation**. It relies on EUROMOD, the European Union tax-benefit microsimulation model, maintained, developed and managed by the Institute for Social and Economic Research (ISER) at the University of Essex and the Joint Research Centre (JRC) in the European Commission, in collaboration with national teams from the EU Member States. For the purposes of the flash estimates exercise standard EUROMOD policy simulation routines are enhanced with additional adjustments to the input data to take into account changes in the population structure, the evolution of employment and main indexation factors. The microsimulation approach in the frame of the flash estimates exercise is based on previous 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 dedicated 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 a second set of countries, the flash estimates are based on national sources:

[6] http://ec.europa.eu/eurostat/web/income-and-living-conditions/overview
[7] http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Equivalised_disposable_income
http://ec.europa.eu/eurostat/statistics-explained/index.php/EU_statistics_on_income_and_living_conditions_(EU-SILC)_methodology_%E2%80%93_concepts_and_contents

- For Romania, flash estimates are based on **current income information** collected in HBS[8] (Household Budget Survey-RO). This differs from traditional EU-SILC income indicators as information is collected via a small set of questions that refer to the current reference period (e.g. current month).
- For the Netherlands[9], provisional national register data were used.
- For Sweden, a national microsimulation model was used.

Following further analysis of the performance and the consultation of both users and Member States microsimulation was selected for all countries where national sources are not available.

Table 2 summarises the methodological approach chosen by country.

Eurostat has produced flash estimates based on microsimulation for 22 Member States. For NL, SE, and RO, flash estimates are based on national sources.

Table 2. Methodological approach by country

Methodological approach	Countries	
Microsimulation	(Eurostat model)	BE, BG, CY, CZ, DE, DK, EE, EL, ES, FR*, HR, LT, LU, LV, MT, HU, AT, PL, PT, FI, SI, SK
	(National model)	SE
Current income		RO
National register based provisional data		NL

***Pending national estimates to be released by the end of November**

An essential point in this exercise was the active participation of the Member States at different levels and the support from the academic community, in particular the University of Essex, in the validation and improvement of the FE methodology and of the flash estimates. For more details please consult the Methodological Note including the description of microsimulation, current income and METS.

[8] http://statistici.insse.ro/shop/index.jsp?page=tempo2&lang=en&context=20

[9] For the Netherlands, the definition of equivalised income is almost equal to the EU-SILC definition except for the inter-household transfers which are not included. The inter-household transfers form only a small part of the total income, so the deciles in both statistics are quite comparable. In general, inter-household transfers are paid by the higher income groups, so the upper deciles may be somewhat actually lower in EU-SILC compared to the national income statistics.

4. How were the flash estimates assessed?

Flash estimates income 2019 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 flash estimates. 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 SILC estimates cannot be expected. Differences can emerge, due to inconsistencies in the input datasets, model errors or theoretical assumptions underlying the microsimulation techniques.

Developing flash estimates on poverty and income inequalities in the ESS involves that their methods, sources and output adhere to a common quality framework. This was developed together with the Member States and validated with the National Statistical Institutes and the academic community.

The quality framework contains 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 identifying possible sources of error and ways of fixing them.
2. ***Quality assessment*** put in place in order to ensure a comparable way to assess results stemming from different methods and national estimates within this ESS exercise:

    2.1 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. Flash estimates were simulated from 2012 to 2018 and compared with EU-SILC indicators. Furthermore, an in-depth performance is done for the most recent years published data, starting 2016 FE. It is expected that FE for more recent years to be more accurate due to the recent improvements in the microsimulation input file and model, as well as due to longer time series.

    2.2 the plausibility of the estimated change is assessed based on the available information for the target year. 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 building trust in the estimates. A trusted estimate is a reasonably good stand-in, to be used for drawing preliminary conclusions until actual data becomes available. Unlike forecasting, for flash estimates several auxiliary sources in the target year are used either in the estimation process or for validation checks (for plausibility assessment). Furthermore, microsimulation allows simulating two complementary counterfactual scenarios where only some parts of the model are updated: only changes in labour and only changes in policies. These are supported with the analysis of ISER, University of Essex (EUROMOD, 2020) and are used for plausibility assessment. Finally, we have used benchmark models based on simple time series models which show the trend based on previous SILC values. This allows checking whether the deviations from the trend are supported by changes related to policy and labour effects.

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

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

This report presents the figures for the flash estimates relating to the income year 2019 (FE 2019, i.e. SILC 2020 whose results are expected in summer 2021 for most countries).

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)[10]. This format takes into account that the expected changes cover a possible range of values, associated with uncertainty.

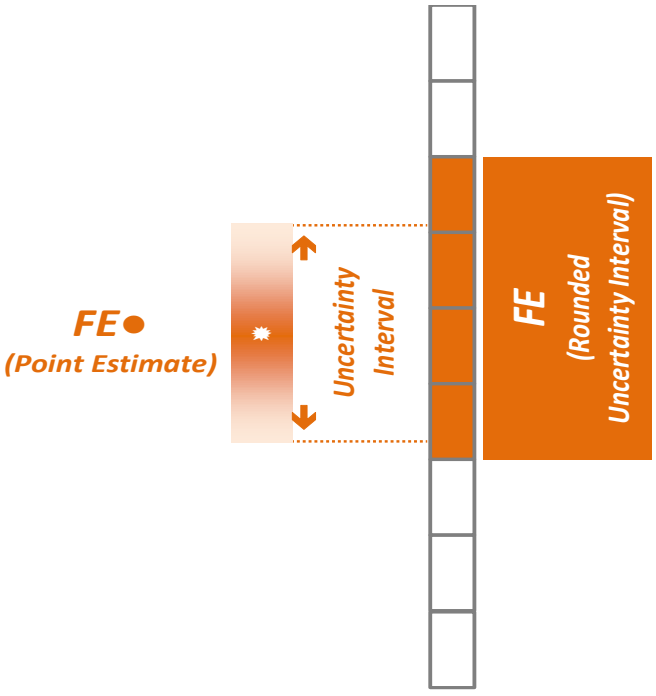
RUI will give an indication – in terms of intervals – on the type (magnitude and direction) of expected change. It is a way of communicating our estimates without showing the actual value (FE●, the point estimate), in order to minimise misinterpretation and misuse due to disregarding the uncertainty 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;

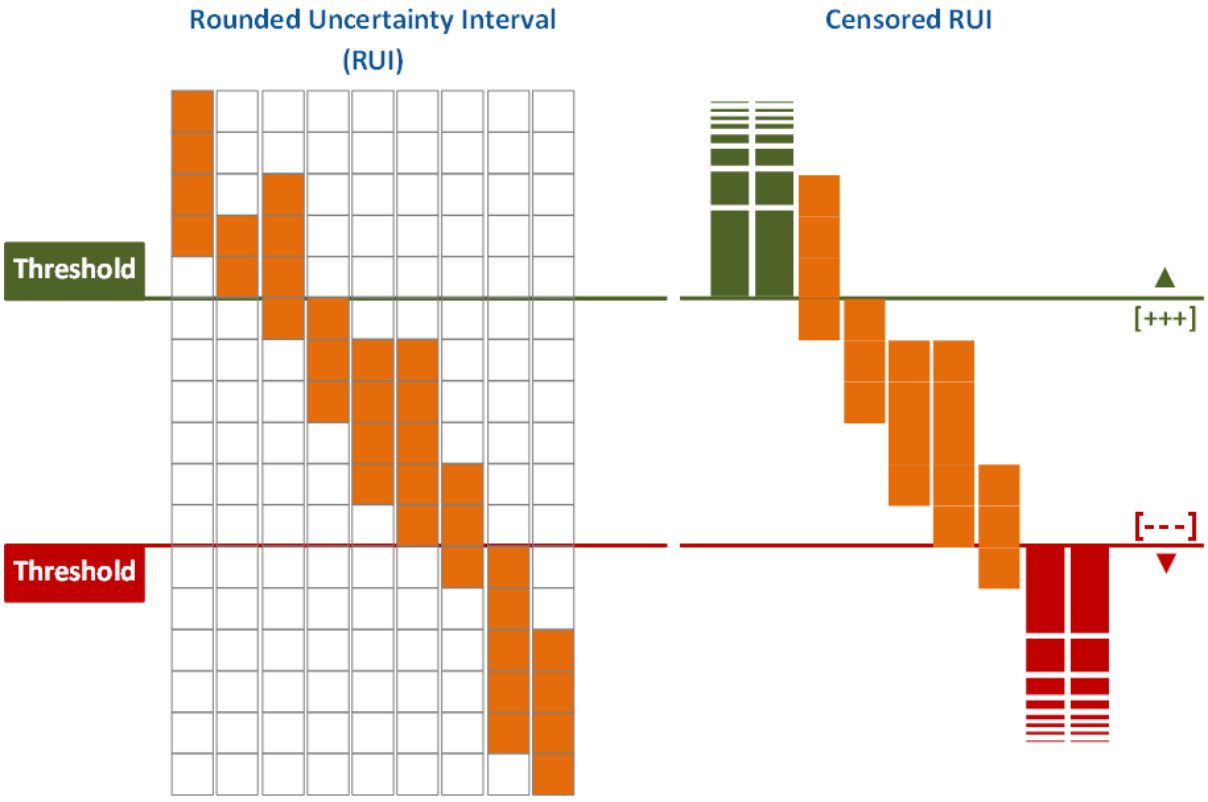
(3) The resulting range – the *Rounded Uncertainty Interval* (RUI) – is communicated as FE, instead of the FE● (the point estimate).



[10] This dissemination format is based on a proposal from Thomas Piasecki-Statistics Poland

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 magnitude 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 for what is considered an extreme value are: 2 pp for AROP, 0.6 for QSR, and 5% for the deciles. These thresholds were data driven and chosen based on the magnitude of past changes and performance of the flash estimates that is more imprecise in case of extreme values.



This is applied to the YoY changes. The RUI of the levels is directly derived from the RUI of the YoY change. In the visuals and tables included in the report, the annexes, or the complementary documents, the cases where the point estimate (FE●) is outside the range of non-significant values is also indicated.

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 2019: flash estimates

This section presents the figures for flash estimates 2019 in terms of absolute change for AROP and QSR and change in percent for the deciles. Table 3 below shows the FE 2019 translated into the rounded uncertainty interval (RUI). Please note that only those estimates indicated as fit-for-purpose, meaning passing the quality assessment framework, are disseminated. All the national statistical institutes have been closely associated in the validation of the FE 2019.

Table 3 presents the flash estimates of the nominal change 2018-19 published as experimental data under the responsibility of Eurostat. To note also that in 3 countries flash estimates are based on national sources: NL, RO and SE.

The visual is based on the the center of the Rounded Uncertainty Interval. For AROP and QSR, the cells of the table containing positive values are highlighted with red and the negative with green. For the income deciles 1, 3, 5 (or MEDIAN), 7 and 9, the cells of the table containing negative values are highlighted with red and the positive with green. The light grey colour background is added when the change is considered not significantly different from 0.

In a limited number of cases specific indicators were not published as it was considered they are not reliable enough.

Calculation of the YoY change

AROP & QSR: $YoY_{Year\ N} = Indicator_{Year\ N} - Indicator_{Year\ N-1}$

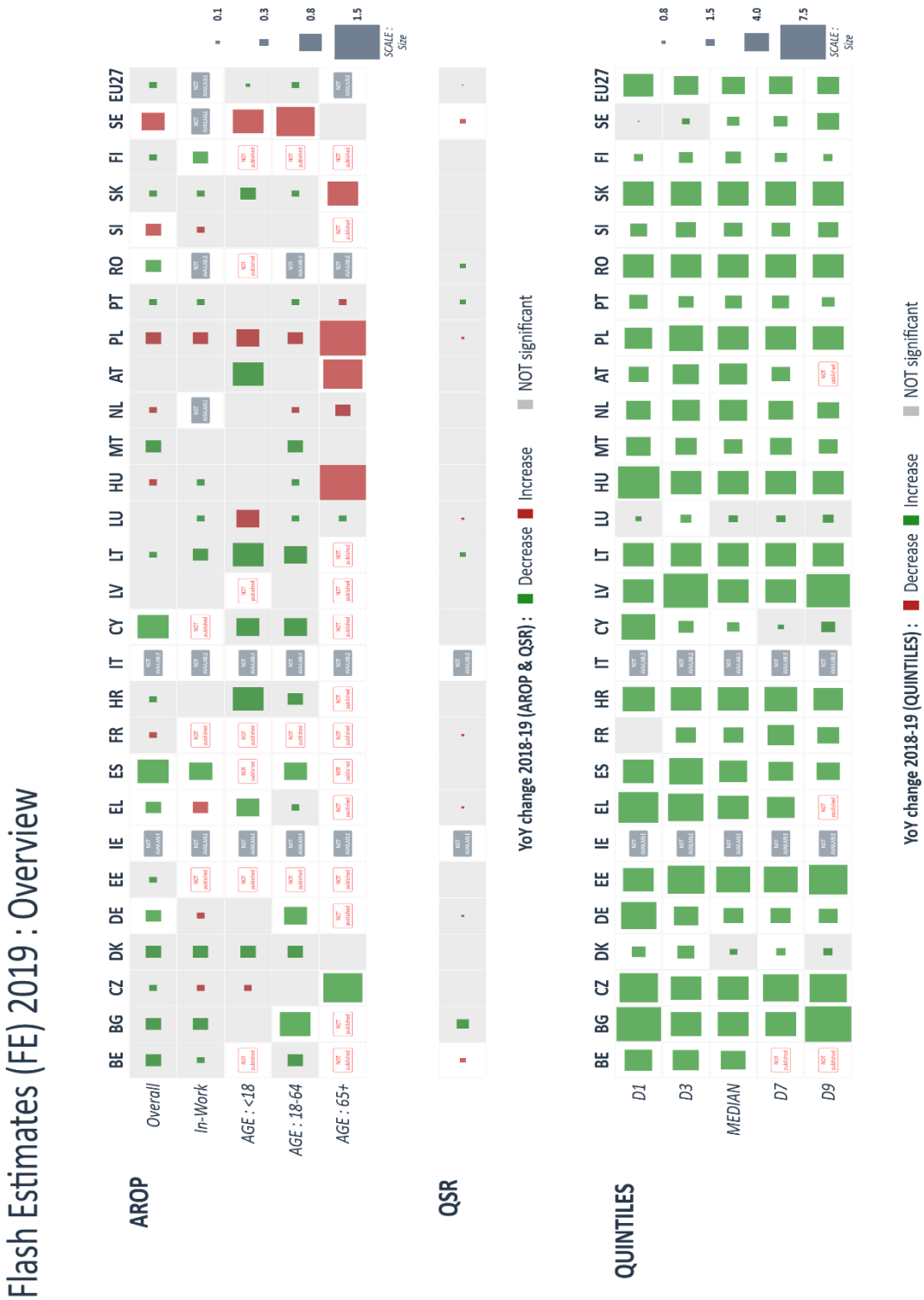
Deciles (%): $$YoY_{Year\ N} = \frac{Indicator_{Year\ N}}{Indicator_{Year\ N-1}} - 1$$

Figure 1 and 2 provide the detailed results in terms of RUI for all countries, for AROP and respectively the median. Charts and tables for all indicators, including timeseries, are available here.

The light grey bars are the ranges of values which should be consider not significantly different from 0. Orange bars indicate the RUI for the FE 2019 in cases where the flash estimates for the year-on-year change *(FE●)* are statistically significant. Yellow bars indicate the RUI for the FE 2019 in cases where the flash estimates 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).

a. FE 2019: main indicators

Table 3. Colour-coded overview of FE● 2019 – for ALL available countries, ALL indicators



Source: Eurostat calculations based on EUROMOD I1.24+ Eurostat data sources (EU-SILC, LFS, Sector Accounts) except: RO: HBS data; NL: National register data; SE: national microsimulation model. FR: pending national estimates to be released by the end of November;DE: break in time series is expected due to a system change for EU-SILC 2020 so we expect differences between FE 2019 and SILC 2020 estimates.

Estimates for Ireland and Italy are used for the calculation of EU-27, but national data not published as SILC 2019 not available yet.

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

Figure 1: FE 2019 (RUI) – ALL countries available, AROP

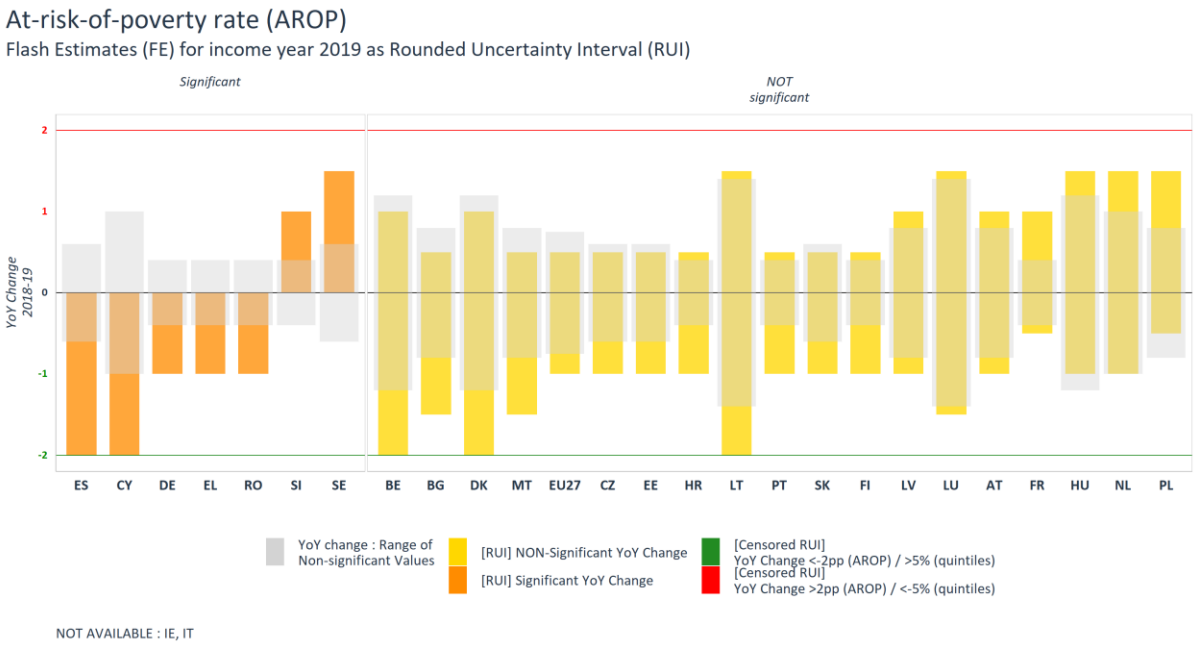


Figure 2: FE 2019 (RUI) – ALL countries available, median

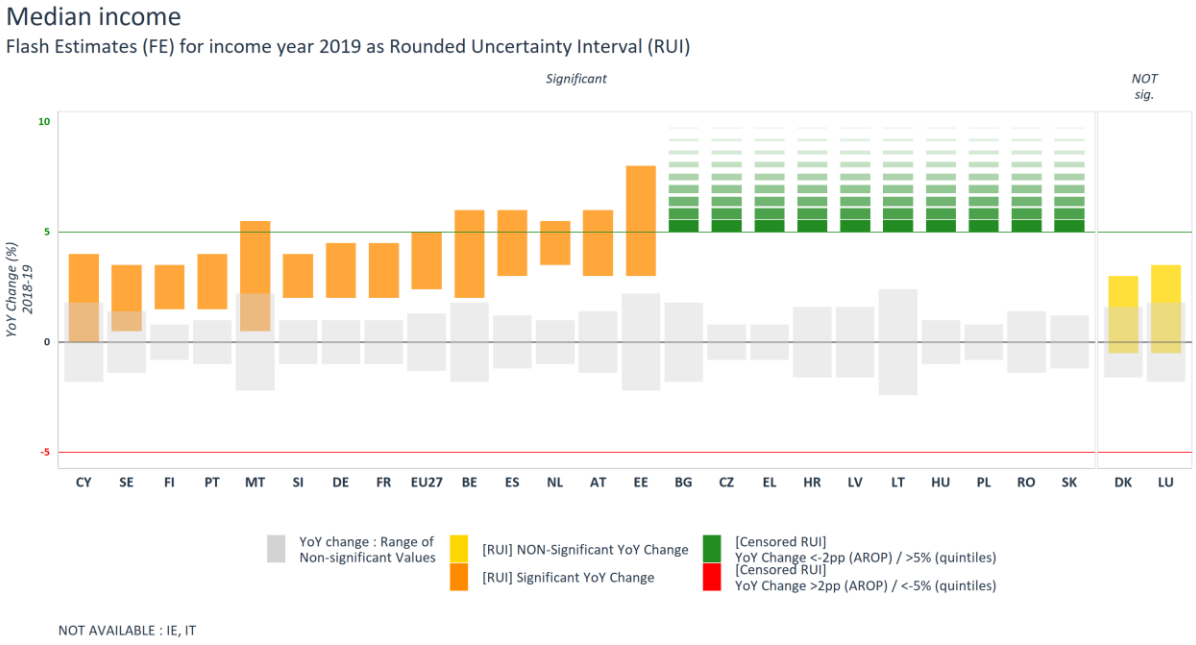
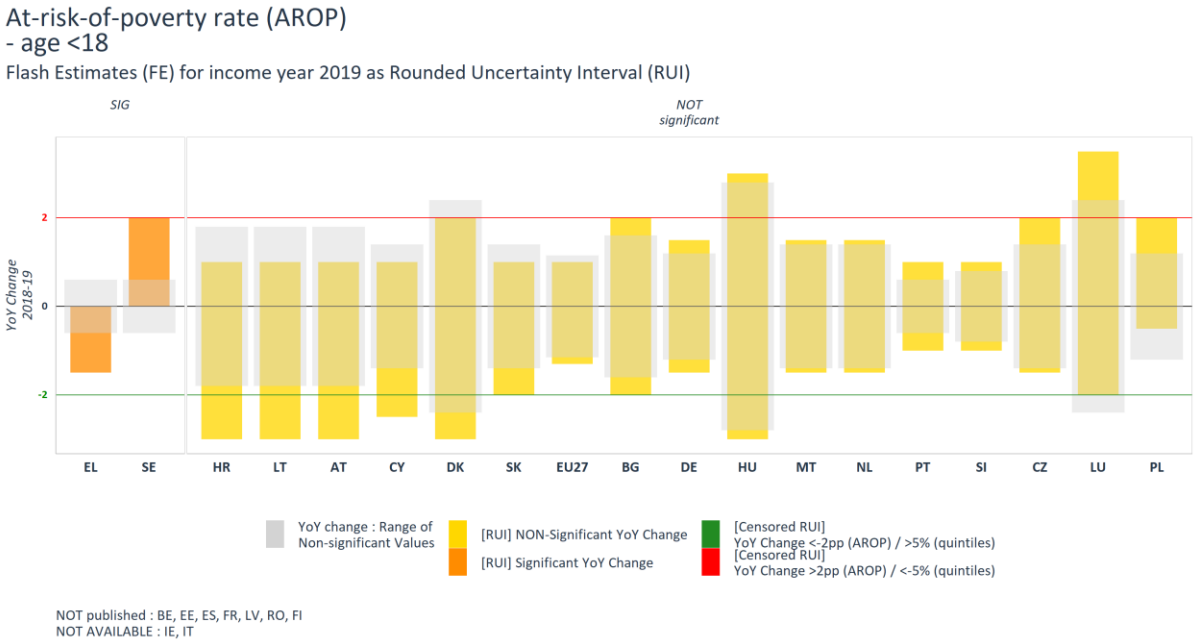
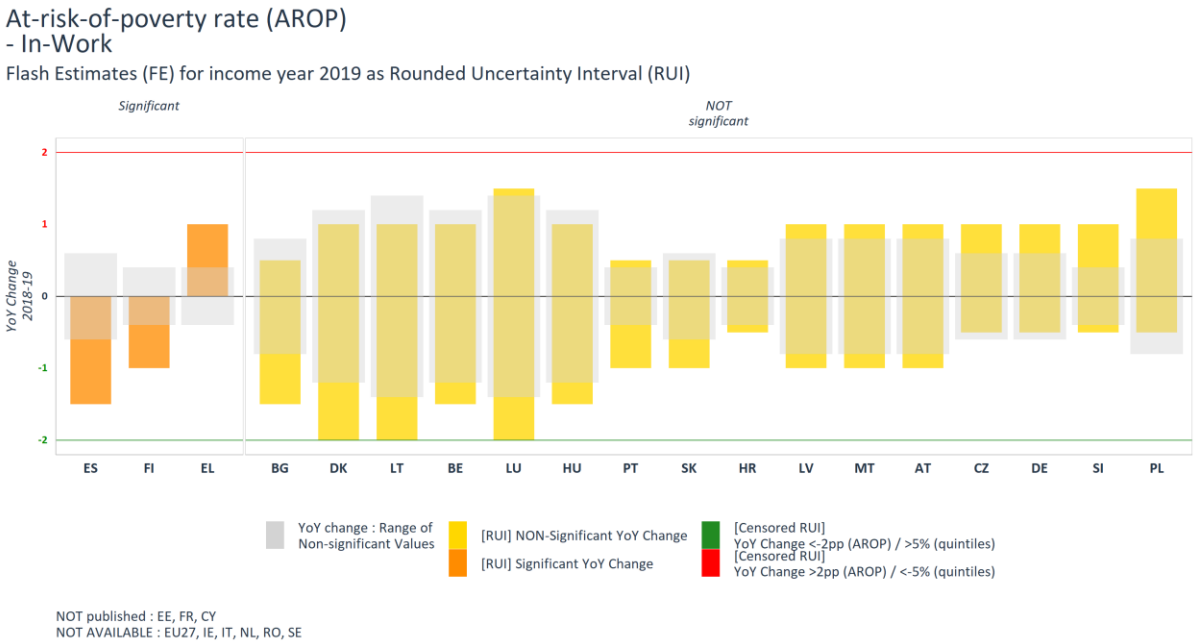


Figure 3: FE 2019 (RUI) – ALL countries available, AROP for <18 age group



NOT published : BE, EE, ES, FR, LV, RO, FI
NOT AVAILABLE : IE, IT

Figure 4: FE 2019 (RUI) – ALL countries available, AROP for in-work persons



NOT published : EE, FR, CY
NOT AVAILABLE : EU27, IE, IT, NL, RO, SE

The results obtained are also presented by country and by indicator over time, in an additional document, so as to help the reader in assessing trends in the data.

7. Some main messages for the FE 2019

The main messages that can be drawn based on the flash estimates are:

- In general, the FE 2019 show an *overall increase of the equivalised disposable* income across the distribution for almost all countries. These estimated changes are supported by main trends in employment situation including average increases in wages, as well as the evolution of the gross disposable income in Sectoral Accounts.
- *AROP and QSR show significant changes for several countries (CY, DE, EL, ES, RO, SE, SI). However, for the majority of countries FE 2019 show not significant changes.* In general, not significant changes can be interpreted as a status quo. Additional information can be further explored when assessing the FE 2019 for AROP/QSR. For example, it is very important to look at the *flash estimates together with the time series* in EU-SILC across several years.
- The *joint analysis of deciles yearly changes provides also more information* on the evolution at different points of the distribution. The main differences come from the relative movement of the left part in relation to the middle/upper part of the distribution.
- Eurostat is publishing also the flash estimates for AROP by main age groups and in-work poverty. These can help to support significant changes in AROP with more detailed information or to identify cases where some particular sub-groups have a different evolution than the general population. Given the higher volatility, due to both large standard deviation in SILC and model quality, estimations are not published this year for several countries. The most affected is the group age 65+, for which data is published only for 11 countries. However we consider that in specific cases this data can support the analysis of changes in the main indicators.

Some key messages are further detailed for individual and groups of countries. ***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[11].***

The estimated change in the AROP between 2018 and 2019 is statistically significant for 7 countries: **Cyprus, Germany, Greece, Romania, Slovenia, Spain** and **Sweden.**

AROP is estimated to increase for **Slovenia** and **Sweden**. In general, this is related to a smaller increase in the left part (D1) compared to the rest of the income distribution. These

TECHNICAL NOTE*: statistical significance*

The analysis of the FE 2019 should take into account some important technical details:

- *The uncertainty interval for the FE is based on the sampling error from SILC which varies a lot across countries. An increase of 0.6 pp can be significant in one country but not in another.*
- *Most of the yearly changes are not significant for AROP and QSR in 2019 but given that these are structural indicators this is valid also for SILC in general.*

→ *More information in Annex 1*

[11] For IE is the only country where the survey year is considered the same as the income year for EU-SILC. For all the others the income year is equal to survey year minus 1.

increases are also estimated in AROP for both children and individuals aged 18-64 for **Sweden**.

AROP is estimated to decrease for **Cyprus, Germany, Greece, Spain** and **Romania.** In general, it is related to a larger increase estimated in the left part of the income distribution than in the rest of the distribution. These decreases are estimated also for AROP (0-17) for **Greece**, for AROP (18-64) for **Germany** and **Spain** and for the in-work poverty for **Spain.**

Besides the seven countries, there is a significant decrease for AROP (18-64) in **Bulgaria**, for AROP (65+) in **Czechia** and for in-work poverty in **Finland.** There is a significant increase for AROP (65+) in **Austria,Hungary, Poland and Slovakia**.

TECHNICAL NOTE – *Plausibility of the estimated changes*

The main elements that enter the nowcasting model based on microsimulation are: changes in employment situation and wages as well as simulated recent changes in the tax and benefit system of a certain country. The plausibility of flash estimates is supported with the analysis of these main factors.

- In Austria,*"the income increase in all decile groups (except for the highest decile) was to a large extent driven by the introduction of the family tax credit "Familienbonus Plus" including an additional amount qualifying for negative tax for single earners and single parents with low incomes."* (EUROMOD, 2020). It should be noted that EUROMOD assumes that all eligible individuals deduct this tax credit in the current year if the amount of tax credit does not exceed the income tax after applying tax brackets. As a result, the impact in the evolution of deciles could be oversimulated.

- For the first time, flash estimates 2019 take into account the evolution of minimum wages in Spain. This is the main driver of change of the estimated decrease in AROP. The wage of *all* individuals earning the minimum wage or less are uprated according to the evolution of the statutory minimum wage. This assumption could lead to an ovesimulation of the impact of minimum wages in the income distribution.

- It should be noted also that in some countries AROP 65+ can register relatively large year-on-year changes related to a high concentrartion around the at-risk-of-poverty threshold.

[1]Source: 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

➔ *More information in Annex 2. Quality Assessment Framework: 2. Plausibility*

There is a statistically significant increase in the QSR for **Belgium** and **Sweden**. This is related to a larger increase estimated in the left part of the income distribution than in the rest of the distribution.

There are some countries with different estimated increases across the distribution that did not impact the inequality indicators. For instance, for **Denmark** overall, deciles in the left part of the distribution increased relatively more than in the right part.

The censored RUI indicates that the increase in most deciles was larger than 5% for Bulgaria, Hungary, Latvia, Lithuania, Poland, Romania and Slovakia.

There are significant increases in most deciles for the remaining countries, except for **Denmark** (MEDIAN, D9), **Finland** (D1), **France** (D1), **Cyprus** (D7 and D9), **Luxembourg** (D1, MEDIAN, D7, D9) and **Sweden** (D1 and D3). With the usual caveats, this non-significance can be interpreted in general as a status quo.

It is important also to analyse the evolution of the indicators together and across time. Given the structural nature of AROP and QSR, it is often the case that their year-on-year changes are not significant. For this a further assessment of the evolution in time of the indicator is recommended even if the FE 2019 might not be significant.

Further information for the specific countries can be found in the country profiles including the time series for all indicators and breakdowns as well as main information included in the model.

8. How to improve the flash estimates?

This is the second publication of flash estimates on income distribution as experimental statistics. The report contains not only the estimated changes for the target year but also a few elements on the estimation process, auxiliary sources used to support the analysis of the figures and their reliability. It is meant to put the basis for a constructive dialogue for further improving the methodology and the dissemination of these indicators.

To help Eurostat improve these experimental statistics, users and researchers are kindly invited to give us their feedback:

- Would you have comments or suggestions for improvements of the methods applied for this flash estimate exercise, i.e. based on either microsimulation or current income?
- Are there any other factors Eurostat should consider?
- What other indicators or breakdowns could be useful as early warnings on trends in income distribution and poverty?
- Are there other indicators Eurostat should analyse for policy purposes?
- Is the rounded uncertainty interval clear and easy to understand? How to improve it? Would point estimates be desirable in the future?

Further developments could be envisaged, following also the feedback from users and stakeholders:

- Improve further the dissemination format, mainly by using a prediction interval based on the calculation of both model error and sample standard deviation;
- use of more recent EU-SILC files for microsimulation so that to minimise the impact of revisions and breaks in series but as well to improve the model;
- take into account more detailed and consistent input data to capture distributional effects.

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[12] 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. 1000 subsamples of the 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 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 SILC indicators (unweighted). The standard deviation of the change for deciles is likely to be overestimated as it doesn't 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

[12] http://ec.europa.eu/eurostat/documents/3888793/5855973/KS-RA-13-024-EN.PDF/cfef2973-4675-4df4-bf6d-e15ef1d3c060

Table 4 below shows the significance bounds for all countries.

Table 4. Range of values for which the YoY is not statistically significant – main indicators

Range of non-significant values (YoY change)								
Country	**Year**	**AROP**	**QSR**	**D1**	**D3**	**MEDIAN**	**D7**	**D9**
BE	2017	±1.2	±0.2	±1.8%	±1.5%	±1.8%	±1.3%	±2.0%
BG	2017	±0.8	±0.6	±4.5%	±2.5%	±1.9%	±1.6%	±4.1%
CZ	2017	±0.6	±0.4	±1.6%	±1.1%	±0.7%	±1.3%	±1.9%
DK	2017	±1.2	±0.7	±2.0%	±1.6%	±1.5%	±1.4%	±2.2%
DE	2017	±0.4	±0.3	±1.9%	±1.2%	±1.0%	±1.2%	±1.3%
EE	2017	±0.6	±0.4	±2.3%	±1.8%	±2.2%	±2.3%	±2.2%
EL	2017	±0.4	±0.6	±1.7%	±1.0%	±0.9%	±0.8%	±1.0%
ES	2017	±0.6	±0.4	±2.8%	±1.4%	±1.2%	±1.1%	±1.6%
FR	2017	±0.4	±0.2	±0.9%	±1.0%	±0.9%	±0.9%	±1.4%
HR	2017	±0.4	±0.3	±3.1%	±1.5%	±1.6%	±1.7%	±1.9%
CY	2017	±1.0	±0.3	±1.4%	±1.4%	±1.9%	±1.7%	±2.7%
LV	2017	±0.8	±0.4	±2.5%	±2.5%	±1.6%	±1.9%	±2.8%
LT	2017	±1.4	±0.6	±3.1%	±3.2%	±2.5%	±2.9%	±4.1%
LU	2017	±1.4	±0.3	±2.4%	±1.6%	±1.9%	±1.8%	±2.0%
HU	2017	±1.2	±0.4	±1.9%	±1.4%	±1.3%	±1.6%	±1.8%
MT	2017	±0.8	±0.2	±2.3%	±2.2%	±2.2%	±1.9%	±2.9%
NL	2017	±0.6	±0.3	±1.3%	±1.0%	±1.1%	±0.9%	±1.3%
AT	2017	±0.8	±0.3	±2.2%	±1.6%	±1.4%	±1.7%	±2.6%
PL	2017	±0.8	±0.2	±1.8%	±1.2%	±0.9%	±1.1%	±1.7%
PT	2017	±0.4	±0.4	±2.2%	±1.3%	±1.1%	±1.2%	±2.1%
RO	2017	±0.2	±0.5	±2.8%	±1.8%	±1.7%	±1.9%	±2.1%
SI	2017	±0.4	±0.2	±1.2%	±1.2%	±1.0%	±1.1%	±1.3%
SK	2017	±0.6	±0.3	±2.0%	±1.5%	±1.1%	±0.6%	±1.4%
FI	2017	±0.4	±0.1	±1.3%	±1.0%	±0.7%	±0.8%	±1.2%
SE	2017	±1.6	±0.3	±4.8%	±2.6%	±2.1%	±2.0%	±2.6%

Annex 2. Quality Assessment Framework (QAF)

Flash estimates 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 QAF aims to provide a common platform to assess Eurostat and national estimates.*

The QAF is composed of two parts: (1) the quality assurance, which focuses on analysing inconsistencies in the input data and includes several intermediate quality checks along the process; (2) the quality assessment, which focuses on the historical performance of different methods.

Quality Assurance

The quality framework is an essential tool for designing the production process of flash estimates. Therefore, the quality framework doesn't focus only on the final results but includes 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 to identify possible sources of error and ways of fixing them. It is also an essential tool for designing the production process of flash estimates. For example, employment trends as measured by LFS or simulated benefits via EUROMOD are compared to EU-SILC statistics for the past. The lack of such consistency could have an important impact on the historical performance of the model.

Quality Assessment

There are two main dimensions that were used for the decision to publish the FE 2019: 1) the historical performance of the model defined as the ability to retropredict accurately changes in all main indicators as captured by EU- SILC (i.e., flash estimates were simulated from 2012 to 2018 and compared with EU-SILC indicators), and 2) the plausibility of the estimated change assessed via several elements: the evolution of related indicators used in the estimation (e.g. employment, social benefits and taxes simulated via microsimulation); consistency with similar income statistics at aggregated level in sectoral accounts; time series analysis of EU-SILC.

1) Historical performance

The historical performance is mainly assessed based on mean absolute error (MAE)[13]. This is supported by a much more detailed analysis of income components and labour variables. The analysis of historical performance is based on simulations of the flash estimates from 2012-2018. The estimated year-on-year change (YOY_EST) for the years 2012 to 2018 is compared with the year-on-year change (YOY_REF) for SILC 2013 to SILC 2019. In this assessment the standard deviation of the target indicators is also taken into account: the lower the variance of EU-SILC indicators, the more stringent the thresholds for MAE are as the points estimates are considered to be close. When

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

$e_y for\ AROP\ and\ QSR = (REF_y - REF_{y-1}) - (EST_y - EST_{y-1})$

the confidence interval for the target indicator for a specific country is larger, the quality requirements are more lenient: the FE is still considered fit for purpose even if the points estimates are not very close but still in the confidence interval.

In general, results for the microsimulation when simulating back based on older files (2012 SILC) can be affected by breaks in SILC data series and revisions. Results improve for the last years, as more recent files are used for producing the flash estimates and with ongoing efforts to introduce disaggregated benefits in EU-SILC and to improve the precision of simulations in EUROMOD. In addition, improvements in the models were tested mainly for flash estimates from 2015 onwards. In order to reflect that quality of flash estimates in the last years is expected to be larger and more related to the expected quality of flash estimates for the current year, the past performance gives more weight to the performance of flash estimates in the latter years (40/60). It is expected that FE for more recent years to be more accurate due to the recent improvements in the microsimulation input file and model, as well as due to longer time series.

2) Plausibility

There are three main parts in the plausibility analysis:

1) An analysis of the plausibility of the FE given changes in policies. These are calculated using the SILC 2018 file and the EUROMOD model and are supported with the analysis of ISER, University of Essex[14] (microsimulation countries only);
2) An analysis of the plausibility of the FE given the general evolution for related indicators on the labour market (employment, wages).
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).

In general, it was assessed if the target income indicators are in line with the evolution of employment (LFS data), wages (National Accounts, national sources and the Labour Cost Index) as well as other aggregated indicators such as the gross disposable income in National Accounts.

1) **Policy changes**

Table 6 illustrates the estimated changes across income deciles for 2019 but taking into account *only* policy changes simulated in EUROMOD for 2018-2019 that impact the social benefits and taxes (labour market characteristics and market incomes are kept constant as in 2018). For instance, changes to public sector wages are not included in these results. Results are calculated using EUROMOD – Policy Effects Tool and its methodology (EUROMOD, 2020).

[14] 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

In table 6, it can be seen that the overall change in income tend to be positive and in most cases it is less than 2%. The largest increases estimated are found in decile 1. Some developments in the bottom of the income distribution are often related to the introduction or increases in social assistance and similar benefits. However, it should be noted that these effects could be oversimulated as EUROMOD generally assumes full benefit take up. Some adjustments for the non take-up of benefits are made in some countries and for some benefits (see EUROMOD country reports for a situation by country).

Table 6. Estimated effects of simulated policy changes – microsimulation countries produced by Eurostat

	Decile 1	Decile 3	Decile 5	Decile 7	Decile 9	**Total**
BE	4.9	3.4	2.7	2.3	2.1	**2.5**
BG	2.0	2.3	1.5	1.0	0.6	**0.8**
CZ	0.9	2.1	0.1	-1.1	-1.8	**-0.7**
DK	0.7	1.0	0.6	0.6	0.6	**0.7**
DE	1.4	1.5	1.3	1.1	0.9	**1.1**
EE	5.9	3.9	1.4	1.0	0.8	**1.5**
EL	-1.8	1.6	1.7	2.1	1.7	**1.6**
ES	1.7	1.5	0.5	0.3	0.3	**0.5**
FR	2.0	2.5	2.0	2.5	2.8	**2.4**
HR	1.5	1.8	2.3	0.8	0.6	**1.3**
CY	0.2	-1.6	-2.0	-1.8	-1.5	**-1.4**
LV	4.0	3.7	2.3	1.5	0.9	**1.6**
LT	13.4	7.6	5.4	4.4	2.3	**3.9**
LU	0.2	0.5	0.9	0.8	0.5	**0.6**
HU	0.2	1.4	1.1	1.1	1.0	**1.0**
MT	6.8	2.1	0.7	0.3	0.2	**0.9**
NL	2.5	2.3	2.1	2.1	1.7	**1.8**
AT	2.5	3.6	2.8	1.7	1.0	**1.8**
PL	3.2	2.0	1.5	0.9	0.5	**1.0**
PT	1.5	0.9	0.7	0.6	0.5	**0.6**
SI	2.0	1.1	0.7	0.6	0.5	**0.7**
SK	2.9	2.2	1.8	1.3	0.9	**1.4**
FI	0.6	0.7	0.7	0.6	0.6	**0.6**

Source: EUROMOD I1.24+ – Policy Effects Tool

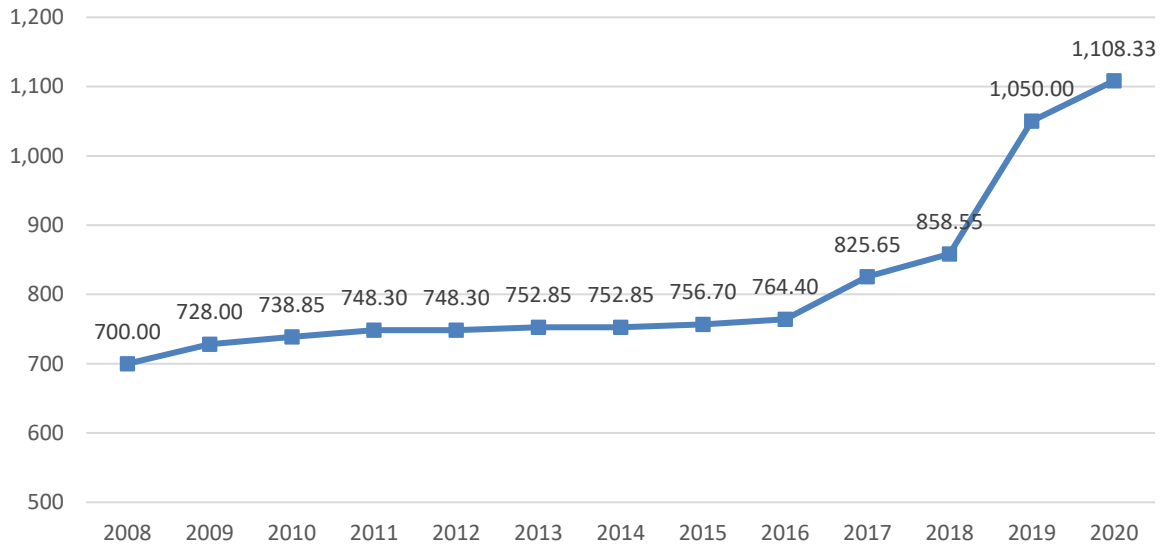
➔ *These results can be complemented with further details in terms of main types of benefits that have an impact for each country in the paper published by the EUROMOD network of experts: EUROMOD (2020)*

NOTE: Differnces between the results in EUROMOD (2020) and the results in this report can arise. These are due to the fact that Eurostat has used a more recent version of both the EUROMOD model and its input files. In addition, data are expressed in nominal terms in this report while in EUROMOD (2020) is adjusted to account for inflation.

- **Minimum wage**

According to Eurostat, the statutory monthly minimum wage in Spain increased from 858.55€ to 1050€ (22.3%) in 2019. This is the largest percentual increase in the historical time series.

Figure 5: Minimum wage in Spain, 2008 -2020 (EUR per month)



Source: Eurostat – minimum wage statistics (table earn_minw)

NOTE: Eurostat provides national minimum wages at *monthly rates*. For cross-country comparability, when the minimum wage is paid for more than 12 months per year, data have been adjusted to take these payments into account. In Spain, it is paid for 14 months a year, so the national minimum wage is calculated as (monthly rate x 14) / 12)
National website: http://www.mites.gob.es/estadisticas/bel/SMI/index.htm

For the first time, flash estimates 2019 take into account the evolution of minimum wages in Spain. This is the main driver of change of the estimated decrease in AROP. It should be noted that the model assumes that the wage of *all* individuals earning the minimum wage or less are uprated according to the evolution of the statutory minimum wage (e.g. the gross wage of a full-time employee -500€ per month- in 2018 is uprated by 22.3% in 2019 -611.5€ per month). This assumption could lead to an ovesimulation of the impact of minimum wages in the income distribution. It should be noted that the baseline model -without accounting for the evolution of minimum wage- also signals towards a decrease in AROP, although less pronounced.

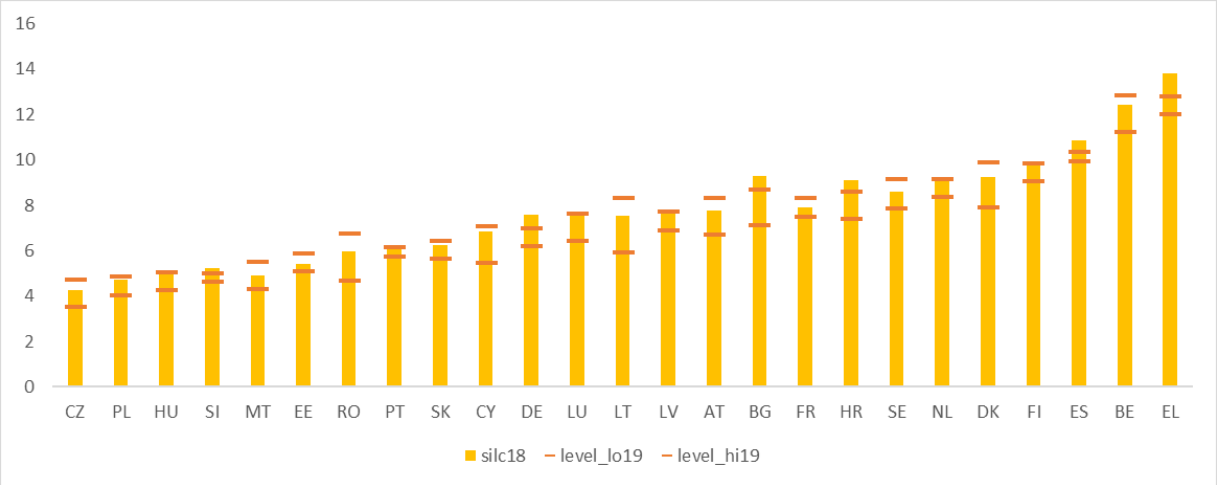
NOTE- Minimum wage earners calculation:
Consistently with the literature on minimum wages (Brandolini et al 2010; Fernández-Macías and Vacas-Soriano 2016), the *proportion* of employees with salaries below the national statutory minimum wage, is calculated in terms of monthly full-time equivalent gross wage. The individual annual gross earnings are divided by the number of months in full-time work in the same reference period, plus the number of months in part-time jobs. Part-time work is further adjusted by the sex-specific ratio between the median of part-time and full-time hours of work.

➔ *More information -Methodological note 2019: 3b.Updating non-simulated income*

2) Labour changes

The employment situation in SILC income year (the calendar of activities) is updated according to the evolution on the labour market in LFS data until our target year (2019). It is important to mention that the SILC employment patterns are "updated" by considering unemployment changes from LFS by several breakdowns, including economic sectors sectors, age groups and gender. The overall unemployment decreases in most countries in 2019, but the effect on inequalities and AROP is likely to depend on the more detailed sub-groups' evolution, including the comparative income growth rate between individual at work and retired.

For this exercise, we have also assessed the impact of the "labour update" in SILC on the low work intensity[15](LWI) indicator, which reflects the employment situation at household level and it is therefore, more directly related to poverty and equivalised income. For microsimulation countries the estimated LWI 2019 is the result of the standard labour update methodology[16], while for national flash estimates the LWI is based on a macro model[17]. The chart below shows tthe estimated interval for the LWI 2019 (high-low limits), relative to the level for 2018 (based on SILC 2019). Countries are ordered by the level estimated for LWI in 2019.



*for SE, NL and RO the low work intensity is estimated via a regression model that takes into account the employment evolution in LFS.

3) Table 7 provides a comparative change in the magnitude for the yearly change of the total disposable income between the FE and Quarterly Sector Accounts[18]. The table includes only countries for which (1) quarterly data is available for the sector household; non-profit institutions serving households (S14_S15) and (2) microsimulation was used. In general, the direction and magnitude are very similar. However, in some cases there are differences and these should be read taking into

[15] The indicator persons living in households with very low work intensity is defined as the number of persons living in a household where the members of working age worked less than 20 % of their total potential during the previous 12 months. Further details available here.

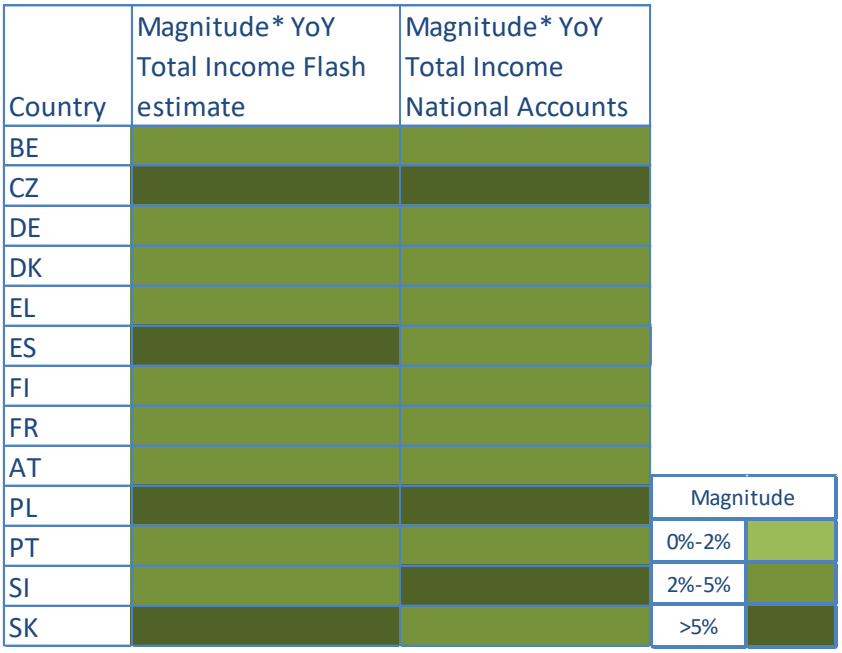
[16] For more details see the methodological note.

[17] Due to short time series a simple regression model was used using LFS employment indicators such as the unemployment rate for age<60, the share of part time workers (also breakdown by sex), and the evolution in the total number of hours worked.

[18] Source: Eurostat calculations- gross disposable income [nasq_10_nf_tr]

account the underlying comparability of income (trends) from EU-SILC and National Accounts. For more details on the latter, please see also Gregorini et al, (2016)[19].

Table 7. Comparison with National accounts: evolution total disposable income



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

For more information please see also the full data in excel format.

[19] http://www.iariw.org/dresden/gregorini.pdf

Annex 3 - Data sources and availability

The data used in this report for the flash estimates 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[20] available at the time of production.[21] This is enhanced with more timely auxiliary information from the reference period (2018) such as Labour Force Survey (LFS), Labour Cost Index and National Accounts, etc.

The data used for the target indicators for the income years 2012-2018 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 statistics on income and living conditions (EU-SILC) methodology

EU-LFS further information

The EU Labour Force Survey 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:

- Labour Force Survey (EU-LFS) data
- EU statistics on EU labour force - methodology

For Romania current income from HBS[22] was used. The Household Budget Survey (FBS) is organised as a continuous quarterly survey over a period of three consecutive months, based on a sample of 9504 permanent dwellings, divided into monthly independent sub-samples of 3168 permanent dwellings (per year the sample cover 38016 households). Response rate is around 80% - 85%.

[20] UDB EU-SILC 2018-1: BE BG CY CZ DE DK EE EL ES HR IT LV LT HU PL PT SI FI
UDB EU-SILC 2018-2: MT
In addition, for CZ EE EL LV LT LU PL SI, additional national SILC variables were also used
National SILC 2017: IT AT SK

[21] EU-SILC 2018 UDB. In the meantime EU-SILC 2019 is available for most countries but not yet the UDB and the EUROMOD input file

[22] http://statistici.insse.ro/shop/index.jsp?page=tempo2&lang=en&context=20

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. The access to metadata regarding HBS is at the link:

http://colectaredate.insse.ro/metadata/viewStatisticalResearch.htm?locale=en&researchId=4356

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