

Flash estimates
of income inequalities and poverty indicators for 2022 (FE 2022)
Methodological note

June 2023

Acknowledgements:

This methodological paper focuses on the updates to the nowcasting methodology put in place to capture the impact of labour market evolutions on income inequalities in 2022.

The microsimulation results 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 Silvia De Poli, Chrysa Leventi, Adrian Hernandez and Fidel Picos.

EUROSTAT

Aura LEULESCU

Adriano DI GUGLIELMO

Mihaela AGAFITEI

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

- *Cyrinus ELEGBEDE*
- *Notaras VASILOPOULOS*

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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 2020¹ and FE 2021² 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 2022³, came back to pre-pandemic standards, but some developments were consolidated in the estimation process (e.g., 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 2022 are provided.

¹ [Methodological note - FE 2020.](#)

² [Methodological note - FE 2021.](#)

³ For Romania, the FE are based on **current income information** collected in the HBS (Household Budget Survey-RO). For Bulgaria the national FE are based on administrative data together with current income information from EU-SILC. In both cases income information is collected via a small set of questions that refer to the current reference period (e.g., current month).

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 2022 the annual labour transition approach is used.

2) *Simulating social benefits and taxes*

The simulation of policies is made using EUROMOD 15.0+. 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 time⁴.

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

Data context

Microsimulation techniques 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 2022, EU-SILC 2020 (income 2019) microdata is used for all countries⁵. The main auxiliary source used for labour evolution and demographics in the target year is EU-LFS.

Labour transitions

Types of transitions

There are four types of labour market transitions:

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

For the transitions into/out of employment, we use detailed annual EU-LFS data for net changes⁶ in employment.

Labour transition effects across the distribution

For FE 2022, 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. A logit model is used for estimating these probabilities. The main covariates used to identify profiles of workers entering transitions: age, sex, education, economic sector, occupation 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

⁵ EU-SILC 2020 was not available for Luxembourg and Slovenia.

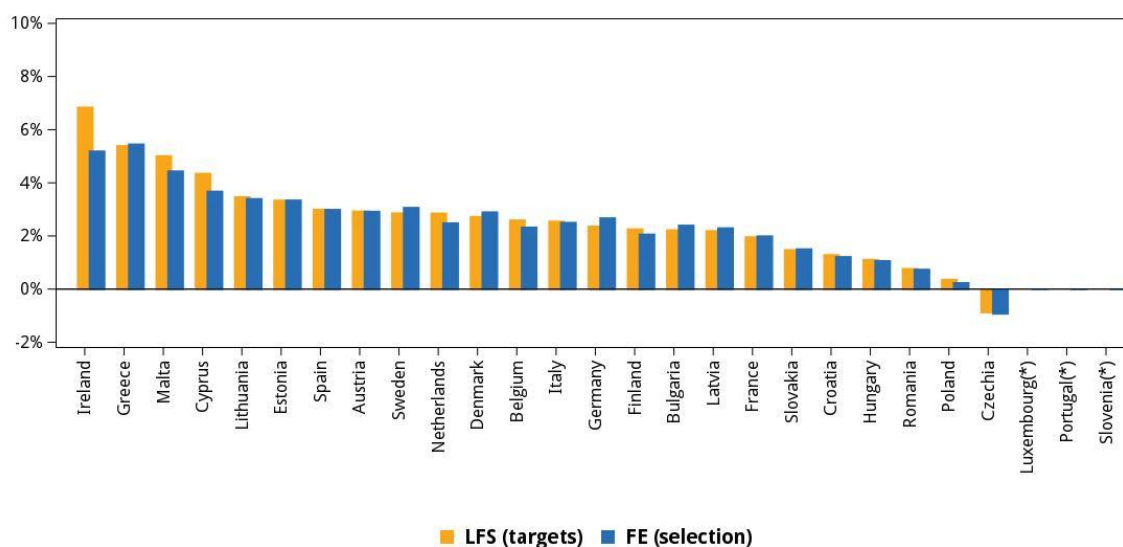
⁶ Net changes are preferred because of the EU-SILC sample size.

people with a high risk profile. To address this issue, targets for employment net changes are replicated by strata based on selected aggregated variables. The level of detail depends on the country and the sample size. Most often employed are: sex (male/female), age group (16-24/25-64), status in employment (employees/self-employees), sector (7 aggregations of sectors) and type of contract (permanent/temporary). Finally, to get a good trade-off between the level of detail and accuracy (e.g., how well the EU-LFS targets are implemented/met) we applied a two-step selection approach:

- A first round of selection is done according to different strata at a more detailed level (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 met 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 table below shows how well the EU-LFS targets are replicated in baseline EU-SILC.

Employment net change: year-on-year % change, 2022 vs 2021



In descending order of year-on-year change

* Not published

Source: Eurostat

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 is similar to the regression method except that for each missing value, it imputes a value randomly from a set of observed values whose predicted values are closest to the predicted value for the missing value from the simulated regression model (Heitjan and Little 1991; Schenker and Taylor 1996). The model is fitted with the various covariates such as age, sex, education level, region of residence, occupation in main job, status in employment and economic sector. Same method is used to impute the hours worked.

Duration of transitions

Finally, for all the individuals undergoing transitions into/out of employment, the number of months worked is also imputed, following the distribution of the correspondent EU-LFS variables⁷. 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.

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, including the short-term schemes adopted during the COVID-19 crisis (Christl et al., 2021). For FE 2022, following the return to work and the end of sanitary restrictions, short term schemes were not simulated anymore.

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.

⁷ A) Year in which person started working for current employer or as self-employed in current main job
B) Month in which person started working for current employer or as self-employed in current main job
C) Year in which person left the last job or business
D) Month in which person left the last job or business

EUROMOD 15.0+, is used to simulate the policies in place in 2022 and the changes in the income distribution within the period of analysis.

For 2022, EUROMOD includes income **support measures** introduced to shield consumers from rising and volatile energy prices⁸. These include indexation measures, social assistance benefits, housing benefits and allowances, often related to minimum living standards. Examples range from the universal climate bonus (Austria), lump-sum transfers to households to cope with high energy prices (Germany), a temporary increase in the national minimum income benefit and minimum living standard (Spain, Czechia). More information on the specific energy measures simulated in EUROMOD in different countries can be found in the [EUROMOD Country Reports](#). On the other hand, price-related measures, such as VAT cuts, social tariffs and price caps are not taken into account due to unavailability of data on indirect taxes and household expenditures. In specific countries, policies put in place by governments to tackle the increase in inflation are mainly price related measures and are therefore not accounted for in the standard income estimates in nominal terms. In addition, several measures are not simulated in the model due to lack of data on the energy consumption of households or the amounts compensated. It is important to consider also that the effect of the increasing interest rates on households' expenditure and material wellbeing is not captured in the EU-SILC definition of income and poverty. This effect is also likely to depend to the extent households have fixed rate mortgages.

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. Further inflation adjusted indicators were computed to take into account considerations related to the cost of living.

Inflation adjusted indicators for flash estimates 2022

In the current 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. Estimates show that despite high increases in nominal terms and important support measures put in place to mitigate the soaring prices for necessity goods and services, median income decreases in real terms in most EU countries. This inflation-adjusted measure of the median disposable income is calculated by deflation, using the overall [Harmonised Index of Consumer Prices \(HICP\)](#). It is important to note that the HICP measures the change over time in the prices of consumer goods and

⁸ Some income support measures cannot be simulated in the model due to the lack of data on the energy consumption of households or the amounts compensated.

services as an average across all households. Therefore, it doesn't capture accurately the impact of inflation along the income distribution.

To better illustrate the potential effects of inflation on the income distribution we have computed an additional index. The rise in prices is driven to a substantial extent by the increase of prices for essential items (goods and services)⁹, such as food, energy and transport were the main reason for the decrease of the real income. This is likely to affect more the purchasing power of lower income households, for which these items represent a higher share of the overall consumption. This index of essential items has been computed via the [procedure for the aggregation of indices](#), which consists of the following three steps:

1. The series (indices) need to be unchained by dividing the value of each year by the value of the previous year.
2. The series must be aggregated by computing the weighted arithmetical average. That is, multiplying each unchained monthly value computed in step 1 with its weight and dividing the result by the sum of the weights of the products to be aggregated.
3. Afterwards, the result obtained in step 2 needs to be chain-linked. This is done by multiplying the value of the aggregate of the previous year with the result obtained in step 2.

We also computed how much the essential items contributed to the total price increases in 2022 by decomposing the annual average change of rate of the total HICP by its COICOP (Classification of Individual Consumption According to Purpose) components.

Further details on the HICP methodology can be found [here](#).

Ex ante quality assessment - model assumptions and limitations

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

⁹ Essential items, usually considered fundamental for meeting basic needs and maintaining a reasonable standard of living, are defined for the purpose of this exercise by the aggregation of the following [COICOP classes](#): Food and non-alcoholic beverages (CP01); Water supply (CP0441); Refuse collection (CP0442); Sewerage collection (CP0443); Electricity, gas and other fuels (CP045); Passenger transport by railway (CP0731); Passenger transport by road (CP0732); Combined passenger transport (CP0735); Other purchased transport services (CP0736); Telephone and telefax services (CP0830).

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.¹⁰

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 early 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 2022, 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 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 early estimates. The estimation process is conducted in collaboration with the JRC and with national EUROMOD teams to produce the simulation of taxes and benefits.

¹⁰ More info can be found at the link <https://euromod-web.jrc.ec.europa.eu/resources/country-reports>

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 focuses 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 early 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 2022 are based on Household Budget Survey (HBS) data¹¹. Their HBS is organized as a continuous quarterly survey over a period of three consecutive months, based on a sample of 9 504 permanent dwellings, divided into monthly independent sub-samples of 3 168 permanent dwellings (per year the sample cover 38 016 households). 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).

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.

¹¹ <http://statistici.insse.ro/shop/index.jsp?page=tempo2&lang=en&context=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), Early estimates of income inequalities. Available at:

[https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Early estimates of income inequalities&stable=0](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Early_estimates_of_income_inequalities&stable=0)

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. Available at:
<https://doi.org/10.34196/ijm.00237>

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).