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)

Methodological note

Acknowledgements:

This methodological paper presents the latest nowcasting methodology put in place to capture the impact of labour market evolutions and social policies on income inequalities in 2023.

For the simulation of social policies flash estimates rely on the use of 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. Eurostat would like to thank the JRC team for their support and contribution, in particular Michael Christl, Kateryna Bornukova, Chrysa Leventi, Luis Manso, and Fidel Picos.

EUROSTAT

Aura LEULESCU

Adriano DI GUGLIELMO

Mihaela AGAFITEI

Andrea FASULO

With the support of SOGETI service contract ’Methodological work for the development of flash estimates’:

Cyrinus ELEGBEDE

Notaras VASILOPOULOS

Contents

1. Introduction

Providing up-to-date social statistics on income poverty and inequality is a priority for the European Commission and for 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 on the EU's targets to address poverty and social exclusion.

Flash estimates have already been produced since long at EU level on macro-indicators, such as GDP growth and inflation rate. In the area of income poverty and inequality, the focus is on the distributional changes. This implies the use of models that can estimate the full range of income distribution and capture the complex interaction of multiple past and present events, such as the effects of economic and monetary policies, social reforms, shifts in macroeconomic circumstances or demographic changes.

In the aftermath of the 2008 financial crisis, 'flash estimates on income distribution indicators' (FE) were put in place to respond swiftly to critical situations. Over the years, different approaches were tested, including macroeconomic models and current income, but most recent releases are based mainly on microsimulation and nowcasting (Bourguignon and Spadaro, 2006; O'Donoghue, 2021). This gives a more accurate analysis of distributional labour and policy effects, and how they combine.

Nowcasting techniques are used to estimate main poverty indicators and the distributional impact of labour market changes by assessing the effects of two main factors:

1) The impact on the income distribution of the labour market trends was modelled using detailed and up-to-date information on the employment net changes from the EU Labour Force Survey (EU-LFS). It aims at developing a generic approach that can be applied to all EU countries in a straightforward, flexible and transparent way. By doing so, it ensures the comparability and consistency of the methodology both across countries and through time.

2) The impact of social policies: government transfers are simulated via EUROMOD, the European Union tax-benefit microsimulation model originally developed by the Institute for Social and Economic Research (ISER) at the University of Essex. Since 2021 EUROMOD has been 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. 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 the most recent policy changes in the population structure, the evolution of employment and main indexation factors.

When the COVID-19 pandemic started, several methodological changes had to be made rapidly in FE 2020[1] and FE 2021[2] productions, to take into account the shock to employment, the loss of income related to the lockdowns and partial unemployment, and the recovery in the following year. In agreement with our stakeholders, the methodology of the FE 2022 and 2023, has returned to pre-pandemic standards. However, certain developments have been consolidated in the estimation process, such as the use of EU-LFS longitudinal data for calculating probabilities of labour transitions.

In the next section, more details on the main methodology used for the FE 2023 are provided.

[1] Methodological note - FE 2020.
[2] Methodological note - FE 2021.

2. Methodological developments and input data

The standard nowcasting methodology to produce FE follows two main steps:

1) Modelling labour updates and market incomes

The statistics on labour in the standard FE methodology is updated either based on reweighting or labour transitions at individual level. The first consists of deriving a new vector of sample weights to meet control totals for the policy simulation year for a set of main socio-demographic variables (Immervoll et al., 2005). The second approach is to model changes in employment by explicitly simulating transitions between labour market states (Figari et al., 2011; Fernandez Salgado et al., 2013; Avram et al., 2011). Income from work is updated according to changes on the labour market and in line with the general evolution in auxiliary sources which are more up to date. For FE 2023 the annual labour transition approach is used.

2) Simulating social benefits and taxes

The simulation of policies is made using EUROMOD *I6.0+*. It enables researchers and policy analysts to calculate, in a comparable manner, the effects of taxes and benefits on household incomes and work incentives for the population of each country and for the EU as a whole (Brewer and Tasseva 2020; Bronka et al., 2020). Income elements simulated by the model include universal and targeted cash benefits, social insurance contributions and personal direct taxes. Data on income that cannot be simulated mostly concern benefits for which entitlement is based on earlier contribution history (e.g., pensions) or unobserved characteristics (e.g., disability benefits). These are extracted from the data and updated according to statutory rules (such as indexation rules) or changes to average levels over time[3].

2.1. Data context

Microsimulation techniques[4] rely on the EUROMOD model combined with the latest EU-SILC users' database microdata file and/or national SILC microdata available at the time of production. In particular, for FE 2023, EU-SILC 2022 (income 2021)

[3] More detailed information on EUROMOD and its applications is available in the work of H. Sutherland and F. Figari, EUROMOD: The European Union tax-benefit microsimulation model. International Journal of Microsimulation, (2013), 6(1), 4-26.

[4] Used for all countries, except Romania where the FE are based on **current income information** collected in the HBS (Household Budget Survey-RO). The income information is collected via a small set of questions that refer to the current reference period (e.g., current month). Sweden produced national flash estimates.

microdata is used for most of countries[5]. The main auxiliary source used for labour evolution and demographics in the target year is EU-LFS.

2.2. Labour transitions

Types of transitions

In the past years, two main approaches have been employed to update labour market statistics: the reweighting (static ageing) and the labour transitions (dynamic ageing). Following the production of the FE 2020, which incorporated the impact of the COVID-19 pandemic, the first choice of the project was to exclusively rely on individual labour transitions – a methodology preferred in the case of significant labour market shocks.

The labour transitions approach aims to model changes in employment by explicitly simulating transitions between labour market statuses (Figari et al., 2011; Fernandez Salgado et al., 2013; Avram et al., 2011). It accounts for changes in labour market characteristics, while other population characteristics (such as demographics) are kept constant.

There are three types of labour market transitions:

1) From non-employment to employment
2) From employment/self-employment to unemployment
    - From employment/self-employment to short-term unemployment
    - From employment/self-employment to long-term unemployment
3) From short-term unemployment to long-term unemployment

For the transitions into/out of employment, we use detailed annual EU-LFS data for net changes[6] in employment.

Labour transition effects across the distribution

For FE 2023, we applied the dynamic approach to adjust for structural changes for both general population and in particular for labour force population. It means that overall trends in labour market are translated in distributional information by assessing the probability to lose/find employment. We model it based on EU-LFS longitudinal data via a logistic regression at individual level for each country at a time. In practical terms it means that individuals in sample are selected for transitions based on their conditional probabilities of being employed rather than being unemployed or inactive. The main covariates used to identify profiles of workers entering transitions are age, sex, aggregated country of birth (i.e., intra/extra EU),

[5] As EU-SILC 2022 was not available, EU-SILC 2021 was used for Bulgaria and Poland.
[6] Net changes are preferred because of the EU-SILC sample size.

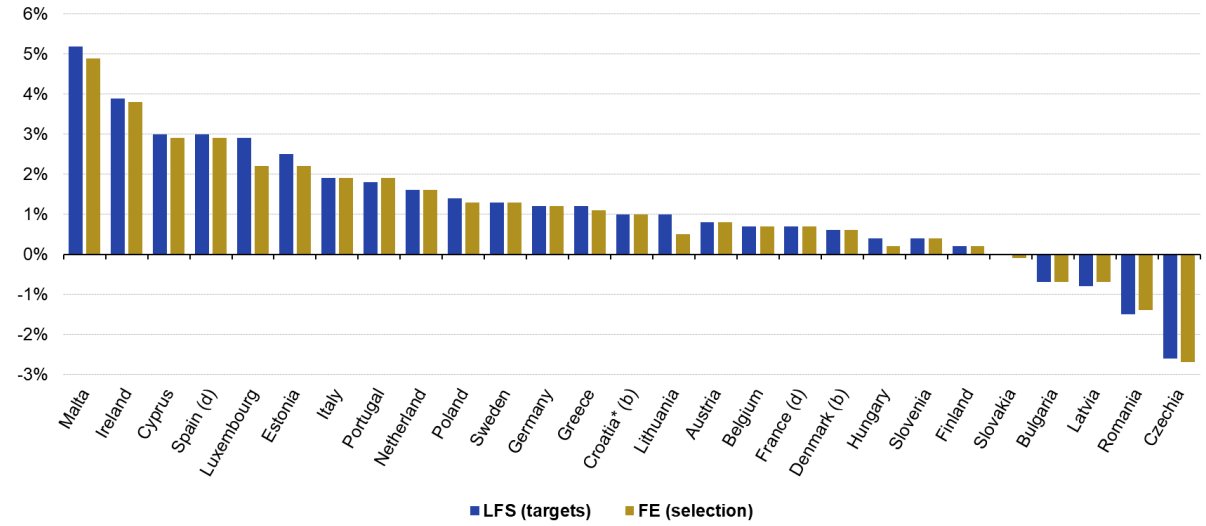
degree of urbanisation, (macro) region of residence, education, work experience and/or duration of unemployment, economic sector, occupation, full or part time job and type of contract (temporary vs permanent). Probabilities are finally imputed in the baseline EU-SILC using the common labour and demographics characteristics. This allows 'to distribute' the labour risks for workers and households at different parts of the income distribution. It can also lead to an over-selection of people with a high-risk profile. To address this issue, targets for employment net changes are replicated by as detailed as possible strata by sex, age group (16-29 and 30-64), employment status (employee versus self-employed), type of contract (permanent versus temporary contract) and activity sector (4 aggregations of sectors). The level of detail is country specific and depends on sample size (i.e., the targets need to fulfil minimum precision requirements and to have big enough sample size for selecting people). Finally, to get a good trade-off between the level of detail and accuracy (i.e., how well the EU-LFS targets[7] are reached), we applied a two-step selection approach:

- A first round of selection is done according to different detailed strata (dependent on the sample size, specific for each country).
- In the second round, the residuals not allocated during the first round are selected just by sex and age group. In this way we ensure that both overall target and targets by the two core breakdown variables are reached at maximum extent possible.

Both detailed targets and the probabilistic selection allow to "distribute" the labour risks for workers and households at different parts of the income distribution. The chart below shows how well the EU-LFS targets are replicated in baseline EU-SILC. The EU-LFS employment net changes are computed as the year-on-year change in the total number of employed persons aged between 16 and 64 years for all countries, except for Croatia[8].

[7] Employment and activity by sex and age - annual data [lfsi_emp_a]
[8] Due to a break in series, for Croatia the employment net change is derived based on the annual change in the employment rate.

Employment net change: year-on-year % change, 2023 versus 2022



In descending order of year-on-year % change
(b) LFS break in series
(d) defintion differs
* derived on the basis of the change in the employment rate
Source: Eurostat

The comparison highlights the alignment between the EU-LFS (targets) and FE (selection), demonstrating the effectiveness of our modelling approach in reflecting employment changes across different countries.

Imputation of employment income

Income is adjusted for those observations that are subject to transitions. In particular, for those individuals moving into employment (or self-employment), the monthly employment income is modelled and imputed from similar individuals in the sample, via predictive mean matching method, which uses a regression model as a tool to identify the donors so that the imputed values will be the observed values with minimum distance in terms of predicted values between donors and recipients. (Heitjan and Little 1991; Schenker and Taylor 1996). The model is fitted with the various covariates such as age, sex, aggregated country of birth (i.e., intra/extra EU), degree of urbanisation, education level, macro region of residence, occupation in main job, status in employment and economic sector. For all individuals undergoing a transition (into/out of employment), the number of the hours and month worked is imputed by applying the distribution observed in EU-LFS data (longitudinal for number of hours worked and cross-sectional for number of months worked) for individuals undergoing the corresponding transition. Then, the (imputed) employment income is thus adjusted proportionally to the total number hours and months worked. In particular, if an individual is transiting into employment, his imputed monthly employment income is multiplied by the number of months worked to estimate his annual income from employment. For the individuals transiting into unemployment the latest observed income from employment is reduced according to the imputed number of months worked.

Unemployment benefits are simulated for those moving out of employment in case they are eligible for such benefits according to the country rules.

2.3. Uprating Factors

Uprating factors are used in nowcasting tor updating market incomes or specific benefits which are not simulated. Uprating factors used in EUROMOD are generally index variables sourced from Eurostat or national statistical offices, including consumer price indices, earnings evolution, and statutory adjustment rules for certain benefits.

Specifically, for FE 2023, Labour Cost Index (LCI)[9] data for all sectors is used as the uprating factor for wages and salaries in Bulgaria, Greece, Spain, Croatia, Hungary, Ireland, Luxembourg, Latvia, the Netherlands, and Sweden. For the remaining countries and other market income variables, EUROMOD uprating factors based on national models and data sources are applied. Details of these uprating factors can be found in the EUROMOD Country Reports[10].

2.4. Policies via EUROMOD

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. EUROMOD labour market adjustment add-on is used to simulate for everyone undergoing a labour transition the policy response in terms of taxes and social benefits.

A breakdown of the different income components gives a more granular analysis, and consequently, enables users to benchmark the observed trends against multiple target indicators from external sources, with the purpose of a more detailed assessment of the quality of the estimates.

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.

[9] The Labour Cost Index (LCI) measures short-term trends in "average hourly labour costs," defined as total labour costs divided by the corresponding number of hours worked.
[10] ANNEX 1. UPRATING FACTORS.

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 and 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, Czechia, Estonia, France and Italy); (iii) Policies from 2022 that have been replaced by new ones in 2023 to support individuals' and households income (for example Germany, Portugal and Slovenia). On the other hand, several measures were not simulated in the model due to a 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 child and family benefit (e.g., Estonia, Italy, and the Netherlands), revised eligibility criteria (e.g., Estonia and Italy), and introduced of supplemental supports (e.g., Portugal and Slovakia). These measures have contributed to reducing significatively AROP for children in these countries. However, some nations, including Czechia, Greece, and Latvia, faced reductions or eliminations of temporary financial aids provided in 2022, 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.

2.5. Ex ante quality assessment – model assumptions and limitations

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

For quality assessment and validation purposes, a broader set of indicators from auxiliary sources is used: 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 (such as wages and salaries, mixed income, household disposable income and property income); time series analysis of EU-SILC.

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 different sources available, 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.

To better assess our flash estimates for 2023, we employed simple time series analysis techniques, such as exponential smoothing and ARIMA models, as benchmark models. These forecasting techniques were used to further validate our flash estimates: by comparing the nowcasted values of AROP overall, obtained using exponential smoothing and ARIMA models, against the results of our flash estimates for 2023, we ensured a robust validation process.

Furthermore, bilateral consultations with the Member States are carried out before the estimates are published. These consultations aim to collect feedback and comments on the plausibility of the results directly from the national statistical institutes. In some cases, where available, the results are also compared with national early estimates to enhance the reliability of our flash estimates.

3. Conclusions

During the COVID-19 pandemic a more agile production system was put in place with the use of infra-annual data, new data sources and the use of forecasting models. To produce the FE 2023, the labour market model was consolidated to fit the current context: no short-term schemes are simulated anymore, and the models rely on annual transitions. However, some specific COVID-19 pandemic related developments were included in the standard methodology for a better estimation of distributional effects: the estimation of the number of months worked during the year, the number of hours worked during the week, and the use of probabilities to make a transition (to employment/unemployment) based on longitudinal EU-LFS.

A cross-domain and inter-institutional collaboration is essential to produce and validate the flash estimates. The estimation process is conducted in collaboration with the JRC and with national EUROMOD teams to produce the simulation of taxes and benefits.

Quality matters are addressed in coordination with the above-mentioned organizations and through bilateral consultations with the Member States. This broader approach to quality assessment, which included the involvement of different actors is essential for the improvement of the methodological and quality framework.

Further work will focus on broadening and consolidating input data sources and modelling assumptions. For instance, full benefit take-up assumptions might lead to over-simulation of benefits and further analysis is ongoing.

In addition, in the current high inflation crisis context, it is important to monitor the evolution of disposable income in real terms, which allows to take into account not only the changes in households' income, but also estimate the impact of the rising cost of living. An extended set of supporting indicators adjusted for inflation enable users to better disentangle income and cost of living considerations. The effects of policy measures put in place by governments to support household' income and purchasing power are partly reflected in inflation adjusted indicators.

Finally, though they are experimental, the flash estimates can be used by both policymakers and users to make a first assessment of the evolution of income and poverty in EU.

Annex 1 - Current income

For Romania, FE 2023 are based on Household Budget Survey (HBS) data. Their HBS is organized as a continuous quarterly survey over a period of three consecutive months. Response rate is around 80%-85%. 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. Data are collected by face-to-face interview and self-registration for the diary. The support of data collection is the household questionnaires and the household diary. The reference period for the data registration in the survey questionnaire and household diary is the calendar month (from the first to the last day of the month).

Annex 2 - References

Avram, S., Sutherland, H., Tasseva, I. 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.

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.

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.

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.

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.

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

Heitjan, F., and Little, R. J. A. (1991). “Multiple Imputation for the Fatal Accident Reporting System.” Journal of the Royal Statistical Society, Series C 40:13–29.

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

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.

Schenker, N., and Taylor, J. M. G. (1996). “Partially Parametric Techniques for Multiple Imputation.” Computational Statistics and Data Analysis 22:425–446.

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