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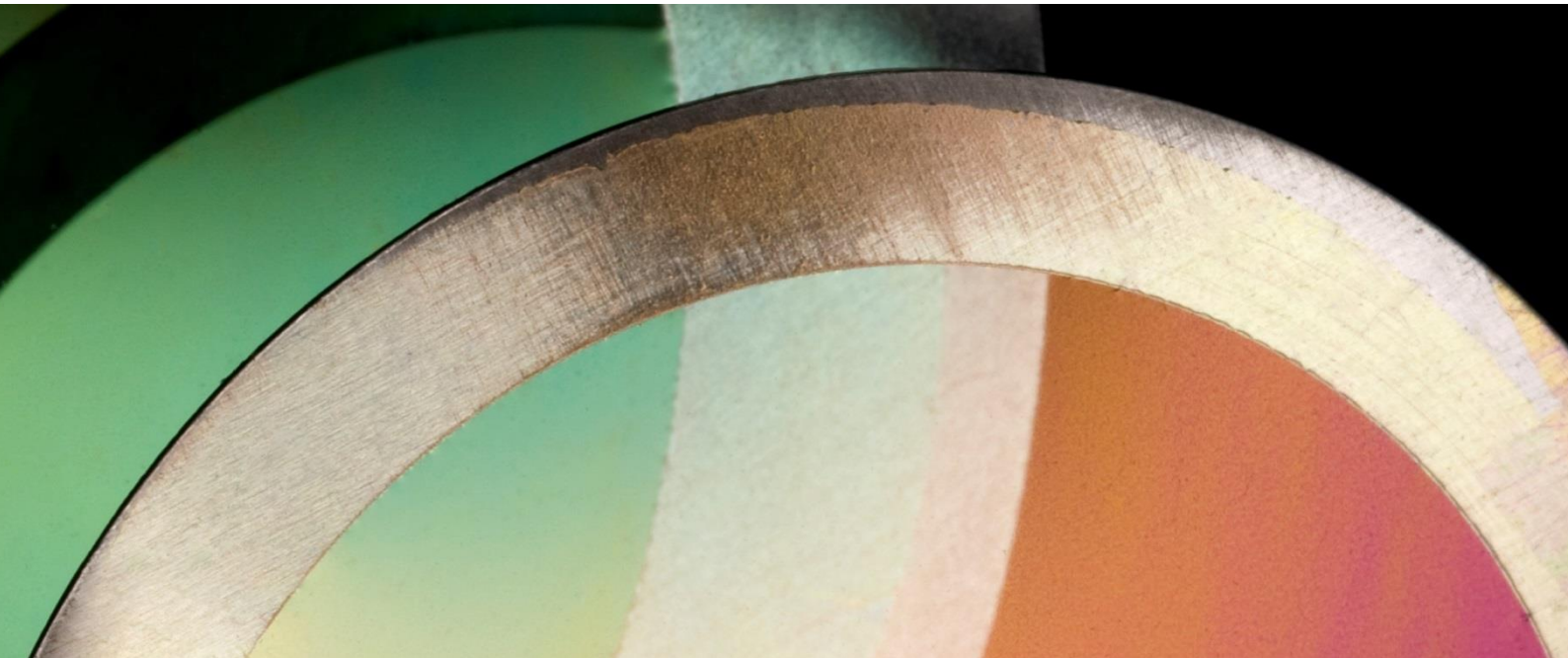

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Foreword

This paper presents the baseline results from the latest public version (I4.0+) of EUROMOD, the tax-benefit microsimulation model for the EU. The model was previously maintained, developed and managed by the Institute for Social and Economic Research (ISER) at the University of Essex, and since 2021 these responsibilities are taken over by the Joint Research Centre of the European Commission (Unit JRC.B2) in collaboration with Eurostat and 27 national teams. The model yearly update is financially supported by the following Directorate-Generals of the European Commission: DG EMPL, DG ECFIN, DG TAXUD, DG JRC and Eurostat.

This paper is largely based on previous baseline reports, particularly on Kneeshaw et al. (2021). It has been drafted by Sofía Maier and Mattia Ricci with the collaboration of the JRC EUROMOD team: Vanda Almeida, Michael Christl, Hugo Cruces, Silvia De Poli, Klaus Grünberger, Adrián Hernández, Tine Hufkens, Daniela Hupteva, Viginta Ivaškaitė-Tamošiūnė, Marta Jędrych, Alberto Mazzon, Bianey Palma, Andrea Papini, Fidel Picos (EUROMOD Project Leader), Alberto Tumino (EUROMOD Project Leader) and Estefanía Vázquez. The report was supervised by Salvador Barrios (Head of Unit, JRC.B2).

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Executive Summary

- EUROMOD is a tax-benefit microsimulation model for the European Union that 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.
- The scope of EUROMOD simulations includes direct taxes and social insurance contributions (SICs), as well as non-contributory in-cash social benefits. The lack of information on individual contributory history in the underlying microdata prevents the simulation of most contributory benefits and pensions, with the exception of unemployment benefits.
- This report presents the key baseline results from EUROMOD version I4.0+. The analysis covers the years 2018-2021 and focuses on income poverty, inequality and work incentives indicators. Despite being mostly based on the same source of data (i.e. EU-SILC), EUROMOD-based indicators might not coincide with ESTAT indicators for a number of reasons, such as the differences between simulated and reported variables, modelling of non-take-up and tax evasion, differences in definitions of households incomes as well as differences in the release version of the data used.
- In the base year 2018, EUROMOD-based estimates of at-risk-of-poverty rates are the highest in Bulgaria, followed by Romania, Hungary, Latvia, Lithuania, Estonia, Spain and Italy (all above 20%). At the other extreme, the lowest poverty rates are registered in Czechia and Croatia, followed by Denmark, Slovakia and Finland (all below 11%). In Romania, child poverty reaches 28%, followed by Hungary, Bulgaria, Spain and Italy (above 25%).
- Looking at the effect of tax-benefit policies on poverty rates across the EU during 2018-2021, we observe that public pensions play the largest anti-poverty effect among the various instruments of the tax-benefit systems. These are followed by non-means tested and means tested benefits, whose effects on poverty are, however, a third of pensions. On the other hand, taxes and SICs appear to play a minor role in reducing poverty. The relative importance of these instruments in closing the poverty gap and reducing inequality is largely similar.
- EUROMOD also calculates Marginal Effective Tax Rates (METRs) for all individuals with earned income. They represent the proportion of marginal increase in earnings that is "taxed away" due to social insurance contributions, taxes and loss of benefit entitlement. Therefore the METRs provide a measure of labour market incentives at the intensive margin. According to EUROMOD simulations, in the base year 2018 Belgium exhibits the highest mean METR by far (54%), followed by Denmark, Luxembourg, Germany and Finland, where METRs range between 44% and 46%. The lowest mean METRs are observed in Cyprus, Croatia, Estonia and Bulgaria (below 25%).
- Comparing METRs during 2018-2021, Lithuania is the country experiencing the largest increase in disincentives (15 percentage points). Such an increase is generated by a SIC reform, which resulted in the recalculation of all the gross wages for the purpose of SIC liabilities. Moreover, personal income tax was also reformed with the introduction of a second income band featuring a higher rate of tax.
- Despite a wide variation across countries, the decomposition of METR shows that the tax component is usually the most important. In this respect, Denmark is the most extreme case with almost all of the average METR being accounted for by direct taxes. On the other hand, a number of eastern European countries, including Hungary, Croatia, Bulgaria, Romania, Slovenia, Slovakia, display a larger contribution of SICs to their METRS with respect to taxes.

Acknowledgements

This paper would have not been possible without the contribution of the many people involved in the development of EUROMOD. We are particularly indebted to the EUROMOD National Teams that make the annual update of the model possible and to the Eurostat colleagues that collaborated on the production of the EUROMOD input data: Henri Busson, Albane Gourdol and Olga Moraru. We also want to acknowledge the work carried out by the authors of previous baseline reports, particularly those of the one published by the University of Essex in 2021: Jack Kneeshaw, Diego Collado, Nicolo Framarin, Katrin Gasior, Holguer Xavier Jara Tamayo, Chrysa Leventi, Kostas Manios, Daria Popova and Iva Tasseva. The present paper is largely based on theirs.

We are grateful for the access to microdata from the EU Statistics on Incomes and Living Conditions (EU-SILC) made available by Eurostat under RPP 189/2019-ECHP-LFS-EU-SILC-HBS; from SILC national variables made the National Statistical Institutes of AT BE BG CY CZ DE DK EE EL ES FI FR HR HU IE IT LU LV MT NL SE SI SK, through practical arrangements signed with JRC and Eurostat; from SILC national variables for LT and PL made available by the respective National Statistical Institutes. Neither of the aforementioned data providers bears any responsibility for the analysis or interpretation of the data reported here.

Abstract

This paper presents baseline results from the latest public version (I4.0+) of EUROMOD, the tax-benefit microsimulation model for the EU. We begin by briefly discussing the process of updating EUROMOD. We then present indicators for income inequality and at-risk-of-poverty using EUROMOD and discuss the main reasons for the differences between these and their correspondent from the EU Statistics on Incomes and Living Conditions (EU-SILC). We further compare EUROMOD distributional indicators across all EU 27 countries and over time between 2018 and 2021. Finally, we provide estimates of marginal effective tax rates (METR), an indicator which captures the effect of tax-benefit systems on work incentives at the intensive margin. Throughout the paper, we highlight both the potential of EUROMOD as a tool for policy analysis and the caveats that should be borne in mind when using it and interpreting results.

1 Introduction

This report presents key baseline results from the EUROMOD microsimulation model, version I4.0+. The analysis covers the years 2018-2021 and focuses on poverty, income distribution and work incentives indicators. The present work updates the previous version of the EUROMOD baseline report by Kneeshaw et al. (2021).

EUROMOD is a tax-benefit microsimulation model for the European Union that 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.

The model is developed and maintained by the Joint Research Centre of the European Commission, in collaboration with Eurostat and a network of national experts from the various Member States. The model is distributed with an open-source license, and it can be freely downloaded from the EUROMOD JRC website (https://euromod-web.jrc.ec.europa.eu/). The model software source code, written in C#, can also be downloaded from the website. To ensure cross-country comparability, EUROMOD runs on microdata from the EU Statistics on Incomes and Living Conditions (EU-SILC). EU-SILC contains information on income and socio-demographic circumstances of representative samples of private households in each EU Member State.[1]

The scope of EUROMOD simulations includes direct taxes and social insurance contributions as well as non-contributory in-cash social benefits. The lack of information on individual contributory history prevents the simulation of most contributory benefits and pensions. Unemployment benefits constitute an exception to this rule for they are simulated in all countries based on assumptions about individual eligibility and imputations of the pre-unemployment earnings. Tax-benefit instruments that are not simulated are set to their reported value in EU-SILC. Altogether, starting from market incomes and socio-demographic characteristics observed in the EU-SILC data, EUROMOD allows users to simulate taxes and social transfers and to analyse the extent to which policy reforms affect household disposable income. It is important to highlight that the main purpose of EUROMOD is not to generate baseline statistics for a particular policy year, but to be used as a tool to explore alternative scenarios in terms of policies and in analysing the characteristics of the populations on which they have an impact on.

The remaining of this report is organized as follows. Section 2 describes the EUROMOD updating process for the year 2021, introducing the main features of the model and the concept of EUROMOD baselines. Section 3 analyses the effect of the EU tax-benefit systems on poverty and inequality indicators for the years 2018-2021. Section 4 presents the validation of EUROMOD baseline results. Section 5 analyses work incentives at the intensive margin, as measured by Marginal Effective Tax rates (METR).

[1] The use of EU-SILC and EU-SILC-based EUROMOD input data is subject to permission by Eurostat. More information can be found in https://euromod-web.jrc.ec.europa.eu/access-euromod/.

2 The EUROMOD project

The annual EUROMOD update project involves four key tasks: (1) updating the input database (in this case to 2019 SILC data), (2) updating policy systems to the latest year (in this case to 2021), (3) validating the baseline outputs and (4) documenting the work in Country Reports. These are described briefly in turn in the following paragraphs.

2.1 Updating input databases

The aim of this task is to build input databases for all countries from the most recent EU-SILC user database (UDB). However, in most countries, the UDB does not contain all the information needed to inform tax- benefit calculations. That's why it was decided, from 2021 onwards, that a new database prepared by Eurostat (EUROMOD SILC database, EMSD) is used to derive the EUROMOD input dataset. The EMSD includes:

- all UDB variables (each variable is described in the document "Methodological guidelines and description of EU-SILC target variables [doc 65]" available online[2]);
- national SILC data supplied by the National Statistical Institute (NSI);
- EUROMOD variables created and imputed by Eurostat because of restricted data access or knowledge in-house.

Based on the EMSD, the national team derives additional variables requiring a deep understanding of country specificities (for instance national tax-benefit rules). Some of the EUROMOD variables produced by Eurostat are created and/or imputed with PDB (Production Database) variables. The reason is that the modalities of the PDB variables are more detailed than in UDB. According to the agreement between the NSI and Eurostat, the national teams are allowed to use the more detailed information coming from the PDB to derive some EUROMOD variables or to use them as intermediate variables to impute other EUROMOD variables. However, in the final EUROMOD input dataset, same disclosure rules as in the UDB are applied. Nevertheless, when imputing variables, disclosure rules are not applied, so the values might still differ from the one that a user could obtain when replicating the imputation based on the UDB data set. In 2021 ten countries used the new EMSD to update their EUROMOD input files, namely AT BE BG CZ ES FR HR HU MT NL. The procedure will be extended to all countries throughout 2022 and 2023.

For other countries, where possible, variables from the underlying national data (often referred to as the "national SILC") have been used. In some cases they have been merged into the EUROMOD input database obtained from the UDB: EE LT LV PL SI. In other cases it was possible to use the "national SILC" as an alternative (rather than a supplement) to the UDB: EL IT SK. For the remaining countries the construction of the EUROMOD input datasets is solely based on EU-SILC UDB: CY DE DK FI IE LU PT RO SE.

In all cases the data used corresponds to 2019 (income reference period 2018).

2.2 Updating policy systems until 2021

Based on detailed descriptions of policies provided by national teams, 2021 policies have been modelled using the EUROMOD tax-benefit modelling "language" for each country. Together with uprating factors, to bring 2018 incomes from 2019 EU-SILC input data up to the level corresponding to more recent policy years (2019, 2020, 2021), it is now possible to simulate tax-benefit policies from each of these four policy years for each of the 27 EU countries.

The aim is to simulate as much as possible of the tax and benefit components of household disposable income. In practice, some parts of the tax or benefit system may be difficult to simulate and in that case the component is taken directly from the input database. This applies in the case of many contributory benefits and pensions (since information on past work and contribution history is not available in the EU-SILC or most other cross-sectional survey data sources) and many disability benefits (since information on the nature and severity of the disability is not included in the UDB data). The extent of these limitations varies across countries. For example, in some countries it is possible to simulate non-contributory pensions; on the contrary, in countries where such pensions do not exist, pension systems cannot be simulated.

[2] https://circabc.europa.eu/sd/a/b862932f-2209-450f-a76d-9cfe842936b4/DOCSILC065_operation_2019_V9.pdf

In some other cases, benefits can only be partially simulated; using assumptions based on the information available in the data, for example, entitlement to unemployment benefits is simulated using information on reported receipt of this benefit in the EU-SILC. In some countries, the user can choose whether to use the simulated values of unemployment benefits or the values inputted from the data in their analysis. In these cases, the default is to make use of recorded values in analysis of income distribution, but to use simulated values when calculating indicators such as replacement rates or welfare resilience indicators.[3] Complete details of the benefits and taxes fully or partially simulated in this paper, and of those which are instead taken from the input data, are provided in the Country Reports.[4]

2.3 Validation

Three distinct types of validation are usually carried out before the release of baseline results. First, as part of the policy implementation, the coding of the rules governing each policy instrument, as well as the interactions between instruments, were checked using a range of built-in tools. This is known as "micro-validation".

Secondly, once a country component in EUROMOD is working satisfactorily, aggregate estimates for expenditure on each benefit and revenues from each tax are compared with official external sources, such as national administrative statistics. Where available, the numbers of recipients and taxpayers are also compared against external data. This "macro-validation" also helps to spot errors and problems in the implementation (either in the policy rules or the data, or in both). Once finalised, a report on the "macrovalidation" is included in each Country Report, to inform model users about how the baseline results from EUROMOD correspond to other external statistics.[5]

A third type of validation takes place when the model is used comparatively across countries. Whether a discrepancy can be considered large or small (important or unimportant) sometimes becomes clearer in cross-national perspective. In addition, unexpected differences in distributional indicators between countries can point to possible problems in the implementation of certain taxes and benefits, or to country-specific factors related to the nature of taxes and benefits. An example of such an exercise is presented below, comparing baseline EUROMOD results with Eurostat statistics calculated directly from the EU-SILC.

Two main issues arise when validating macro statistics from EUROMOD: tax compliance and non-take-up of benefits. Assuming full knowledge of and compliance with policy rules tends to result in over- simulation of taxes and of benefits, and hence to under-estimate inequality of disposable incomes. At the same time, estimates based on the assumption of full compliance and benefits full take-up can be interpreted as the "de jure" or intended effects of the system.

EUROMOD models benefit non-take-up and tax compliance using a country-specific approach, relying on the best available information from external administrative data. At the same time, we attempt to make our modelling as transparent as possible, by enabling external users to switch off (or modify) the model components specific to tax evasion and take-up, depending on their research objectives. Tax compliance adjustments (TCA) are included in the models of BG, EL, IT, LT and RO, while benefit non-take-up adjustment (BTA) is modelled for BE, EE, EL, ES, FI, FR, HR, IE, LV, RO, SI and SK.[6]

In addition, it needs to be noted that, as a general rule, EUROMOD implements policies as they were on the 30th of June. In some cases where major reforms happen after that date, the policy effect will not be captured in EUROMOD which can also have an effect on the validation results. However, to capture these types of measures some countries (BG EE EL FR HU IT LT) have implemented full year adjustments (FYA), which are intended to simulate situations where policy instruments were in effect for only a part of the year. Annex 4 describes where these types of adjustments have been implemented. However, by default they are off when calculating the baseline results.

A country-by-country description of the three types of adjustments (TCA, BTA and FYA) can be found in annex 3.

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[3] For example, see Fernández Salgado, Figari, Sutherland and Tumino (2013).

[4] The latest country reports are available at https://euromod-web.jrc.ec.europa.eu/resources/country-reports/latest.

[5] It should be noted that external statistics are often available only with a time lag (e.g. macro-validation of 2020 policies typically cannot be finalised until late 2021). Country Reports document these issues.

[6] Both BTA and TCA are on by default in all countries, except TCA for LT, which is off by default.

2.4 Country reports

Each national team (see Annex 2) has produced a Country Report conforming to common guidelines in terms of style and content. The intention is to provide comprehensive documentation for EUROMOD users and serve as reference for developers and national teams in the future.[7]

2.5 Important note on the COVID-19 policies implemented in 2020 and 2021

In an ordinary year, incomes in the input data are uprated from the year that they are reported for (i.e. SILC year-1) to the policy year that is being analysed (e.g. 2018 incomes from the 2019 SILC are uprated to 2021, if that is the policy year that we are interested in). At the same time, it is standard practice in EUROMOD for the input data populations to remain the same. In particular, demographic (e.g. increased migration) and socio-economic (e.g. increased unemployment) changes that might have altered the distribution of households or their market incomes are not accounted for. In an ordinary year, this works satisfactorily since sudden demographic and labour market shocks are much rarer than incremental changes.

However, due to COVID-19 pandemic, in 2020 and in 2021 labour market disruptions were substantial in EU countries. Abstracting from these disruptions should therefore be undertaken with more care in these years. To allow users to overcome this limitation of the EUROMOD baseline simulation, the 2020 and 2021 policy systems of the EUROMOD public release (versions I3.0+ and I4.0+) contain a new policy - the "TransLMA_cc". This policy simulates the labour market shock caused by the COVID-19 crisis by operating a labour market transition of individuals to a country's monetary compensation scheme and into unemployment. For 2020, this policy therefore effectively replicates the COVID-19 labour market conditions based on Eurostat data on job losses and short-term work schemes. For 2021, these statistics were not available at the time of the preparation of the release of the model and were, therefore, not included.[8] Crucially, the policy "TransLMA_cc" only produces results if the model is run in combination with the Labour Market Adjustment (LMA) add-on, included in the public release. Prior to using the policy and the add-on, users are encouraged to refer to the related documentation that accompanies the public release of the model, i.e. "Simulating labour market transitions in EUROMOD: EUROMOD LMA Add-on and COVID-related policies" and "Labour Market Adjustment (LMA) Add-on - technical note".[9]

Since the simulation of labour market transitions are switched off by default, they do not produce any effect on the baseline results analysed in this report. However, Covid-related policies that are not linked to labour market transitions are fully functional (e.g. greater generosity for existing benefits or tax cuts). Therefore, simulated disposable income in the baseline is likely to be overestimated. The fall in the poverty risk in many countries in 2020 – see Section 3.1, below – is a good example of this 'static' policy effect, which does not account for a rise in unemployment. Interpretation of the 2020 and 2021 results for all countries presented here should bear this in mind.

[7] The latest country reports are available at https://euromod-web.jrc.ec.europa.eu/resources/country-reports/latest.

[8] Figures including the labour transitions to unemployment and compensation schemes for 2021 will be available with the 2021 Flash Estimates of poverty and inequality indicators by Eurostat, which will be published in June 2022.

[9] The two documents are available in https://euromod-web.jrc.ec.europa.eu/resources/model-documentation.

3 Poverty and inequality indicators with EUROMOD

Policy systems for years 2018 to 2021 are simulated in EUROMOD allowing the analysis of the effect of policy changes on income distribution. Table 1 shows selected poverty and inequality indicators for these policy years. Risk of poverty rates for the whole population of each of the 27 EU countries are shown for three poverty thresholds: 50%, 60% and 70% of national median equivalised household incomes (using the modified OECD equivalence scale). Risk of poverty for children (aged under 18) and older people (aged 65 or more) using the 60% threshold are also included. A commonly used indicator of income inequality is also shown: the Gini coefficient.

The one area that EUROMOD is especially designed to address is the role of taxes and benefits in reducing inequality and poverty risk. Tables 2, 3 and 4 show the effects of various tax and benefit components on poverty risk, poverty gap and inequality between 2018 and 2021.

Note that for Tables 2 and 3 the poverty threshold is the same throughout, using 60% of median household disposable income in the respective year. The poverty threshold stays constant as income components are added and subtracted in order to highlight the role played by the component in poverty reduction. Columns 3-7 in Tables 2 to 4 show what happens to poverty and inequality if each component (means-tested benefits, non-means-tested benefits -not including public pensions-, taxes and social insurance contributions) is added back (in the case of taxes) or deducted (in the case of benefits), in turn, from disposable income. Column 8 depicts poverty and inequality estimates on the basis of market income and column 9 presents what happens to these indices when public pensions are added to market income. The role of public pensions (in contrast with that of direct taxes and non-pension benefits, which are usually considered to be the main instruments of redistribution) is also graphically illustrated in Figures 1 (effects on poverty risk) and 2 (effects on inequality).

Results for all years are based on the same input database, so do not capture the effects of changes in population composition and characteristics. In each case, we have calculated the indicators using the same methods in principle as Eurostat although, as explained in section 5, there are a number of reasons why the values may differ from those produced by Eurostat from the EU-SILC data directly.

Incomes that are not simulated (e.g. market incomes) are updated from the base year 2018 to the following years based on indices for each separate income source (e.g. earnings indices for earnings, pension uprating indices for pension-related incomes). These tables show how poverty and inequality indicators evolve over time in each country, as a result of policy changes and changes in income levels, abstracting from changes in socio-demographic characteristics of the population, which are kept constant as in the base year.

3.1 Poverty risk: baseline year and trends

Table 1 shows the evolution over time of the poverty threshold, defined as 60% of the median equivalised household disposable income, in nominal terms across countries. In this analysis the poverty line can shift because of inflation, changes in market and non-market incomes, tax and benefit policy reforms and uprating of policies over the period considered. In the non-euro-zone countries, poverty thresholds, which are expressed in euro, can also be affected by fluctuations in the exchange rate.

Table 1 shows that the highest at-risk-of-poverty rate using the 60% poverty line in the base year 2018 is observed in Bulgaria (23.2%), followed by Romania, Hungary, Latvia, Lithuania, Estonia, Spain and Italy (above 20%). The lowest poverty rate is registered in Czechia and Croatia (9.6%), followed by Denmark, Slovakia and Finland (below 11%). The ranking of countries seem to remain relatively stable when considering alternative poverty thresholds (50% and 70% of the poverty line). Poverty risk results are higher for more vulnerable categories, such as children and elderly people. In Romania, child poverty reaches 28% in the base year, followed by Hungary, Bulgaria, Spain and Italy (above 25%). The lowest child poverty rates (below 12%) are observed in Slovenia, Czechia, Denmark and Finland (about 9%). Elderly poverty reaches 46% in Latvia, 43% in Estonia, 36% in Bulgaria, and about 32% in both Lithuania and Malta. At the other end of the spectrum, the countries with the lowest elderly poverty rates (below 8%) are France, Denmark, Netherlands, Luxembourg and Slovakia.

Table 1 also shows that over the period 2018 – 2021 changes in poverty rates due to changes in tax- benefit policies and income levels tend to be relatively small, though decreases in poverty rates were more prevalent than in previous years and increases, where they occurred, much less marked. Much of this relates to the effects of 2021 policy reforms, including those in response to Covid (see Section 2.5). Still, increases in poverty rates greater than 2 percentage points were registered in Ireland and Greece. In contrast, the

countries experiencing the largest poverty reduction due to changes in policy between 2018 and 2021 according to Table 1 are Malta and Lithuania, where the poverty rate decreased by around 1.5 percentage points.

It should be emphasised that these figures are not expected to coincide with the value of social indicators produced by the EU-SILC for the same years. The EUROMOD estimates show the movement in poverty and inequality indicators resulting from tax-benefit policy changes over the period 2018- 2021, but they are all based on EU-SILC 2019 (2018 incomes) data, uprated to reflect the evolution of average incomes during the years in question. On the contrary, standard EU-SILC indicators for the same period are based on the EU-SILC survey corresponding to each year, thus also incorporating demographic and socioeconomic changes. For example, if benefit amounts and tax thresholds for a specific country were uprated in line with average increases in incomes, and the same increase was used to uprate the underlying data, we would expect to see no changes in poverty and inequality indicators. To the extent that there were demographic and labour market changes during the period EU-SILC-based indicators may show changes for the same period.

Table 1. EUROMOD poverty and inequality statistics: 2018-2021

		Poverty risk			Poverty risk (60%)		Poverty threshold	Gini
	Policy year	50%	60%	70%	age<18	age>=65	EUR/year	
Austria	2018	6.3	13.5	21.2	15.5	13.1	15017	0.253
	2019	6.6	13.6	20.7	14.5	14.0	15620	0.249
	2020	6.3	13.1	20.5	13.6	13.9	16170	0.243
	2021	5.3	13.3	20.8	14.8	13.3	16223	0.244
Belgium	2018	5.7	12.3	22.3	14.8	14.0	14248	0.229
	2019	5.7	12.2	22.1	14.3	14.5	14748	0.227
	2020	5.5	11.8	22.3	13.4	15.1	15122	0.227
	2021	5.6	12.3	22.6	13.7	15.7	15257	0.229
Bulgaria	2018	16.5	23.2	31.2	27.7	35.8	2556	0.404
	2019	16.9	23.3	31.4	27.5	38.0	2779	0.409
	2020	16.7	23.6	31.6	27.5	39.1	3011	0.411
	2021	15.6	22.9	30.9	28.3	34.6	3261	0.406
Cyprus	2018	7.7	15.9	25.3	18.7	27.0	10048	0.309
	2019	7.0	15.5	25.1	18.7	24.6	10014	0.310
	2020	6.1	16.7	25.2	18.5	30.8	10111	0.309
	2021	6.3	16.5	25.1	18.8	30.0	10255	0.310
Czechia	2018	4.5	9.6	17.7	9.9	14.7	5791	0.232
	2019	4.7	9.5	17.6	10.6	12.9	6270	0.232
	2020	4.1	8.5	16.2	10.0	10.4	6383	0.225
	2021	5.0	9.8	18.0	11.1	12.9	7112	0.234
Germany	2018	8.1	14.1	21.8	12.4	17.5	14021	0.267
	2019	8.2	14.3	21.9	13.1	17.3	14390	0.268
	2020	8.0	13.5	21.2	11.0	16.7	14638	0.263
	2021	8.2	14.0	21.8	11.3	18.1	15042	0.267
Denmark	2018	5.1	10.2	19.3	7.7	6.7	18259	0.247
	2019	5.1	10.2	19.5	7.7	6.8	18591	0.248
	2020	5.5	10.5	20.2	7.6	7.6	19089	0.253
	2021	5.6	10.8	20.4	7.7	9.0	19343	0.261
Estonia	2018	12.2	20.6	28.9	15.1	42.5	6783	0.282
	2019	11.7	20.3	28.8	14.9	41.9	7219	0.281
	2020	10.6	19.6	28.0	15.2	38.6	7442	0.278
	2021	10.3	19.3	27.7	15.1	37.6	7502	0.277
Greece	2018	10.0	15.6	23.3	18.7	10.4	5197	0.293
	2019	10.2	16.2	23.8	18.7	11.3	5455	0.295
	2020	11.4	17.6	25.2	19.6	15.2	5575	0.303
	2021	11.4	17.7	25.2	19.4	15.2	5561	0.307
Spain	2018	14.2	21.3	28.8	26.0	18.6	9061	0.323

		Poverty risk			Poverty risk (60%)		Poverty threshold	Gini
	Policy year	50%	60%	70%	age<18	age>=65	EUR/year	
	2019	13.7	20.5	28.5	26.4	14.4	9199	0.320
	2020	13.6	20.6	28.4	26.7	13.7	9069	0.318
	2021	13.5	20.6	28.3	26.7	13.6	9081	0.316
Finland	2018	3.1	10.2	19.8	9.5	11.6	14763	0.241
	2019	3.2	10.4	20.2	9.6	12.0	15039	0.243
	2020	3.2	10.2	20.0	9.5	11.5	15255	0.242
	2021	3.4	10.6	20.4	9.7	12.2	15505	0.244
France	2018	5.3	11.4	20.4	15.8	6.6	13207	0.282
	2019	5.8	12.0	20.9	16.1	7.8	13745	0.284
	2020	5.1	10.6	20.0	14.0	5.7	13479	0.281
	2021	5.7	12.0	20.9	16.5	6.8	13860	0.284
Croatia	2018	12.3	17.9	25.6	15.3	30.4	4489	0.289
	2019	12.6	18.1	25.7	15.5	30.8	4680	0.288
	2020	12.9	18.6	25.9	16.0	32.2	4769	0.292
	2021	12.9	18.7	26.0	16.5	32.2	4929	0.296
Hungary	2018	16.7	22.6	28.1	25.4	22.6	3273	0.298
	2019	17.0	22.4	28.5	25.3	22.9	3640	0.300
	2020	16.9	22.1	28.2	25.0	22.9	3311	0.299
	2021	17.3	22.4	28.3	25.4	24.0	3553	0.300
Ireland	2018	7.5	15.9	24.9	17.6	26.0	14434	0.291
	2019	7.4	16.8	25.5	17.9	30.2	14905	0.293
	2020	8.4	17.5	26.6	20.1	23.2	15280	0.298
	2021	10.9	19.8	28.2	23.7	23.4	16168	0.308
Italy	2018	13.8	20.2	27.6	25.5	14.5	9917	0.323
	2019	13.1	19.8	27.4	25.1	14.6	10032	0.315
	2020	12.3	19.5	27.0	25.0	14.7	10132	0.310
	2021	12.6	20.3	27.3	25.3	16.7	10210	0.311
Lithuania	2018	13.5	21.1	29.1	23.9	31.6	4529	0.342
	2019	9.5	18.0	25.8	20.6	21.2	4312	0.321
	2020	11.1	18.7	27.2	18.1	30.3	5654	0.322
	2021	11.9	19.7	28.2	19.5	30.7	6028	0.327
Luxembourg	2018	3.5	13.3	21.8	16.8	6.7	23734	0.258
	2019	3.6	13.4	21.7	17.3	7.0	24304	0.258
	2020	3.7	13.2	21.7	16.4	7.2	24874	0.258
	2021	3.2	12.4	21.4	15.5	6.8	25261	0.257
Latvia	2018	14.8	21.8	28.9	13.3	45.6	4646	0.345
	2019	14.8	21.7	29.1	13.2	45.9	5016	0.345
	2020	14.8	21.5	29.0	13.2	44.9	5376	0.342
	2021	14.1	20.9	28.2	12.2	42.6	5819	0.331
Malta	2018	8.7	16.9	25.9	16.0	32.6	9463	0.276
	2019	8.3	16.8	26.0	15.2	33.5	9785	0.277
	2020	7.3	15.2	24.8	14.4	28.5	9627	0.270
	2021	6.8	15.3	24.3	14.7	28.0	9786	0.269
Netherlands	2018	5.5	12.0	19.9	14.1	6.8	14694	0.256
	2019	5.6	12.2	20.0	14.3	7.0	15205	0.256
	2020	5.6	12.0	19.9	14.0	6.8	15588	0.255
	2021	5.2	11.6	19.6	13.5	6.1	15845	0.251
Poland	2018	8.7	14.7	22.2	10.4	17.5	4143	0.280
	2019	8.5	14.5	22.4	11.3	17.0	4512	0.280
	2020	8.9	15.1	22.6	11.4	19.4	4673	0.279
	2021	9.0	15.3	22.9	12.2	19.0	4864	0.279

	Policy year	Poverty risk 50%	Poverty risk 60%	Poverty risk 70%	Poverty risk (60%) age<18	Poverty risk (60%) age>=65	Poverty threshold EUR/year	Gini
Portugal	2018	10.2	17.2	25.2	17.5	19.0	6218	0.311
	2019	9.8	17.2	25.0	17.2	19.0	6310	0.311
	2020	9.9	17.1	25.0	16.9	19.3	6383	0.311
	2021	9.8	17.0	24.7	16.3	19.8	6432	0.311
Romania	2018	16.5	22.9	29.7	28.4	25.2	2319	0.336
	2019	16.1	22.9	29.7	27.9	25.5	2553	0.334
	2020	16.3	22.6	29.5	29.2	22.1	2723	0.332
	2021	16.3	23.4	30.2	31.0	21.1	2948	0.334
Sweden	2018	8.4	15.2	24.0	19.3	11.3	14480	0.256
	2019	9.1	15.8	24.3	19.9	12.7	14937	0.259
	2020	9.3	15.7	24.4	20.6	10.8	15681	0.261
	2021	9.4	15.9	24.5	20.7	11.4	16596	0.261
Slovenia	2018	4.4	11.4	20.1	9.1	16.9	8113	0.230
	2019	4.8	11.7	20.3	9.4	17.0	8342	0.234
	2020	5.4	12.3	20.7	10.3	17.3	8739	0.237
	2021	6.0	12.9	21.2	11.0	18.1	9185	0.240
Slovakia	2018	7.2	10.9	18.7	16.2	7.6	4835	0.220
	2019	7.3	11.2	18.9	16.2	8.9	5134	0.222
	2020	7.4	11.1	18.9	16.0	8.6	5410	0.221
	2021	7.5	11.3	19.1	15.8	9.7	5651	0.223

Source: EUROMOD version I4.0+

Note: EUROMOD figures for 2018-2021 are based on SILC 2019 (2018 incomes).

3.2 The effect of taxes and benefits on the risk of poverty

Figure 1 shows that the effect of adding public pensions to market income reduces poverty before taxes and benefits significantly in all countries. In the base year 2018, public pensions show the largest anti- poverty effect among various instruments of EU tax-benefit systems. Table 2 shows that in Greece, when added to market incomes, pensions contribute to reducing the poverty rate by 25 percentage points, the largest effect across countries. Other countries where public pensions play a major role in reducing poverty (a reduction of about 20 percentage points or higher) are Belgium, Finland, Poland and Portugal. On the contrary, the countries where public pensions are less effective in reducing poverty when added to market incomes are Netherlands and Ireland. In these countries in fact an important part of the pensions system consists of occupational and private pensions (included in market income), while public pensions have the role of a residual safety net.

After public pensions, universal benefits or benefits not subject to a means-test (e.g. unemployment benefits) are another important instrument of poverty reduction. This is particularly the case for Luxembourg, Finland, Sweden, Denmark, Estonia and Austria: in these countries, when non-means tested benefits are subtracted from disposable income, the poverty rate increases between 7 and 9 percentage points. On the other hand, the anti-poverty effect of non-means-tested benefits in the base year is very modest in Greece, slightly above 1 percentage point only.

In addition, in several countries an important anti-poverty role is played by means-tested benefits. Especially, in Ireland, Denmark, Finland and France. In these countries, when means-tested benefits are subtracted from disposable income, the poverty rate increases between around 7 and 10 percentage points. On the other hand, in many countries, the anti-poverty effect of means-tested benefits remains modest. In fact, in 11 countries the increase is below 3 percentage points; and for Estonia, Hungary and Latvia, the anti-poverty effect of means-tested benefits is very close to zero.

Adding back taxes to disposable income has a relatively small poverty-reducing effect. Larger effects are observed in the Nordic countries, where the tax system has a more marked redistributive role: in fact, in Denmark and Sweden the poverty-reducing effect of adding taxes back to the disposable income is 6.5 and 4.3 percentage points respectively. Other countries experiencing a noticeable effect above 3 percentage points

are Hungary (5.4), Poland (4.2) and Finland (3.5). On the other hand, for 13 EU countries, the poverty-reducing effect remains below 1 percentage point.

Regarding the poverty-reducing effect of adding back social insurance contributions (SIC) to disposable income, we observe similar magnitudes as for taxes. The strongest poverty-reducing effects are observed in Hungary, Poland, Luxembourg and Romania (around 4-5 percentage points). On the other hand, SICs have a very minor poverty-reducing effect (less than 1 percentage point) in Estonia, Ireland and Denmark.

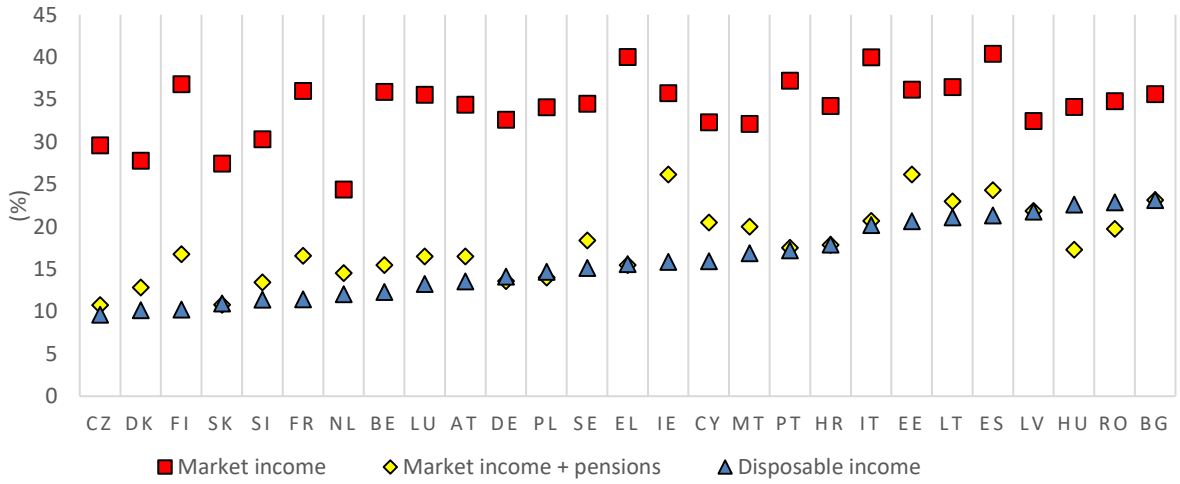
Table 2 compares the impact of different components of the tax/benefits systems on poverty over the years 2018-2021. In general, the rankings of the countries, in terms of the anti-poverty effectiveness of the single tax/benefits instruments, are largely preserved. Whilst for most countries the performance of means-tested benefits remains basically unchanged (mostly between -1 and 1 percentage points), we observe a decline in anti-poverty effectiveness in Poland and Ireland (with a decrease in the poverty-reducing effect of about 4 and 2.8 percentage points, respectively). In the case of Poland, however, such a decrease is more than offset by a larger increase in the poverty-reducing effect of non-means-tested benefits (see below) due primarily to childcare allowance being reclassified from means to non-means tested benefits in 2020, thereby expanding its effectiveness.

Moving to non-means-tested benefits, again, at the EU level we do not observe large differences in their anti-poverty impact between 2018 and 2021. The effect for most countries stays between -1 and 1 percentage points. The most significant exceptions are Ireland and Poland (as just noted). For Poland we observe larger increases in the anti-poverty effectiveness of non-means-tested benefits (7.8 percentage points), whereas for Ireland a larger decrease (2.2 percentage points).

As far as taxes are concerned, between 2018 and 2021 we observe an even smaller variation of their poverty- reducing effect. Again, the effect for almost all countries stays in the range -1 to 1 percentage points. Similar findings apply to Social Insurance Contributions with the effect size for most countries remaining between -1 and 1 percentage points. Lithuania constitutes the only exception by featuring a poverty-reduction effect of about 2.6 percentage points smaller.

Finally, when looking at how the anti-poverty effects of public pensions have changed over time, while for most countries we do not observe any substantial change, we see a decline in the poverty-reduction effect of between 2 and 4 percentage points in Cyprus and Ireland. The opposite is true for Latvia and Poland where the increase in anti-poverty effectiveness of public pensions is about 2.5 percentage points.

Figure 1. Poverty risk and the role of public pensions and non-pension benefits and taxes (2018 incomes and policies)



Source: EUROMOD version I4.0+

Note: Countries have been ranked according to the poverty estimates for disposable income. EUROMOD figures are based on SILC 2019 (2018 incomes).

Table 2. Effects of tax-benefit components on at-risk-of-poverty rate: 2018-2021

	Policy year	Disposable Income (DPI) 50%	DPI less means-tested	DPI less non means-tested	DPI plus direct taxes	DPI plus SIC	Market income	Market income plus pensions
Austria	2018	13.55	16.71	21.92	12.62	10.81	34.39	16.48
	2019	13.63	16.67	21.09	13.53	11.18	34.79	17.03
	2020	13.15	16.38	21.53	13.29	10.92	35.25	17.44
	2021	13.34	16.64	21.21	13.36	10.74	35.15	17.24
Belgium	2018	12.32	16.70	15.88	11.87	10.57	35.89	15.46
	2019	12.22	16.75	15.71	12.13	10.68	36.06	15.66
	2020	11.84	16.70	15.45	11.92	10.65	35.96	15.64
	2021	12.28	16.98	15.80	11.88	10.95	35.83	15.75
Bulgaria	2018	23.15	25.20	26.05	21.73	20.93	35.63	23.15
	2019	23.35	25.09	26.25	22.05	21.30	34.81	23.14
	2020	23.62	25.36	26.48	22.27	21.44	34.77	23.30
	2021	22.85	24.27	25.70	21.31	20.51	35.10	22.12
Cyprus	2018	15.94	20.53	18.94	15.74	13.58	32.31	20.49
	2019	15.52	20.71	18.51	15.23	12.62	31.48	19.67
	2020	16.67	21.00	19.61	16.31	13.29	31.23	19.47
	2021	16.54	20.83	19.50	16.44	13.29	31.27	19.08
Czechia	2018	9.63	11.32	12.64	9.08	7.34	29.59	10.77
	2019	9.52	11.10	12.56	8.92	7.17	29.43	10.32
	2020	8.50	9.80	12.15	7.92	6.68	30.10	9.95
	2021	9.80	11.25	13.06	9.61	7.65	30.76	11.03
Germany	2018	14.13	15.82	19.14	12.80	11.24	32.64	13.57
	2019	14.30	15.75	19.19	12.92	11.20	32.51	13.41
	2020	13.53	15.29	19.19	12.45	10.93	32.79	13.41
	2021	13.98	15.77	19.57	12.90	11.27	32.79	13.70
Denmark	2018	10.15	18.42	17.91	3.64	9.84	27.77	12.82
	2019	10.23	18.59	18.01	3.76	9.92	27.85	12.82
	2020	10.49	18.72	18.15	3.77	10.13	27.76	12.70
	2021	10.80	18.54	18.47	3.97	10.30	27.27	12.69
Estonia	2018	20.64	20.93	29.03	19.76	19.93	36.19	26.16
	2019	20.33	20.60	28.93	19.16	19.76	35.99	25.73
	2020	19.56	19.86	28.26	18.29	18.98	36.06	24.81
	2021	19.29	19.66	28.13	18.04	18.76	36.09	24.65
Greece	2018	15.60	21.18	16.87	13.45	12.74	40.01	15.46
	2019	16.21	20.79	17.41	14.41	12.97	39.88	15.08
	2020	17.62	21.54	19.04	15.86	14.23	40.38	16.37
	2021	17.72	21.51	19.12	15.74	14.52	40.35	16.40
Spain	2018	21.32	24.80	24.81	20.96	18.68	40.40	24.32
	2019	20.53	25.03	23.81	20.10	17.68	40.41	24.30
	2020	20.61	25.24	23.85	20.17	17.49	40.77	24.34
	2021	20.59	25.23	23.87	20.12	17.29	40.85	24.28
Finland	2018	10.22	17.29	18.24	6.71	9.11	36.83	16.78
	2019	10.44	17.36	18.38	6.89	9.33	36.73	16.76
	2020	10.22	17.16	18.14	6.78	9.13	36.67	16.71
	2021	10.63	17.34	18.44	7.09	9.48	36.50	16.66
France	2018	11.45	18.96	17.23	8.44	8.47	36.03	16.58
	2019	11.96	19.36	17.70	9.08	9.39	36.36	17.20
	2020	10.60	19.65	16.93	8.07	8.25	37.33	17.75
	2021	12.01	19.64	17.56	8.94	9.28	36.68	17.37
Croatia	2018	17.89	19.67	20.06	17.80	15.14	34.24	17.84

	Policy year	Disposable Income (DPI) 50%	DPI less means-tested	DPI less non means-tested	DPI plus direct taxes	DPI plus SIC	Market income	Market income plus pensions
	2019	18.08	19.98	20.08	17.97	15.46	34.35	18.03
	2020	18.57	20.24	20.49	18.39	15.78	34.27	18.25
	2021	18.70	20.22	20.43	18.63	15.80	34.30	18.29
Hungary	2018	22.61	22.87	25.13	17.16	18.47	34.14	17.28
	2019	22.38	22.72	24.98	17.80	18.59	33.87	17.18
	2020	22.10	22.44	24.76	17.80	18.62	33.91	17.23
	2021	22.38	22.64	24.89	18.13	18.86	33.69	17.15
Ireland	2018	15.86	25.55	21.96	15.19	15.60	35.77	26.17
	2019	16.84	25.56	21.83	15.52	16.29	35.67	26.19
	2020	17.49	25.53	22.70	16.54	16.99	35.36	26.03
	2021	19.77	26.64	23.67	18.23	19.41	35.69	26.50
Italy	2018	20.20	23.38	23.07	18.60	17.43	39.99	20.71
	2019	19.84	23.55	22.80	18.23	17.04	40.12	20.75
	2020	19.45	23.30	22.96	17.81	16.77	40.33	20.93
	2021	20.26	23.56	23.19	18.29	17.48	40.40	21.07
Lithuania	2018	21.12	22.31	27.28	19.76	18.89	36.49	22.99
	2019	18.02	19.84	25.48	15.13	12.61	34.00	18.25
	2020	18.75	21.37	27.08	16.29	14.59	33.33	20.39
	2021	19.66	21.90	27.29	17.31	14.89	33.09	20.56
Luxembourg	2018	13.26	15.95	20.44	12.60	8.01	35.55	16.48
	2019	13.36	15.96	20.12	12.41	7.91	35.36	16.22
	2020	13.23	16.03	20.17	12.41	8.25	35.35	16.05
	2021	12.40	15.77	19.63	11.85	7.54	35.15	15.95
Latvia	2018	21.77	21.80	27.88	19.21	19.83	32.47	21.88
	2019	21.75	21.79	27.83	19.27	19.66	32.27	21.92
	2020	21.50	21.54	27.29	19.47	19.41	32.42	21.97
	2021	20.91	20.98	28.92	18.95	18.81	33.78	23.60
Malta	2018	16.89	20.97	19.61	16.51	14.08	32.14	20.00
	2019	16.82	21.09	19.65	16.31	14.21	31.91	19.97
	2020	15.22	20.34	18.27	14.79	12.97	32.32	19.74
	2021	15.26	20.47	18.21	14.63	12.82	32.30	19.63
Netherlands	2018	12.03	18.86	17.77	10.03	8.09	24.39	14.53
	2019	12.24	18.95	17.95	10.39	8.36	24.72	14.68
	2020	12.03	19.01	17.86	10.21	8.28	24.96	14.82
	2021	11.61	19.03	17.45	10.03	8.15	25.41	15.11
Poland	2018	14.67	20.97	16.88	10.43	10.76	34.08	14.01
	2019	14.52	20.45	18.16	10.17	11.12	33.74	14.78
	2020	15.12	17.47	23.98	10.89	12.02	35.17	16.73
	2021	15.29	17.61	25.38	10.78	11.94	34.50	17.17
Portugal	2018	17.23	19.44	19.37	16.45	14.88	37.24	17.50
	2019	17.15	19.56	19.17	16.42	14.73	37.22	17.50
	2020	17.13	19.63	19.12	16.33	14.78	37.09	17.45
	2021	17.04	19.64	19.07	16.23	14.79	37.04	17.63
Romania	2018	22.88	24.53	26.07	21.33	18.33	34.82	19.73
	2019	22.86	24.12	26.99	21.02	18.18	34.85	19.88
	2020	22.60	23.49	26.78	20.62	17.52	35.12	19.22
	2021	23.39	24.04	27.58	21.14	18.31	36.28	19.89
Sweden	2018	15.15	18.92	24.26	10.81	13.52	34.53	18.40
	2019	15.81	19.04	24.52	11.26	14.14	34.60	18.56
	2020	15.71	19.18	24.16	11.50	13.99	34.64	18.58
	2021	15.88	19.24	24.33	11.77	14.19	34.63	18.53

	Policy year	Disposable Income (DPI) 50%	DPI less means-tested	DPI less non means-tested	DPI plus direct taxes	DPI plus SIC	Market income	Market income plus pensions
Slovenia	2018	11.40	15.24	18.15	10.49	7.67	30.31	13.43
	2019	11.71	15.27	18.67	10.80	7.79	30.10	13.35
	2020	12.31	15.57	19.21	11.41	8.15	30.05	13.36
	2021	12.93	15.69	19.59	11.92	8.52	29.91	13.35
Slovakia	2018	10.95	11.86	15.72	10.49	7.54	27.47	10.81
	2019	11.18	12.09	15.16	10.51	7.73	26.81	10.90
	2020	11.12	11.99	15.48	10.53	7.88	27.51	11.16
	2021	11.31	12.29	15.42	10.75	7.95	26.82	11.17

Source: EUROMOD version I4.0+

Note: EUROMOD figures for 2018-2021 are based on SILC 2019 (2018 incomes).

3.3 The effect of taxes and benefits on the poverty gap

Table 3 shows the effects of tax/benefits instruments on the relative median at-risk-of-poverty gap, which is computed as the difference between the median equivalised disposable income of people below the at-risk-of-poverty threshold and the at-risk-of-poverty threshold, expressed as a percentage of the at-risk-of-poverty threshold. The table shows that the countries with the highest poverty rates are also in general the countries with the highest poverty gap in the base year. The poverty gap exceeds 30% in Romania, Hungary and Italy. The countries with the lowest poverty gap in the base year are Finland (10.6%) and Luxembourg (9.5%). Comparing the 2021 results with the base year, we do not observe substantial differences or re-rankings, save for Italy, where the poverty gap closes fairly substantially over the four years, and Ireland where it increases significantly.

Table 3 also enables us to decompose the effects of taxes and benefits on the poverty gap using the same approach as in Table 2. Public pensions lower the poverty gap on average by about 50 percentage points when added to market incomes in the base year. This effect varies widely across countries, however, almost reaching 80 percentage points in Czechia and reaching or exceeding 60 percentage points in Belgium, Greece, Croatia, Portugal, Slovenia and Slovakia. On the other hand, very small effects can be found in Denmark and Netherlands.

On average, means-tested benefits represent the second most important instrument, after public pensions, in terms of effectiveness at reducing the poverty gap. On average they help in closing the poverty gap by 8 percentage points, and up to 25 percentage points in Ireland. On the other hand, they have very modest effects (below 2 percentage points) in Romania, Slovakia, Croatia, Estonia, and Latvia. Non-means tested benefits have a smaller impact on average, helping to close the gap by around 5 percentage points. The poverty gap reduction effect is strongest in Denmark (18 percentage points), while only modest effects (below 0.5 percentage point) can be found in Bulgaria and Romania. The poverty gap estimates are not significantly affected by the addition of taxes and social insurance contributions.

Table 3. Effects of tax-benefit components on relative median at-risk-of-poverty gap: 2018-2021

	Policy year	Disposable Income (DPI) 50%	DPI less means-tested	DPI less non means-tested	DPI plus direct taxes	DPI plus SIC	Market income	Market income plus pensions
Austria	2018	14.64	31.25	19.57	16.39	13.15	97.03	45.68
	2019	15.86	31.30	20.64	17.03	14.13	97.08	43.41
	2020	15.41	30.49	20.58	16.68	13.93	96.95	41.84
	2021	14.45	30.53	19.06	15.69	13.08	97.08	42.61
Belgium	2018	15.53	24.04	23.72	16.75	16.17	99.06	39.09
	2019	15.47	24.78	22.83	16.96	16.02	99.15	39.45
	2020	15.19	23.98	22.95	16.25	15.25	99.21	38.91
	2021	14.93	23.85	22.01	15.79	15.02	99.11	38.29
Bulgaria	2018	26.85	30.97	27.31	26.29	25.76	77.99	31.65

	Policy year	Disposable Income (DPI) 50%	DPI less means-tested	DPI less non means-tested	DPI plus direct taxes	DPI plus SIC	Market income	Market income plus pensions
	2019	27.76	31.53	28.20	26.88	26.76	78.56	31.52
	2020	26.71	31.04	27.24	26.10	25.44	78.82	31.46
	2021	25.12	29.49	26.76	24.72	24.02	78.25	29.88
Cyprus	2018	15.91	23.46	17.79	15.93	16.51	67.93	26.02
	2019	14.78	23.22	17.18	14.78	15.33	69.75	25.69
	2020	12.76	23.31	14.32	12.73	12.39	70.33	25.69
	2021	13.23	22.61	14.70	12.96	12.52	69.83	25.25
Czechia	2018	15.11	18.76	16.03	15.72	15.83	100.00	20.98
	2019	15.96	18.82	17.38	16.57	16.73	100.00	21.08
	2020	15.86	18.72	16.00	16.08	16.76	100.00	22.09
	2021	17.11	19.63	17.76	16.68	16.50	99.96	21.60
Germany	2018	20.78	30.23	24.82	22.68	23.72	97.04	40.09
	2019	20.74	30.29	24.99	22.60	24.12	97.20	40.49
	2020	21.86	31.12	23.93	22.91	24.26	97.31	40.80
	2021	21.90	30.72	23.84	23.10	24.26	97.31	39.99
Denmark	2018	16.28	28.24	34.69	25.05	16.95	72.97	60.89
	2019	16.73	27.32	34.88	25.13	16.91	72.90	60.80
	2020	17.40	26.74	35.43	24.35	17.31	72.51	60.95
	2021	18.22	28.54	35.22	24.90	18.20	72.49	61.74
Estonia	2018	19.93	21.29	26.53	20.25	19.57	72.93	27.11
	2019	19.41	20.81	25.88	19.79	19.08	73.30	26.66
	2020	18.12	19.06	25.78	18.81	17.70	72.98	26.70
	2021	17.77	18.82	26.04	18.39	17.40	72.89	26.70
Greece	2018	23.02	29.71	23.69	21.65	22.78	100.00	30.03
	2019	24.89	29.66	25.42	23.41	23.35	100.00	30.97
	2020	24.57	30.19	24.99	23.56	23.27	99.32	30.16
	2021	24.64	29.75	25.62	24.70	23.39	99.32	29.88
Spain	2018	27.69	35.28	29.21	27.73	27.06	75.13	38.00
	2019	28.87	35.11	30.65	29.19	27.77	75.14	38.08
	2020	28.05	35.44	30.26	28.60	27.17	75.14	38.06
	2021	27.41	35.38	29.84	27.47	26.97	75.12	38.22
Finland	2018	10.62	26.78	19.86	10.29	10.80	92.19	41.05
	2019	11.03	26.63	19.71	10.79	11.37	92.17	40.91
	2020	10.62	26.87	19.81	10.86	11.03	92.26	40.87
	2021	11.21	26.49	19.75	11.10	11.20	92.44	40.42
France	2018	15.77	32.01	21.96	18.95	18.38	83.51	42.94
	2019	15.68	31.71	21.89	18.06	17.85	83.36	40.97
	2020	15.80	31.22	22.00	18.00	18.00	81.63	40.59
	2021	15.40	31.23	22.19	18.34	17.86	82.71	41.01
Croatia	2018	27.61	28.82	27.62	27.61	28.32	96.23	31.60
	2019	28.08	28.59	28.32	28.08	28.80	96.00	31.68
	2020	28.40	29.21	29.21	28.48	29.21	96.39	31.57
	2021	28.48	29.05	29.05	28.48	29.05	96.01	31.53
Hungary	2018	31.89	35.15	39.13	30.97	31.49	90.74	38.14
	2019	34.29	35.89	40.51	30.99	33.59	90.97	39.57
	2020	34.23	35.75	40.36	31.17	33.07	90.94	39.74
	2021	34.49	36.18	40.32	31.33	33.61	91.44	40.74
Ireland	2018	14.29	39.50	15.45	14.32	14.13	86.84	47.59
	2019	13.19	40.03	15.75	13.89	12.78	87.07	47.40
	2020	16.07	40.25	18.98	16.40	16.40	88.02	46.11
	2021	19.61	43.70	24.80	20.10	19.79	87.04	51.16

	Policy year	Disposable Income (DPI) 50%	DPI less means-tested	DPI less non means-tested	DPI plus direct taxes	DPI plus SIC	Market income	Market income plus pensions
Italy	2018	31.23	35.19	35.95	33.49	33.44	86.44	40.29
	2019	28.22	35.10	31.18	29.47	27.60	86.70	40.65
	2020	24.75	34.81	28.94	26.37	24.29	86.99	40.52
	2021	24.64	35.21	28.33	26.95	24.50	86.76	40.72
Lithuania	2018	22.98	26.83	27.70	23.46	23.17	83.02	31.02
	2019	17.37	23.96	25.88	20.98	22.70	88.15	30.75
	2020	21.25	25.01	27.22	22.27	23.05	91.10	30.15
	2021	21.49	24.88	28.02	22.58	24.68	91.62	30.27
Luxembourg	2018	9.56	27.86	20.77	9.58	9.40	85.10	39.33
	2019	9.66	28.28	21.19	9.14	9.39	85.95	39.09
	2020	10.40	28.67	20.70	9.81	8.55	85.92	39.71
	2021	10.01	29.22	20.20	9.08	8.41	86.57	39.33
Latvia	2018	27.14	27.28	29.98	28.02	28.12	85.99	30.36
	2019	27.52	27.63	29.76	28.20	28.66	86.34	30.93
	2020	27.81	27.87	29.68	28.08	28.40	86.01	30.98
	2021	26.11	26.42	30.28	26.85	26.91	83.88	31.24
Malta	2018	16.92	22.71	18.51	16.46	14.85	76.69	25.16
	2019	16.59	22.60	18.53	16.32	14.93	76.99	25.20
	2020	16.11	22.80	18.71	15.25	13.92	75.46	24.67
	2021	15.41	22.71	17.97	14.96	13.53	74.70	24.45
Netherlands	2018	14.13	33.90	26.43	15.49	16.73	61.14	60.38
	2019	14.19	33.85	26.92	15.46	17.45	61.32	60.33
	2020	14.16	33.83	26.51	15.58	17.79	61.59	59.82
	2021	14.36	33.77	26.71	15.06	17.65	60.96	59.16
Poland	2018	21.27	27.45	22.47	23.67	20.28	79.16	28.46
	2019	20.77	26.95	22.53	21.66	20.28	80.75	29.11
	2020	21.41	23.72	25.18	22.08	21.01	75.20	28.72
	2021	21.47	23.19	26.13	22.45	21.09	78.01	29.50
Portugal	2018	21.06	26.16	22.97	20.63	20.50	88.83	28.99
	2019	20.31	26.18	22.70	19.75	19.89	88.75	28.82
	2020	20.21	26.06	22.49	19.97	19.44	89.82	29.09
	2021	19.82	25.99	22.27	19.79	19.14	89.41	28.60
Romania	2018	30.76	32.21	30.97	31.56	38.37	100.00	46.25
	2019	30.10	32.51	30.86	30.45	37.75	100.00	46.85
	2020	30.81	32.33	31.00	31.05	38.68	100.00	47.89
	2021	31.19	32.43	33.56	31.74	39.99	100.00	50.39
Sweden	2018	18.91	28.24	34.96	19.78	18.59	85.68	59.63
	2019	19.78	29.22	34.91	20.83	19.41	85.64	58.53
	2020	20.65	29.04	36.27	21.01	20.18	86.03	58.12
	2021	20.81	28.98	36.23	20.64	20.27	86.03	58.57
Slovenia	2018	13.10	22.52	17.12	13.64	15.78	94.08	26.54
	2019	13.52	22.70	17.49	13.97	15.78	93.92	26.69
	2020	14.46	23.31	18.32	14.60	16.45	94.43	27.69
	2021	15.28	23.22	19.89	15.59	17.23	94.66	27.42
Slovakia	2018	29.08	29.08	26.49	30.50	34.69	99.48	29.64
	2019	27.65	28.24	26.94	29.22	34.03	99.67	28.97
	2020	27.84	29.01	27.01	29.33	35.18	99.71	28.98
	2021	27.48	28.19	28.17	28.13	35.63	99.81	29.66

Source: EUROMOD version I4.0+

Note: EUROMOD figures for 2018-2021 for all countries are based on SILC 2019 (2018 incomes).

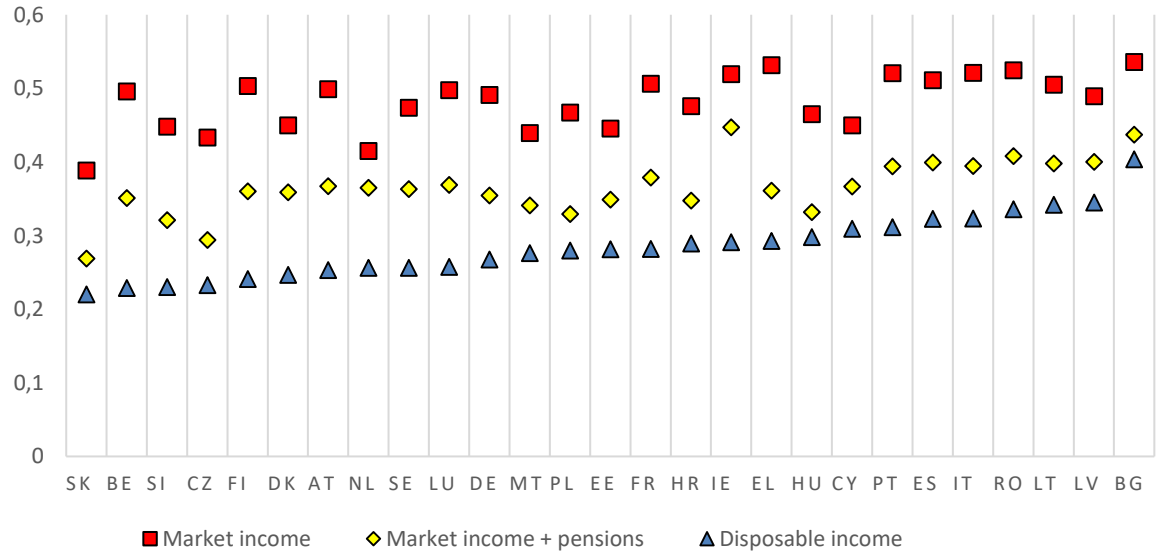
3.4 The effect of taxes and benefits on inequality

Table 4 and Figure 2 show the role of tax-benefit components of household income in reducing income inequality as measured by the Gini coefficient. Inequality of market income including public pensions (before tax) is everywhere lower than inequality of market income but higher than that of disposable income.

As in the case of poverty, public pensions are the most significant income component in reducing inequality in market incomes. The countries experiencing the largest reduction in the Gini coefficient once public pensions are added to market income are Greece (the Gini drops by over 0.17 points), followed by Belgium, Czechia, Germany, Finland, Austria, Hungary, Poland (0.13-0.15 points). At the other extreme of the spectrum, in Netherlands the Gini coefficient drops only by around 0.05 points, given the greater importance of private and occupational pensions (included here in market income) in this country, in addition to publicly provided old age pensions.

Non-pension benefits and taxes (income taxes and social contributions) vary in their effectiveness in reducing income inequality across countries. They have a relatively large role compared with other countries in Belgium, Luxembourg, Ireland, Finland, Sweden, The Netherlands, Denmark, and Austria.

Figure 2. Income inequality (Gini coefficient) and the role of public pensions and non-pension benefits and taxes (2018 incomes and policies)



Source: EUROMOD version I4.0+

Note: Countries have been ranked according to the value of the Gini coefficient for disposable income. EUROMOD figures are based on SILC 2019 (2018 incomes).

After pensions, means-tested benefits are on average the second instrument in order of importance to reduce inequality. The largest effect of means-tested benefits on the Gini coefficient can be found in Ireland where the Gini increases by around 0.07 points when means- tested benefits are removed from disposable income. The other countries where means-tested benefits have a large effect on the Gini are Netherlands, Denmark, France and Finland (between 0.04 and 0.05 percentage points). On the other hand, the countries where means-tested benefits have the smallest inequality reducing effect are Hungary, Estonia, Slovakia and Latvia. In these countries, the increase in the Gini index is below 0.01 points when means-tested benefits are subtracted from disposable income. This ranking can be explained partly by the higher importance of non-means tested benefits in some of the countries. In fact, when considering the inequality-reducing effect of non-means tested benefits, we observe that in Sweden, Finland and Denmark non-means tested benefits have the largest inequality-reducing effect (around 0.04 points). On the other hand, in countries such as Poland, Portugal, Malta, Italy, Greece, Croatia and Cyprus, non-means tested have the smallest anti-inequality effect just below 0.01 percentage points.

Table 4 shows that income tax systems can have differential effects on inequality. In particular, the largest inequality-reducing effect of direct taxes can be found in Belgium, Ireland, Luxembourg and Netherlands,

where the Gini coefficient increases by over 0.06 points when direct taxes are added back to disposable income. These countries are characterized by progressive tax systems, which could explain the equalising effect of direct taxes on the income distribution. On the contrary, in Bulgaria and Hungary direct taxes do not substantially affect inequality, likely because of their flat tax systems. Finally, as far as SICs are concerned, their impact over Gini is more ambiguous with the sign of their effect varying across countries. At the one extreme, in Denmark and Ireland SICs appear largely inequality increasing (they increase Gini by about 0.05 points), whereas at the other extreme, in Romania, they appear having an inequality reducing effect (they decrease Gini by about 0.04 points). Other member states present intermediate situations.

Looking at changes between 2018 and 2021, the effects of taxes and benefits instruments in reducing income inequality seem to have remained largely stable over time.

Table 4. Effects of tax-benefit components on Gini coefficient: 2018-2021

	Policy year	Disposable Income (DPI) 50%	DPI less means-tested	DPI less non means-tested	DPI plus direct taxes	DPI plus SIC	Market income	Market income plus pensions
Austria	2018	0.25	0.29	0.28	0.31	0.27	0.50	0.37
	2019	0.25	0.28	0.28	0.31	0.27	0.50	0.37
	2020	0.24	0.28	0.27	0.31	0.26	0.50	0.37
	2021	0.24	0.28	0.27	0.31	0.26	0.50	0.37
Belgium	2018	0.23	0.25	0.25	0.31	0.26	0.50	0.35
	2019	0.23	0.25	0.25	0.31	0.25	0.50	0.35
	2020	0.23	0.25	0.25	0.31	0.25	0.50	0.35
	2021	0.23	0.25	0.25	0.31	0.26	0.50	0.35
Bulgaria	2018	0.40	0.42	0.41	0.41	0.41	0.54	0.44
	2019	0.41	0.42	0.42	0.42	0.41	0.53	0.44
	2020	0.41	0.42	0.42	0.42	0.41	0.53	0.44
	2021	0.41	0.42	0.41	0.41	0.41	0.53	0.43
Cyprus	2018	0.31	0.34	0.31	0.34	0.31	0.45	0.37
	2019	0.31	0.34	0.31	0.34	0.31	0.45	0.37
	2020	0.31	0.34	0.31	0.34	0.31	0.45	0.37
	2021	0.31	0.34	0.31	0.34	0.31	0.45	0.37
Czechia	2018	0.23	0.24	0.24	0.26	0.25	0.43	0.29
	2019	0.23	0.24	0.24	0.26	0.25	0.43	0.29
	2020	0.22	0.23	0.24	0.25	0.24	0.43	0.29
	2021	0.23	0.24	0.25	0.25	0.25	0.43	0.29
Germany	2018	0.27	0.29	0.29	0.33	0.28	0.49	0.35
	2019	0.27	0.29	0.29	0.33	0.28	0.49	0.35
	2020	0.26	0.28	0.28	0.32	0.28	0.49	0.35
	2021	0.27	0.29	0.29	0.32	0.28	0.49	0.35
Denmark	2018	0.25	0.29	0.29	0.30	0.25	0.45	0.36
	2019	0.25	0.29	0.29	0.30	0.25	0.45	0.36
	2020	0.25	0.29	0.30	0.30	0.25	0.45	0.36
	2021	0.26	0.30	0.31	0.32	0.26	0.46	0.37
Estonia	2018	0.28	0.29	0.31	0.31	0.28	0.45	0.35
	2019	0.28	0.29	0.31	0.31	0.28	0.44	0.35
	2020	0.28	0.28	0.31	0.31	0.28	0.44	0.34
	2021	0.28	0.28	0.31	0.31	0.28	0.44	0.34
Greece	2018	0.29	0.32	0.30	0.32	0.31	0.53	0.36
	2019	0.30	0.32	0.30	0.33	0.31	0.53	0.36
	2020	0.30	0.33	0.31	0.34	0.31	0.53	0.36
	2021	0.31	0.33	0.31	0.34	0.31	0.53	0.36
Spain	2018	0.32	0.35	0.33	0.37	0.32	0.51	0.40
	2019	0.32	0.35	0.33	0.37	0.32	0.51	0.40
	2020	0.32	0.35	0.33	0.37	0.32	0.51	0.40

	Policy year	Disposable Income (DPI) 50%	DPI less means-tested	DPI less non means-tested	DPI plus direct taxes	DPI plus SIC	Market income	Market income plus pensions
	2021	0.32	0.35	0.33	0.36	0.31	0.51	0.40
Finland	2018	0.24	0.28	0.28	0.29	0.26	0.50	0.36
	2019	0.24	0.28	0.28	0.29	0.26	0.50	0.36
	2020	0.24	0.28	0.28	0.29	0.26	0.50	0.36
	2021	0.24	0.28	0.28	0.29	0.26	0.50	0.36
France	2018	0.28	0.32	0.30	0.32	0.29	0.51	0.38
	2019	0.28	0.32	0.31	0.32	0.29	0.51	0.38
	2020	0.28	0.32	0.30	0.32	0.29	0.51	0.38
	2021	0.28	0.32	0.31	0.32	0.29	0.51	0.38
Croatia	2018	0.29	0.30	0.30	0.31	0.31	0.48	0.35
	2019	0.29	0.30	0.30	0.31	0.31	0.48	0.35
	2020	0.29	0.30	0.30	0.32	0.31	0.48	0.35
	2021	0.30	0.31	0.30	0.32	0.31	0.48	0.35
Hungary	2018	0.30	0.30	0.32	0.30	0.31	0.46	0.33
	2019	0.30	0.30	0.32	0.30	0.31	0.46	0.33
	2020	0.30	0.30	0.32	0.30	0.31	0.46	0.33
	2021	0.30	0.30	0.32	0.31	0.31	0.46	0.34
Ireland	2018	0.29	0.36	0.31	0.37	0.30	0.52	0.45
	2019	0.29	0.36	0.31	0.37	0.30	0.52	0.45
	2020	0.30	0.36	0.31	0.38	0.31	0.52	0.45
	2021	0.31	0.37	0.33	0.38	0.32	0.52	0.45
Italy	2018	0.32	0.34	0.33	0.37	0.33	0.52	0.39
	2019	0.31	0.34	0.32	0.37	0.32	0.52	0.39
	2020	0.31	0.34	0.32	0.36	0.32	0.52	0.39
	2021	0.31	0.34	0.32	0.36	0.32	0.52	0.39
Lithuania	2018	0.34	0.35	0.36	0.36	0.35	0.51	0.40
	2019	0.32	0.33	0.35	0.35	0.34	0.51	0.40
	2020	0.32	0.34	0.35	0.36	0.35	0.50	0.40
	2021	0.33	0.34	0.35	0.36	0.35	0.50	0.41
Luxembourg	2018	0.26	0.28	0.29	0.32	0.26	0.50	0.37
	2019	0.26	0.28	0.29	0.33	0.26	0.50	0.37
	2020	0.26	0.28	0.29	0.33	0.26	0.50	0.37
	2021	0.26	0.28	0.29	0.32	0.26	0.50	0.37
Latvia	2018	0.34	0.35	0.36	0.37	0.35	0.49	0.40
	2019	0.34	0.35	0.36	0.37	0.35	0.49	0.40
	2020	0.34	0.34	0.36	0.37	0.35	0.49	0.40
	2021	0.33	0.33	0.36	0.36	0.34	0.49	0.40
Malta	2018	0.28	0.30	0.29	0.31	0.28	0.44	0.34
	2019	0.28	0.30	0.29	0.31	0.28	0.44	0.34
	2020	0.27	0.30	0.28	0.31	0.27	0.44	0.34
	2021	0.27	0.29	0.28	0.30	0.27	0.44	0.34
Netherlands	2018	0.26	0.30	0.29	0.32	0.27	0.42	0.36
	2019	0.26	0.30	0.29	0.31	0.27	0.42	0.36
	2020	0.26	0.30	0.29	0.31	0.27	0.42	0.36
	2021	0.25	0.30	0.28	0.31	0.27	0.42	0.36
Poland	2018	0.28	0.31	0.29	0.29	0.28	0.47	0.33
	2019	0.28	0.31	0.29	0.29	0.29	0.47	0.33
	2020	0.28	0.29	0.31	0.29	0.29	0.47	0.34
	2021	0.28	0.29	0.31	0.29	0.29	0.47	0.34
Portugal	2018	0.31	0.33	0.32	0.37	0.32	0.52	0.39
	2019	0.31	0.33	0.32	0.37	0.32	0.52	0.39

	Policy year	Disposable Income (DPI) 50%	DPI less means-tested	DPI less non means-tested	DPI plus direct taxes	DPI plus SIC	Market income	Market income plus pensions
	2020	0.31	0.33	0.32	0.37	0.32	0.52	0.39
	2021	0.31	0.33	0.32	0.37	0.32	0.52	0.39
Romania	2018	0.34	0.35	0.35	0.35	0.38	0.52	0.41
	2019	0.33	0.34	0.35	0.34	0.38	0.52	0.41
	2020	0.33	0.34	0.35	0.34	0.38	0.52	0.40
	2021	0.33	0.34	0.36	0.34	0.38	0.53	0.41
Sweden	2018	0.26	0.28	0.31	0.30	0.26	0.47	0.36
	2019	0.26	0.28	0.32	0.30	0.26	0.47	0.36
	2020	0.26	0.28	0.32	0.30	0.26	0.47	0.36
	2021	0.26	0.28	0.32	0.30	0.26	0.47	0.36
Slovenia	2018	0.23	0.26	0.25	0.27	0.26	0.45	0.32
	2019	0.23	0.26	0.26	0.27	0.26	0.45	0.32
	2020	0.24	0.26	0.26	0.27	0.26	0.45	0.32
	2021	0.24	0.26	0.26	0.28	0.27	0.45	0.33
Slovakia	2018	0.22	0.23	0.24	0.24	0.23	0.39	0.27
	2019	0.22	0.23	0.24	0.24	0.23	0.39	0.27
	2020	0.22	0.23	0.24	0.24	0.23	0.39	0.27
	2021	0.22	0.23	0.24	0.24	0.23	0.39	0.27

Source: EUROMOD version I4.0+

Note: EUROMOD figures for 2018-2021 are based on SILC 2019 (2018 incomes).

4 Comparing EUROMOD estimates with external statistics

The results obtained from the EUROMOD baseline scenarios can be assessed in two ways. The first is to compare aggregate values for expenditure on benefits, revenues from taxes and contributions, and recipients/payers of benefits/taxes, with figures taken from external statistics (usually official administrative sources). The second is to compare poverty and inequality indicators, such as those provided in Table 1, with similar estimates obtained directly from the EU-SILC data provided by Eurostat. These methods are considered in turn below.

4.1 Comparison with external aggregate statistics

This process is known as "macro-validation" and the comparisons for each country are documented in detail in the Country Reports. Comparisons are made between the weighted number of recipients/payers for each policy instrument (simulated or not simulated) in the EUROMOD baseline with figures taken from national administrative statistics for the same period. Similarly, the amount of annual benefits expenditure and tax revenues is compared for EUROMOD and national administrative estimates. Comparisons are often not straightforward to carry out for a number of reasons. First, the administrative statistics may refer to a different reference time period or unit of analysis than EUROMOD (this applies particularly to recipients/payers of an instrument). Secondly, the administrative statistics may not refer to the same instruments or income components that are itemised in EUROMOD. They may refer to sub-instruments or to combinations of several income components. Thirdly, in some countries the statistics for certain instruments may only be available at the regional level. In such cases, they might only be published with a long time delay or not be made publicly available at all.

Furthermore, the process of validation is cumulative. If there is a problem with one income component this will also affect the precision of simulation of the components which rely on it. As an example, if earnings are under-reported in the survey, not only will social contributions be under-estimated, but so will be the size of any tax relief on the contributions. Thus, income taxes will be over-estimated for this reason, but at the same time under-estimated because of the under-reporting of earnings. The problem with the latter effect may seem less serious than it is, because of the former effect.

Here we summarize the main challenges that typically arise by comparing EUROMOD results with national administrative statistics across countries.

- First, it is not the case that the same patterns of over- or under- estimation can be observed across countries. For example, income taxes may be under-estimated because market incomes are under-reported or the available survey generally does not adequately represent high income taxpayers. Further, income tax may be over-estimated because of lack of modelling of tax evasion (as in Latvia). It may also be over-estimated because it is not possible to model or measure the size of some tax reliefs and common tax avoidance measures (as in Portugal). Finally, it may be under- or over-estimated because of under- or over-estimation of simulated income components which are taxable.

- The simulations are only as good as the underlying SILC data and, in the cases where it is necessary, as good as the imputation of income components from the UDB aggregates. Their quality also depends on the level of complexity of national tax and benefit systems.

- Our assessment of whether a simulation is "good enough" depends on the importance of the instrument in total household disposable income, generally. If the instrument is small or affects few people, then it is less likely to match external statistics (not least, due to sampling variability), and it is less important that it does so than if it is an important component of household income.

- As indicated above, non-take-up of benefits, or the application of local discretion decisions in the assignment of benefits, leads EUROMOD to over-simulate means-tested benefits in many instances (see also Annex 3). In many countries, social assistance receipt is over-simulated by a factor of 2 or 3. The size of this effect (e.g. on poverty risk) varies with the emphasis on this type of benefit in each national system. Adjustments to account for non-take-up behaviour can be applied, but these can only be approximate. If the EU-SILC data adequately capture social assistance benefit recipients and payments (for example), then one solution is to tie "eligibility" to those with recorded receipt in the data. This results in baseline estimates that compare well with the SILC but might be less appropriate when modelling policy changes or "what if" scenarios

involving new benefit entitlements, or swapping policies across countries. An overview of the treatment of non-take-up and tax evasion is given in Annex 3.

4.2 Comparison with EU-SILC distributional statistics

Table 5 compares EUROMOD baseline results on poverty and inequality with official statistics published by Eurostat: EUROMOD results based on 2018 policies and incomes are compared to Eurostat figures based on EU-SILC 2019 (income reference period 2018). Given that EUROMOD uses SILC as its input data, one would expect the estimates for the base year 2018 to be the most closely related. This comparison is of some use for validation purposes as, if the two sets of estimates are very different, this may suggest some problem with the simulations or the input data. At the same time, there are several reasons, beside some of the reasons explained in the previous section, for which the two sets of estimates in base years should not be expected to be identical. These include:

- As a microsimulation tool, EUROMOD simulates most taxes and benefits, which are in turn an important part of disposable income. On the contrary, these components are either self-reported or derived by administrative sources in SILC. This discrepancy is bound to create differences in the calculated distributional estimates. These does not mean that one set of results is more accurate than the other, but that they represent different concepts. For example, if there is no information for a perfect simulation of a benefit in EUROMOD, the SILC value may be more accurate; but in cases where respondents give imprecise answers about a specific tax-benefit instrument, EUROMOD simulations may be more realistic.

- As mentioned above, not accounting for non-take-up of benefits and tax evasion in some countries, will tend to make the income distribution appear less unequal and, risk of poverty rates smaller than those calculated using the SILC directly (which itself may be subject to measurement errors). In this report, adjustments have been made to account for benefit non-take-up in Belgium, Estonia, France, Spain, Greece, Ireland, Latvia, Poland, Portugal, Romania and Finland. Adjustments for tax evasion have been implemented in Bulgaria, Greece, Italy and Romania.

- The release version of EU-SILC data. In some cases EUROMOD uses the first release of EU-SILC data (see Annex 1), while statistics provided by Eurostat are based on the most recent release, we assume. To the extent that the relevant underlying data change between releases, we would expect differences in the indicators from the two sources.

- The standard definition of household disposable income produced by EUROMOD and used in this report is slightly different from the definition of the UDB variable (HY020) used for the official indicator calculations. In EUROMOD we do not include any non-cash employment income in the definition of disposable income (e.g., value of company car).[10] This is likely to have some effect on the income distribution, for example by reducing the median and the poverty threshold in countries with significant non-cash employment incomes in this form.

- In the EUROMOD input database we drop observations (households) from the SILC where one or more persons in the household have missing data on weights. This is not necessary in many countries, but in some countries the number of such cases varies from a few to more than 50.

- In constructing the input information used in the calculation of tax liabilities and benefit entitlements it is important that the different variables are as consistent as possible. One adjustment made to ensure that the information on the income reference period (and EUROMOD policy year) is consistent with the characteristics of the household (current at the time of the survey) is to drop children born after the EU-SILC income reference period and before the interview. This will affect household composition and hence the equivalence scale and the calculation of household equivalised disposable income.

As we can appreciate in Table 5, the EUROMOD and Eurostat/EU-SILC estimates of the poverty rate based on the 60% of the median household disposable income poverty line indeed differ, but remain bounded between 2 and -2 percentage points for most countries in the base year 2018. More significant underestimations with

[10] In a definitive reconciliation of the two sources the income measures could in principle be adjusted to include precisely the same components.

respect to the Eurostat figures are observed in Luxembourg and Germany, amounting to about 4 percentage points. In Hungary, on the contrary, poverty rates are over-estimated by about 10 percentage points. Differences with Eurostat do not appear more severe when looking at different poverty lines, calculated on the basis of 50% and 70% of the median household disposable income. The general tendency is to slightly underestimate rather than overestimate Eurostat poverty figures; the ranking of countries, however, does not seem to be affected.

When looking at poverty rates for the elderly, we observe differences of a similar magnitude as those for the overall population. However, in the case of children differences appear a bit more pronounced and, in some countries, large. In both cases, again, the tendency is toward the underestimation of Eurostat figures.

The differences with Eurostat in the estimation of the Gini coefficient seem less sizeable but involve the same set of countries: the underestimation exceeds 0.06 percentage points in Luxembourg and it is about 0.03 points in Germany. EUROMOD overestimates the Gini by around 0.02 points in Hungary.

In order to understand these discrepancies, the following factors should be taken into account:

- Over-simulation of some particular means-tested benefits can explain some of the low EUROMOD poverty rates. Over-simulation might result from several factors alone or in combination: unobserved differences at the municipality level, lack of information to simulate asset tests where these exist, and non-take-up.[11] For example, unemployment assistance and sickness benefits in Germany leading to underestimation of poverty rates, and social assistance in Luxembourg due to non-take-up from potential beneficiaries.
- In many countries groups of elderly people are concentrated around the 60% median poverty threshold, meaning that their risk of poverty is sensitive to small shifts in the poverty line. This discrepancy is also driven by the over-simulation of pensions in EUROMOD. Comparisons of the threshold itself are only straightforward for the euro-zone countries.[12]
- Over-simulation of income taxes can lead to under-estimation of inequality and of median disposable income, and hence the risk of poverty estimates. The main contributing factors are the existence of tax evasion, which is not typically captured, and the non-simulation of some tax deductions due to lack of necessary information.

Table 5. Comparison of baseline poverty and inequality statistics: EUROMOD output (2018 incomes and policies) vs. Eurostat EU-SILC estimates

		Poverty Risk: all			Poverty risk (60%)		Poverty threshold	Gini coefficient
		50%	60%	70%	age <18	age>=65	(60% median) €/year	(%)
Austria	Eurostat	8.6	13.3	22.0	19.2	13.9	15437	0.275
	EUROMOD	6.3	13.5	21.2	15.5	13.1	15017	0.253
Belgium	Eurostat	7.3	14.8	24.2	20.1	15.7	14765	0.251
	EUROMOD	5.7	12.3	22.3	14.8	14.0	14248	0.229
Bulgaria	Eurostat	16.3	22.6	30.1	26.6	34.6	2534	0.408
	EUROMOD	16.5	23.2	31.2	27.7	35.8	2556	0.404
Cyprus	Eurostat	7.0	14.7	24.4	17.3	24.6	9729	0.311
	EUROMOD	7.7	15.9	25.3	18.7	27.0	10048	0.309
Czechia	Eurostat	4.3	10.1	18.1	11.0	16.6	5997	0.240
	EUROMOD	4.5	9.6	17.7	9.9	14.7	5791	0.232
Germany	Eurostat	9.0	18.9	23.0	14.5	22.3	14109	0.297
	EUROMOD	8.1	14.1	21.8	12.4	17.5	14021	0.267

[11] It is worth noting that in some countries simulated means-tested benefits correspond very well to external statistics; higher poverty estimates in the EU-SILC may also be due to under-reporting of benefits in the data. For example, Unemployment Benefit II in Germany has been oversimulated in comparison to EU-SILC input data. However, macrovalidation results show that the benefit is accurately simulated when compared to official statistics. These results clearly point out to issues in the EU-SILC input data. e.g. underreporting of the benefit.

[12] For non-euro-zone countries the comparison of the threshold is complicated by the choice of exchange rate to use and this makes a difference in cases where this is changing over the data and policy simulation reference period. In the policy simulation we use the exchange rate prevailing at 30th June 2018.

		Poverty Risk: all			Poverty risk (60%)		Poverty threshold	Gini coefficient
		50%	60%	70%	age <18	age>=65	(60% median) €/year	(%)
Denmark	Eurostat	6.7	12.5	20.2	11.0	9.0	18430	0.275
	EUROMOD	5.1	10.2	19.3	7.7	6.7	18259	0.247
Estonia	Eurostat	13.9	21.7	29.6	15.2	43.7	6877	0.305
	EUROMOD	12.2	20.6	28.9	15.1	42.5	6783	0.282
Greece	Eurostat	12.3	17.9	25.3	22.7	12.2	4917	0.310
	EUROMOD	10.0	15.6	23.3	18.7	10.4	5197	0.293
Spain	Eurostat	13.6	20.7	28.4	26.8	14.5	9009	0.330
	EUROMOD	14.2	21.3	28.8	26.0	18.6	9061	0.323
Finland	Eurostat	5.4	11.6	20.8	11.1	14.4	14927	0.262
	EUROMOD	3.1	10.2	19.8	9.5	11.6	14763	0.241
France	Eurostat	6.7	13.6	21.1	19.9	9.7	13537	0.292
	EUROMOD	5.3	11.4	20.4	15.8	6.6	13207	0.282
Croatia	Eurostat	12.2	18.3	25.6	19.7	30.1	4384	0.292
	EUROMOD	12.3	17.9	25.6	15.3	30.4	4489	0.289
Hungary	Eurostat	8.6	12.3	22.2	13.8	11.1	3511	0.280
	EUROMOD	16.7	22.6	28.1	25.4	22.6	3273	0.298
Ireland	Eurostat	6.0	13.1	22.1	15.8	18.1	15317	0.283
	EUROMOD	7.5	15.9	24.9	17.6	26.0	14434	0.291
Italy	Eurostat	13.8	20.1	27.4	26.2	16.2	10299	0.328
	EUROMOD	13.8	20.2	27.6	25.5	14.5	9917	0.323
Lithuania	Eurostat	13.7	20.6	28.4	23.9	31.6	4552	0.354
	EUROMOD	13.5	21.1	29.1	23.9	31.6	4529	0.342
Luxembourg	Eurostat	11.0	17.5	25.2	22.6	9.3	21812	0.323
	EUROMOD	3.5	13.3	21.8	16.8	6.7	23734	0.258
Latvia	Eurostat	16.2	22.9	29.5	17.5	47.9	4912	0.352
	EUROMOD	14.8	21.8	28.9	13.3	45.6	4646	0.345
Malta	Eurostat	8.7	17.1	25.6	21.4	27.7	9212	0.280
	EUROMOD	8.7	16.9	25.9	16.0	32.6	9463	0.276
Netherlands	Eurostat	6.7	13.2	21.2	13.1	11.8	14767	0.268
	EUROMOD	5.5	12.0	19.9	14.1	6.8	14694	0.256
Poland	Eurostat	9.4	15.4	23.1	13.0	17.4	4275	0.285
	EUROMOD	8.7	14.7	22.2	10.4	17.5	4143	0.280
Portugal	Eurostat	10.5	17.2	25.2	19.0	17.3	6014	0.319
	EUROMOD	10.2	17.2	25.2	17.5	19.0	6218	0.311
Romania	Eurostat	17.6	23.8	30.2	32.0	25.1	2310	0.348
	EUROMOD	16.5	22.9	29.7	28.4	25.2	2319	0.336
Sweden	Eurostat	10.2	17.1	24.9	19.3	15.2	14684	0.276
	EUROMOD	8.4	15.2	24.0	19.3	11.3	14480	0.256
Slovenia	Eurostat	6.3	12.0	19.4	11.7	18.6	8440	0.239
	EUROMOD	4.4	11.4	20.1	9.1	16.9	8113	0.230
Slovakia	Eurostat	7.5	11.9	19.2	20.5	8.7	4872	0.228
	EUROMOD	7.2	10.9	18.7	16.2	7.6	4835	0.220

Source: EUROMOD version I4.0+

Note: EUROMOD figures are based on SILC 2019 (2018 incomes).

5 Work incentives: estimates of marginal effective tax rates

EUROMOD can be used to calculate the effect of tax and benefit systems on work incentives. In Table 6, we provide mean and median marginal effective tax rates (METR) based on 2019 data for 4 policy years (from 2018 to 2021) for the 27 EU countries. These are calculated using the METR add-on, which is yearly updated and released with the model.[13] [14]

Marginal Effective Tax Rates (METRs) represent the proportion of marginal increase in earnings that is "taxed away" due to social insurance contributions, taxes and loss of benefit entitlement. Thus, they provide a measure of labour market incentives at the intensive margin: the highest (lowest) the METRs, the lowest (highest) the incentives to work more hours.

EUROMOD calculates METRs for all individuals with earned income, taking account of the effect of earning 3% more such income (in gross terms) on their household disposable income. Following Jara and Tumino (2013), we present METR results for individuals of working age (18-64) who have more than 1 unit of national currency of monthly earnings. We exclude from our calculations the top percentile of the METR distribution if the value is above 150% and the lowest percentile if the value of METR is negative. The latter exclusions are made in order for average METR to be less sensitive to "outliers", although such values are in principle plausible.

There can be different ways of calculating METR, depending on the interpretation that one wishes to place upon them, and comparability issues across countries should be borne in mind. One such issue relates to the treatment of benefit non-take-up and tax evasion for the calculation of METR. The results presented below assume full take-up of benefits and full tax compliance in all countries. Hence, all of the marginal earnings for all countries are assumed to be earned in the official economy and are subject to taxes, contributions and benefit withdrawal, assuming full compliance. From the methodological standpoint, whether or not to take evasion into account at all when measuring work incentives is therefore an issue to consider. This depends very much on whether the METRs are to be considered as indicators of the effects of the design of the tax-benefit system on marginal earnings that are retained; or whether they are to be interpreted as calculations of the marginal return to additional work in practice, taking into account opportunities to evade. Further, the METRs focus on the components of disposable income and hence exclude employer SIC. Therefore, these calculations do not reflect the overall tax wedge.

Table 6 shows that Belgium exhibits by far the highest mean METR (54%), followed by Denmark, Luxembourg, Germany and Finland, where METRs range between 44% and 46%. The lowest mean METRs are observed in Cyprus, Croatia, Estonia and Bulgaria (below 25%). The ranking of countries remains largely the same when ranked by the median METR instead of the mean. The table is also useful to understand which countries have made progress towards reducing disincentives to increase working hours over the period considered, and which have worsened in the ranking. Looking at mean METR, Lithuania is the country with the largest increase in disincentives between 2018 and 2021 (15 percentage points). Such an increase is generated by a SICs reform, which resulted in the recalculation of all the gross wages for the purpose of SIC liability. Moreover, personal income tax was also reformed with the introduction of a second income band featuring a higher rate of tax.

Even though average METRs already give a good indication of intensive-margin work incentives across countries, the distributional pattern of METRs provides a more complete picture. Figure 3 shows the share of the working population with different levels of work incentives (under 20%, 20% to under 40%, 40% to under 60%, 60% to under 80% and 80% and above) for the 2018 policy system.

In a few countries, an important share of the working population show low METRs (below 20%). This is the case in Cyprus (66%), Croatia (58%), Spain (42%), Greece (26%) and Portugal (26%). On the other hand, the distribution of METR is very concentrated at higher levels (e.g. between 40% and 60%) in Denmark (84%), Romania (79%), Germany (67%), Netherlands (62%), Finland (62%), Austria (58%). Further, there are cases where there are large shares of the population in paid work both with relatively low and relatively high marginal rates (Luxembourg, Ireland, France and Italy). In almost all countries there is a small minority facing very low incentives (i.e. METRs over 80%) which typically occurs because of the interaction of tax and contributions with benefit withdrawal, or because of discontinuities in entitlement to benefits or tax

[13] For more details see the document "Marginal Tax Rate (MTR) Add-on - technical note", released with the model and available in available in https://euromod-web.jrc.ec.europa.eu/resources/model-documentation.

concessions. The share of working people with such high METRs is 5% or more in Greece, Luxembourg, Finland and Slovenia.

Figure 3. Marginal effective tax rates 2018: share of population in paid work (%) by range of METR[15]

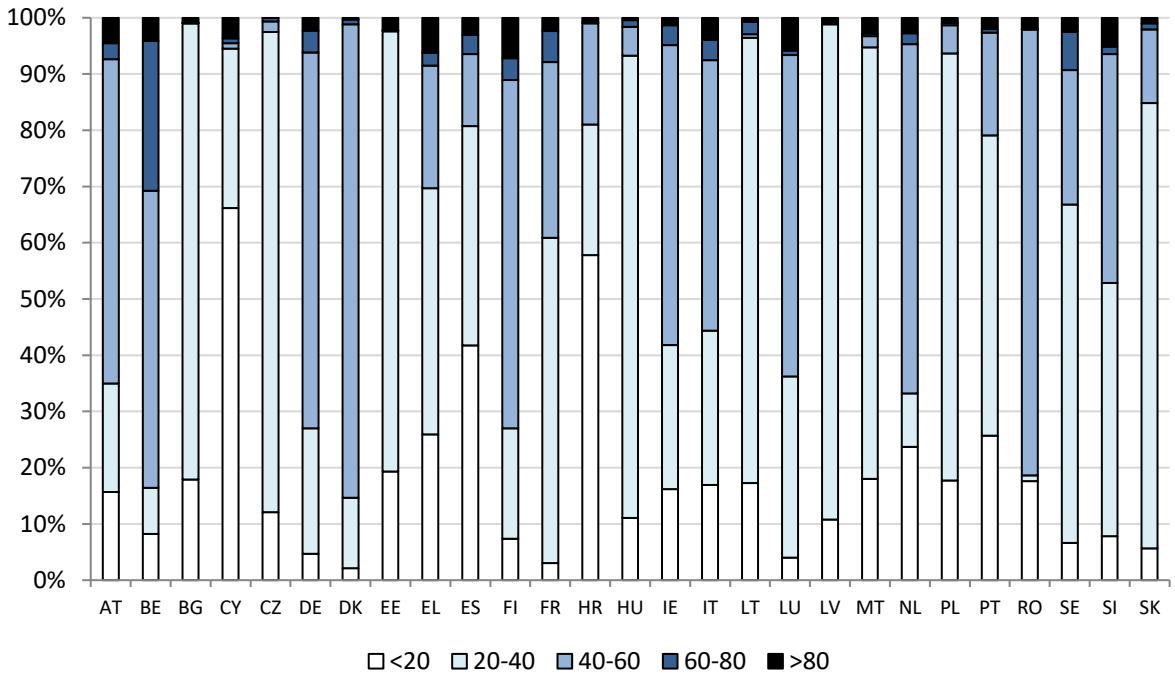


Table 6. Mean and median Marginal effective tax rates: 2018-2021

Country		2018	2019	2020	2021
Austria	mean	40.5	40.3	40.0	40.7
	median	43.3	43.3	43.3	43.3
Belgium	mean	54.2	54.1	54.6	54.8
	median	56.7	57.2	57.6	57.3
Bulgaria	mean	21.9	21.8	21.6	21.5
	median	22.4	22.4	22.4	22.4
Cyprus	mean	18.8	20.2	20.9	21.0
	median	8.4	10.7	11.6	11.6
Czech Republic	mean	29.3	29.2	29.1	24.6
	median	31.1	31.1	31.1	26.0
Germany	mean	45.1	43.5	43.7	42.7
	median	44.5	44.5	44.5	43.8
Denmark	mean	45.0	44.6	44.3	44.2
	median	42.9	42.1	42.1	42.1
Estonia	mean	24.0	24.6	24.6	24.7
	median	22.9	22.9	22.9	22.9
Greece	mean	37.6	33.6	29.8	28.1

[15] The figure presents the share of individuals over the population in paid work that face a certain marginal effective tax rate in 2018. So, for example, EUROMOD estimates that in 2018 in Spain about 40% of the population in paid work faced a marginal effective tax rate of less than 20%.

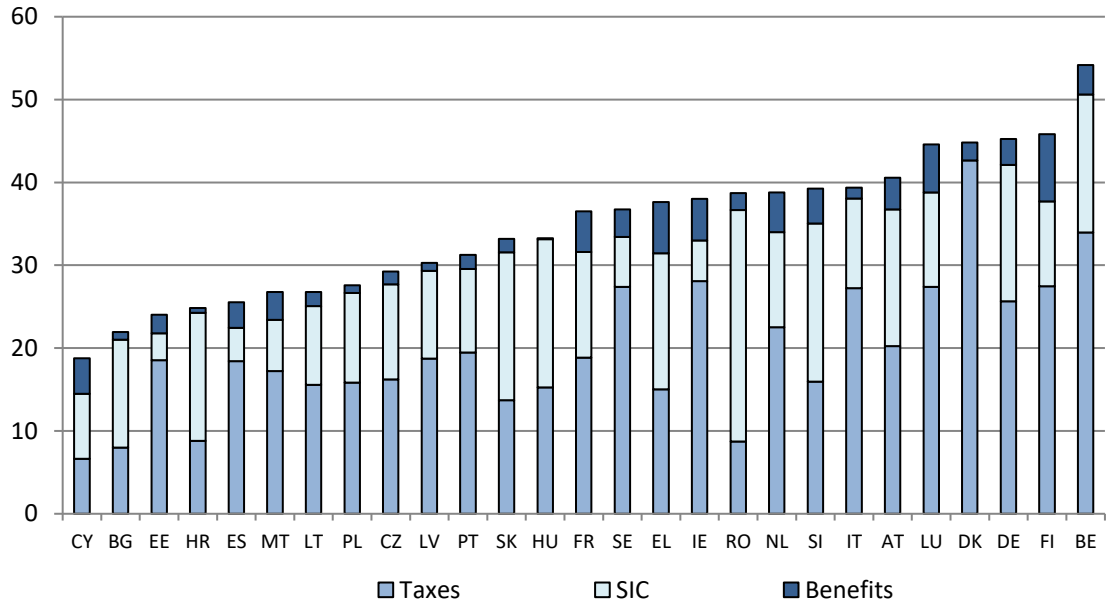
Country		2018	2019	2020	2021
	median	36.3	36.1	33.0	28.0
Spain	mean	25.6	25.5	26.9	27.0
	median	28.8	28.8	28.8	28.8
Finland	mean	45.8	45.6	46.0	45.7
	median	45.8	45.9	46.6	46.9
France	mean	36.5	35.3	34.3	34.5
	median	36.5	34.8	32.6	33.0
Croatia	mean	24.9	25.2	24.1	23.2
	median	20.0	20.0	20.0	20.0
Hungary	mean	33.3	33.2	32.5	32.3
	median	34.5	34.5	34.5	34.5
Ireland	mean	38.4	38.5	39.3	39.6
	median	48.8	48.5	48.5	48.5
Italy	mean	39.4	41.8	43.0	41.7
	median	42.7	44.6	44.8	42.2
Lithuania	mean	26.8	40.3	41.5	41.7
	median	31.5	44.1	45.2	45.5
Luxembourg	mean	44.6	44.6	44.9	46.0
	median	45.3	46.2	47.3	47.7
Latvia	mean	30.3	30.3	30.6	30.2
	median	30.4	31.8	31.8	33.0
Malta	mean	26.8	27.7	27.9	28.2
	median	25.0	25.0	25.0	25.0
Netherlands	mean	39.3	38.6	38.3	37.7
	median	49.1	49.3	48.5	48.8
Poland	mean	27.6	27.7	25.8	26.6
	median	29.5	29.5	28.1	29.5
Portugal	mean	31.3	32.6	32.7	32.8
	median	34.0	34.0	34.0	34.0
Romania	mean	38.7	38.1	37.9	37.6
	median	41.5	41.5	41.5	41.5
Sweden	mean	36.7	35.8	35.5	35.9
	median	32.4	32.4	32.5	32.5
Slovenia	mean	39.3	39.5	38.3	38.2
	median	39.7	39.8	38.8	38.7
Slovakia	mean	33.2	33.3	32.8	33.3
	median	29.9	29.9	29.9	29.9

Source: EUROMOD version I4.0+

Note: EUROMOD figures are based on SILC 2019 (2018 incomes).

Figure 4 presents the decomposition by components of average METR for each country in the base year 2018. Average METR has been decomposed into three main components: taxes, representing the average increase in taxes paid at the household level as a proportion of the increase in individual gross earnings; social insurance contributions, including changes in both employee, self-employed and other social insurance contributions paid by the individual; and benefits, representing the average reduction in benefits and pensions paid at the household level as a proportion of the increase in earnings. The results of the decomposition for all the policy years 2018-2021 are reported in Table 7.

Figure 4. Marginal effective tax rates (%) by income component, 2018



Source: EUROMOD version I4.0+

Note: Countries have been ranked according to the total (mean) marginal effective tax rate. EUROMOD figures are based on SILC 2019 (2018 incomes).

Despite a wide variation across countries, the graph shows that the tax component is usually the most important. Its size varies significantly across countries and range from relatively low values in Cyprus, Bulgaria and Croatia to relatively high values in Denmark, Belgium, Finland, Ireland, Luxembourg, Italy and Sweden.

In Denmark, almost all of the average METR is accounted for by taxes. While in Belgium, Finland, Ireland, Luxembourg, Italy and Sweden the share of taxes is lower but still accounting for most of the average METR. Nordic countries together with Ireland, Luxembourg and Belgium also have the highest METR due to taxes in absolute terms (all over 27%), while taxes seem to offer less disincentive to work at the margin in Cyprus, Bulgaria and Croatia, countries which are also characterized by a relatively flat wage distribution. Countries where the contribution of SIC to METR is the largest are instead Hungary, Romania, Slovenia, Slovakia, in all cases above 17% (28% in Romania). At the other end of the spectrum, in Spain, Estonia, Ireland and Denmark, the SIC contribution to METR is the lowest, below 5 percentage points (in Estonia, for example, most of SICs are paid by employers). In a few countries, the contribution of benefits is also relevant to the mean METR, however to a minor extent if compared to SIC and especially to taxes: this is the case of Luxembourg, Finland and Greece.

The METR estimates presented here show only a very small selection of indicators of work incentives that may be of interest. Breakdowns by gender, family status, employment status and analysis of METRS across the income distribution are examples of additional analysis that can be carried out using EUROMOD.

Table 7. Marginal effective tax rates by income component: 2018-2021

	Policy year	Taxes	SIC	Benefits	Total
Austria	2018	20.3	16.5	3.8	40.5
	2019	20.3	16.3	3.7	40.3
	2020	20.1	16.1	3.7	40.0
	2021	20.2	16.4	4.0	40.7
Belgium	2018	34.0	16.7	3.5	54.2
	2019	33.7	16.6	3.8	54.1
	2020	34.1	16.5	4.0	54.6
	2021	34.3	16.4	4.1	54.8
Bulgaria	2018	8.0	13.0	0.9	21.9

	Policy year	Taxes	SIC	Benefits	Total
	2019	8.0	13.1	0.7	21.8
	2020	8.0	12.9	0.7	21.6
	2021	8.1	12.8	0.6	21.5
Cyprus	2018	6.6	7.8	4.3	18.8
	2019	6.0	10.1	4.1	20.2
	2020	5.8	11.1	4.0	20.9
	2021	5.9	11.2	3.9	21.0
Czechia	2018	16.2	11.5	1.6	29.3
	2019	16.5	11.3	1.4	29.2
	2020	16.7	11.1	1.3	29.1
	2021	11.7	11.2	1.8	24.6
Germany	2018	25.7	16.5	3.1	45.1
	2019	25.1	15.4	3.0	43.5
	2020	24.8	15.7	3.2	43.7
	2021	23.7	15.8	3.2	42.7
Denmark	2018	42.6	0.0	2.2	45.0
	2019	42.5	0.0	2.0	44.6
	2020	42.5	0.0	1.7	44.3
	2021	42.4	0.0	1.7	44.2
Estonia	2018	18.5	3.3	2.2	24.0
	2019	19.2	3.3	2.1	24.6
	2020	19.4	3.3	1.9	24.6
	2021	19.5	3.3	1.9	24.7
Greece	2018	15.0	16.4	6.2	37.6
	2019	16.2	15.8	1.6	33.6
	2020	16.6	12.0	1.3	29.8
	2021	15.4	11.3	1.4	28.1
Spain	2018	18.4	4.0	3.1	25.6
	2019	18.6	3.7	3.1	25.5
	2020	18.3	3.7	4.9	26.9
	2021	18.3	3.7	5.0	27.0
Finland	2018	27.5	10.2	8.1	45.8
	2019	27.5	10.3	7.9	45.6
	2020	28.1	10.1	7.9	46.0
	2021	27.9	10.3	7.6	45.7
France	2018	18.9	12.7	4.9	36.5
	2019	18.7	11.2	5.4	35.3
	2020	17.0	11.3	6.0	34.3
	2021	17.8	11.3	5.4	34.5
Croatia	2018	8.8	15.5	0.6	24.9
	2019	9.2	15.5	0.6	25.2
	2020	8.1	15.5	0.5	24.1
	2021	7.0	15.5	0.7	23.2
Hungary	2018	15.3	17.9	0.1	33.3
	2019	15.3	17.9	0.1	33.2
	2020	15.0	17.4	0.1	32.5
	2021	15.0	17.2	0.1	32.3
Ireland	2018	28.1	4.9	5.0	38.4
	2019	28.5	4.9	4.7	38.5
	2020	29.2	4.9	5.0	39.3
	2021	29.7	4.8	5.1	39.6
Italy	2018	27.2	10.9	1.3	39.4
	2019	27.4	10.8	3.5	41.8

	Policy year	Taxes	SIC	Benefits	Total
	2020	27.4	10.8	4.7	43.0
	2021	26.2	10.8	4.7	41.7
Lithuania	2018	15.6	9.5	1.7	26.8
	2019	17.8	20.9	1.6	40.3
	2020	18.7	21.0	1.7	41.5
	2021	18.8	21.1	1.8	41.7
Luxembourg	2018	27.4	11.4	5.8	44.6
	2019	27.9	11.4	5.4	44.6
	2020	28.5	11.4	5.0	44.9
	2021	28.9	11.4	5.7	46.0
Latvia	2018	18.7	10.6	1.0	30.3
	2019	18.8	10.6	0.9	30.3
	2020	19.0	10.6	1.0	30.6
	2021	18.5	10.3	1.4	30.2
Malta	2018	17.2	6.2	3.3	26.8
	2019	17.8	6.1	3.8	27.7
	2020	17.2	6.6	4.2	27.9
	2021	17.5	6.5	4.1	28.2
Netherlands	2018	22.5	11.5	4.8	39.3
	2019	21.5	11.7	4.8	38.6
	2020	20.8	11.1	6.0	38.3
	2021	20.2	10.7	6.3	37.7
Poland	2018	15.8	10.8	0.9	27.6
	2019	16.0	10.8	0.9	27.7
	2020	15.1	10.0	0.7	25.8
	2021	15.0	10.8	0.7	26.6
Portugal	2018	19.5	10.1	1.7	31.3
	2019	19.8	11.1	1.8	32.6
	2020	20.0	11.1	1.6	32.7
	2021	20.1	11.1	1.6	32.8
Romania	2018	8.7	27.9	2.0	38.7
	2019	8.7	27.9	1.6	38.1
	2020	8.5	27.9	1.5	37.9
	2021	8.2	27.9	1.5	37.6
Sweden	2018	27.4	6.0	3.3	36.7
	2019	26.7	6.0	3.1	35.8
	2020	26.7	6.0	2.8	35.5
	2021	27.1	6.0	2.8	35.9
Slovenia	2018	16.0	19.1	4.2	39.3
	2019	16.2	19.0	4.3	39.5
	2020	15.1	19.0	4.2	38.3
	2021	15.1	19.0	4.2	38.2
Slovakia	2018	13.7	17.9	1.6	33.2
	2019	13.7	17.8	1.8	33.3
	2020	13.4	17.6	1.8	32.8
	2021	14.2	17.4	1.8	33.3

Source: EUROMOD version I4.0+

Note: EUROMOD figures are based on SILC 2019 (2018 incomes).

6 Conclusions

The results from EUROMOD shown in this report are limited to some key statistical indicators of the baselines for 2018-2021 policies. As discussed in the introduction to this article, the main purpose of EUROMOD is not to generate baseline statistics for a particular policy year. Instead, EUROMOD is a tool to explore alternative policy scenarios and their impact on households. At the same time, a number of improvements and refinements which are conducted on a yearly basis are aimed at improving the quality, comparability and applicability of the baseline results. These for example include:

- Adjustments to increase the coherence between EUROMOD baseline and external statistics (while at the same time maintaining transparency in the model and its responsiveness to the effects of simulated policy changes). Among them, adjustments for non-take-up of benefits and evasion of taxes are of particular importance.
- Continued efforts to improve the precision and level of detail in (as well as cross-country consistency of) the treatment of the updating of non-simulated incomes from the data to the policy year.
- Continuous expansion of the number of countries using the disaggregated benefit variables now included in EU-SILC since 2014 for some countries. These are likely to improve the imputation of non-simulated benefits and hence the simulations.

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Annexes

Annex 1. SILC datasets used to create EUROMOD input datasets used in this paper

Table 8. SILC datasets used to create EUROMOD input datasets used in this paper

Country	Base dataset for EUROMOD
AT	EMSD 2019-v1 (UDB 2019 Release_20-09 + national SILC)
BE	EMSD 2019-v1 (UDB 2019 Release_20-09 + national SILC)
BG	EMSD 2019-v2 (UDB 2019 Release_20-09 + national SILC)
CY	UDB 2019-1 (UDB 2019 Release_20-09)
CZ	EMSD 2019-v1 (UDB 2019 Release_20-09 + national SILC)
DE	UDB_c19_v2019 (Nov 2020)
DK	UDB_c19_v2019 (Nov 2020)
EE	UDB_c19_v2019 (Nov 2020) + National SILC 2019 (Apr 2021)
EL	ELSTAT 2019 hybrid datasets (national UDB + PDB)
ES	EMSD 2019-v1 (UDB 2019 Release_20-09 + national SILC)
FI	UDB 2019-1 (UDB 2019 Release_20-09)
FR	EMSD 2019-v1 (UDB 2019 Release_20-09 + national SILC)
HR	EMSD 2019-v1 (UDB 2019 Release_20-09 + national SILC)
HU	EMSD 2019-v2 (UDB 2019 Release_20-09 + national SILC)
IE	UDB_c19_v2019 (Nov 2020) + additional information from the NT
IT	National SILC
LT	UDB 2019-1 (UDB 2019 Release_20-09 + national SILC)
LU	UDB_c19_v2019 (Nov 2020)
LV	UDB 2019-1 (UDB 2019 Release_20-09 + national SILC)
MT	EMSD 2019-v1 (UDB 2019 Release_20-09 + national SILC)
NL	EMSD 2019-v2 (UDB 2019 Release_20-09 + national SILC)
PL	UDB 2019-1 (UDB 2019 Release_20-09 + national SILC)
PT	EU-SILC microdata full set 201204 silc cros 2004-2019 v 201204
RO	UDB_c19_v2019 (Nov 2020)
SE	UDB_c19_v2019 (Nov 2020)
SI	EMSD 2019-v1 (UDB 2019 Release_20-09 + national SILC)
SK	National SILC (31/08/2020)

Annex 2. National teams contributing to EUROMOD I4.0+

Table 9. National teams contributing to EUROMOD I4.0+

Country	National team – team leader
AT	European Centre for Social Welfare Policy and Research – Michael Fuchs
BE	University of Antwerp – Gerlinde Verbist KU Leuven – André Decoster
BG	University of National and World Economy (UNSS), Sofia – Ekaterina Tosheva
CY	Ministry of Labour, Welfare and Social Insurance – Costas Stavrakis
CZ	CERGE-EI – Daniel Münich
DE	ifo Institute – Leibniz Institute for Economic Research at the University of Munich – Max Lay
DK	Roskilde University – Bent Greve
EE	PRAXIS Center for Policy Studies – Merilen Laurimäe
EL	Athens University of Economics and Business (AUEB) – George Economides
ES	Instituto de Estudios Fiscales (IEF) – Noemí Villazán and María Navas
FI	Research Department of the Social Insurance Institution of Finland (KELA) – Tapio Räsänen
FR	Université d'Aix Marseille – Alain Trannoy
HR	Institute of Public Finance – Ivica Urban
HU	TÁRKI Social Research Institute – Péter Szivós
IE	Economic and Social Research Institute (ESRI) – Karina Doorley
IT	Milan University – Carlo Fiorio University of Insubria/ISER – Francesco Figari
LT	Vilnius University – Jekaterina Navicke
LU	LISER – Nizamul Islam
LV	Baltic International Centre for Economic Policy Studies (BICEPS) – Anna Pluta
MT	Ministry of Finance, the Economy and Investment – Wayne Apap
NL	CentERdata – Klaas de Vos
PL	Center for Economic Analysis (CenEA) – Michal Myck
PT	Lisboa School of Economics & Management – Carlos Farinha Rodrigues Institute of Public Policy – Joana Vicente
RO	National Research Institute for Labour and Social Protection – Eva Militaru
SE	SOFI - Stockholm University – Kenneth Nelson and Rense Nieuwenhuis
SI	Inštitut za Ekonomska Raziskovanja (IER) – Boris Majcen and Nataša Kump
SK	Ministry of Finance of the Slovak Republic – Martin Miklos and Dusan Paur

Annex 3. Country notes: tax compliance adjustment (TCA), benefit non-take-up adjustment (BTA) and full year adjustments (FYA)

Table 10. Summary of tax compliance, benefit non-take up and full year adjustments in EUROMOD I4.0+, 2021 systems

Country	Benefit take-up adjustment (BTA)	Tax compliance adjustment (TCA)	Full year adjustment (FYA)
AT	-	-	-
BE	on	-	-
BG	-	on	off
CY	-	-	-
CZ	-	-	-
DE	-	-	-
DK	-	-	-
EE	on	-	off
EL	on	on	off
ES	on	-	-
FI	on	-	-
FR	on	-	off
HR	on	-	-
HU	-	-	off
IE	on	-	-
IT	-	on	off
LT	-	off	on
LU	-	-	-
LV	on	-	-
MT	-	-	-
NL	-	-	-
PL	-	-	-
PT	-	-	-
RO	on	on	-
SE	-	-	-
SI	on	-	-
SK	on	-	-

Source: EUROMOD version I4.0+

Note: "on" ("off") indicates that the adjustment is available and switched on (off) by default; "-" indicates that not adjustment is available.

Tax evasion

For **Bulgaria** tax evasion adjustments have been made because of oversimulation of taxes and social insurance contributions. The adjustment is based on a comparison between net and gross employment incomes. Under this approach, it is assumed that an individual is involved in the shadow economy if her (positive) net and gross employment incomes are equal. Such an individual is assumed to be a full tax evader and hence, no income tax and social insurance contributions are simulated for her. Furthermore, for the simulation of the income test for child and social assistance benefits, the earnings of a tax evader are not taken into account because it is assumed that they will not be reported and thus, will not be part of the income test. No correction for individuals with self-employment income has been done. These adjustments lead to more accurate simulations of the tax and benefit instruments.

For **Greece** tax evasion adjustments have been made on the basis of external estimates for the extent of average income underreporting by income source (earnings, self-employment income from farming and non-

farm business). Assuming that net incomes reported in SILC reflect true incomes, two sets of gross incomes have been derived – one under the assumption of full compliance and the other assuming that everyone have underreported a given income source to the tax authority by the same proportion. A user can choose which assumption is utilised for calculating disposable incomes, and the model automatically draws on the relevant set of gross incomes. Adjustments for tax evasion are used by default for the baseline scenarios.

For **Italy** self-employment income has been calibrated in order to take into account tax evasion behaviour. Since we implement our own net-to-gross procedure (starting from net incomes reported in SILC data), we split the recorded self-employment income into two components: the first component declared to the tax authorities (and hence grossed up) and the second component not declared (but still included in the definition of disposable income). The coefficient used to separate the two components allows us to get a total aggregate gross self-employment income corresponding to the aggregate amount of reported self-employment income as reported in the official statistics.

For **Lithuania** a switch for tax compliance adjustment has been introduced since 2017. Full tax compliance is assumed, hence the adjustment is set to off by default. However, the switch can be manually set to on by the user in order to adjust simulations.

For **Romania** all self-employed in agriculture living in rural areas and with a self-employment income below the average wage are assumed to evade taxes.

Full compliance is assumed for both income taxes and social insurance contributions for the rest of the countries.

Benefit non-take-up

For **Belgium** we employ a simple non-take-up correction of the main means-tested benefits by applying the take-up proportions estimated on a caseload basis (own calculations in case of Belgium; using statistics from the Department of Work and Pensions and HM Revenue and Customs in case of the UK). Take-up probabilities are applied at the household level (so that people entitled to the same benefits within a household exhibit the same take-up behaviour), for each benefit separately. In general we assume that take-up behaviour is not affected by changes in the size of benefit or tax credit entitlements. However, by applying differential take-up probabilities according to type of claimant in the UK, some of this effect is captured.

For **Estonia** non-take-up is simulated for social assistance on the assumption that small entitlements (12 euro or below) are not claimed. Full take-up is assumed for all other simulated means-tested benefits.

For **France** non-take-up correction of the main means-tested social assistance benefit (RMI/RSA)[13] is simulated to be random- proportions of non-take-up -separately by active and inactive units (for RSA) taken from external data. (30% take-up for families with work income, 60% take-up for families with work income).

For **Ireland**, non-take-up is simulated for Family Income Supplement, applying external estimates on the caseload. Full take-up is assumed for all other means-tested simulated benefits.

For **Greece** a random non-take-up correction is simulated for unemployment assistance benefit for long-term unemployed. The receipt of social dividend (a lump-sum benefit only provided in 2014) was restricted to the amount of the primary budget surplus that was allocated to the benefit, i.e. approximately €450 million. The beneficiaries of food stamps and rent allowance (two benefits only provided in 2015 and 2016) were also calibrated to guarantee consistency with the official statistics. Full take-up is assumed for all other simulated means-tested benefits.

For **Croatia**, non-take-up is simulated for subsistence benefit on the assumption that small entitlements (i.e. smaller than 3% of the average net wage) are not claimed. Full take-up is assumed for all other simulated means-tested benefits.

For **Latvia** non take up is simulated for paternity benefit based on the benefit receipt observed in the data.

For **Poland** full take up is assumed in the simulation of nursing supplement, nursing allowance, family allowance, family supplements, birth allowance, nursing benefit and permanent social assistance. In general, the simulated number and amount of benefits are consistent with official statistics. However, for housing benefit, due to significant differences between the number of recipients simulated by the model (assuming full take up) and reported in official statistics, eligibility is conditional on receipt being reported in the input

database. Furthermore, due to lack of information on assets that are necessary for the means-test, the eligibility for temporary social assistance is simulated conditional on an estimated expected probability to be eligible. Moreover, by law the central government is obliged to pay just a share of the total benefit amount. The rest (or part of it) may be paid by the local government. In EUROMOD, we assume that only the central government pays its part.

For **Portugal** full take up is assumed in the simulation of all means-tested benefits. However, given the inability of simulating all eligibility conditions for the social solidarity supplement for the elderly, the simulation of this benefit overestimates the number of recipients and aggregate amounts. Thus, the number of beneficiaries is calibrated to guarantee consistency with official statistics, such that the simulated number of beneficiaries matches the official number of beneficiaries.

For **Romania** non-take-up is simulated for the minimum guaranteed income, which under full take-up is overestimated by a factor of 4. The calibration is based on the assumption that households headed by a person under 26 do not claim, under the assumptions that these are students..

In **Slovenia** non-take-up is simulated for social assistance and income support based on the benefit receipt observed in the data.

In **Finland** eligibility for income support is assessed at the family level (rather than at the household level). For example, adult children can apply separately from their parents. In practice, however, this happens rarely. Therefore, in the model we account for non-take-up by simulating income test at the household level. Also, the households where the head is self-employed are excluded from eligibility (as they rarely apply for income support).

In **Spain,** non-take-up adjustments are simulated for the national and regional minimum income schemes. These benefits are overestimated in EUROMOD due to (i) the non-simulation of some eligibility conditions, due to lack of information in EU-SILC, (ii) the non-take-up by potential beneficiaries, and (iii) the existence of different budget constraints and bureaucratic procedures across regions. Regarding the regional schemes, the calibration aligns both the simulated number of beneficiaries and total expenditure by region with official statistics, whereas the calibration of the national scheme matches the official expenditure.

In **Slovakia**, non-take-up is simulated for the material need benefits. The take-up rate is calculated as the ratio between the actual expenditure based on administrative data and the expenditure simulated by EUROMOD using the latest dataset and without correcting for non-take-up. When administrative data are not yet available for the current year, the last known take-up rate is used.

Full take-up is assumed for all simulated means-tested benefits for the remaining EU countries.

Full year adjustments

It is possible to use full year adjustment in the following countries:

For **Estonia** in **2007** for child allowance and allowance for families with 3+ children. In **2009** for unemployment insurance benefit, employer social insurance contribution, credited social insurance contribution, employee social insurance contribution and self-employed social insurance contribution. In **2013** for child allowance and needs based family benefit. In **2017** for parental allowance for families with 7+ children / many children. In 2021, for funded pension contribution.

For **France**, in **2020** and **2021**, for the share of the wage compensation paid by the state in COVID-19 related wage compensation schemes.

For **Finland** in **2020** for a temporary reduction in social security contribution and a temporary increase in the amount of the basic social assistance.

For **Greece** in **2010** for pensioners' solidarity contributions. In **2011** for pensioners' solidarity contributions, temporary pension reduction, SIC: private sector employers and SIC: self-employed liberal professions. In **2013** for SIC: banking employees, SIC: public enterprise employees and SIC: civil servants. In **2014** for SIC: private sector employers and SIC: banking employees (ETE). In **2015** for pensioners' SIC, food stamps and rent allowance. In **2016** for temporary pension reduction and supplementary pension recalculation. In **2017** for gross pensions cap and guaranteed minimum income. In **2019** for employees' and employers' social

insurance contribution for supplementary pensions. For Italy in 2020 for the new additional tax credit. In 2021 for the new Children Universal Allowance.

For **Spain** in **2015** for Personal Income Tax. In **2018** for self-employed SIC. In **2020** for the simulation of the new nation-wide minimum income.

For **Czechia** in **2020** for the change in the Minimum Living Standard (MLS) index and for the credited insurance contributions.

For **Slovakia** in **2019** for child benefit.

For **Lithuania** in **2017** for unemployment insurance benefit and in **2020** for social assistance benefit due to COVID pandemic.

For **Netherlands** in **2015** for Social Assistance Benefit (net).

For **Portugal** in **2012** for Social insertion income.

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