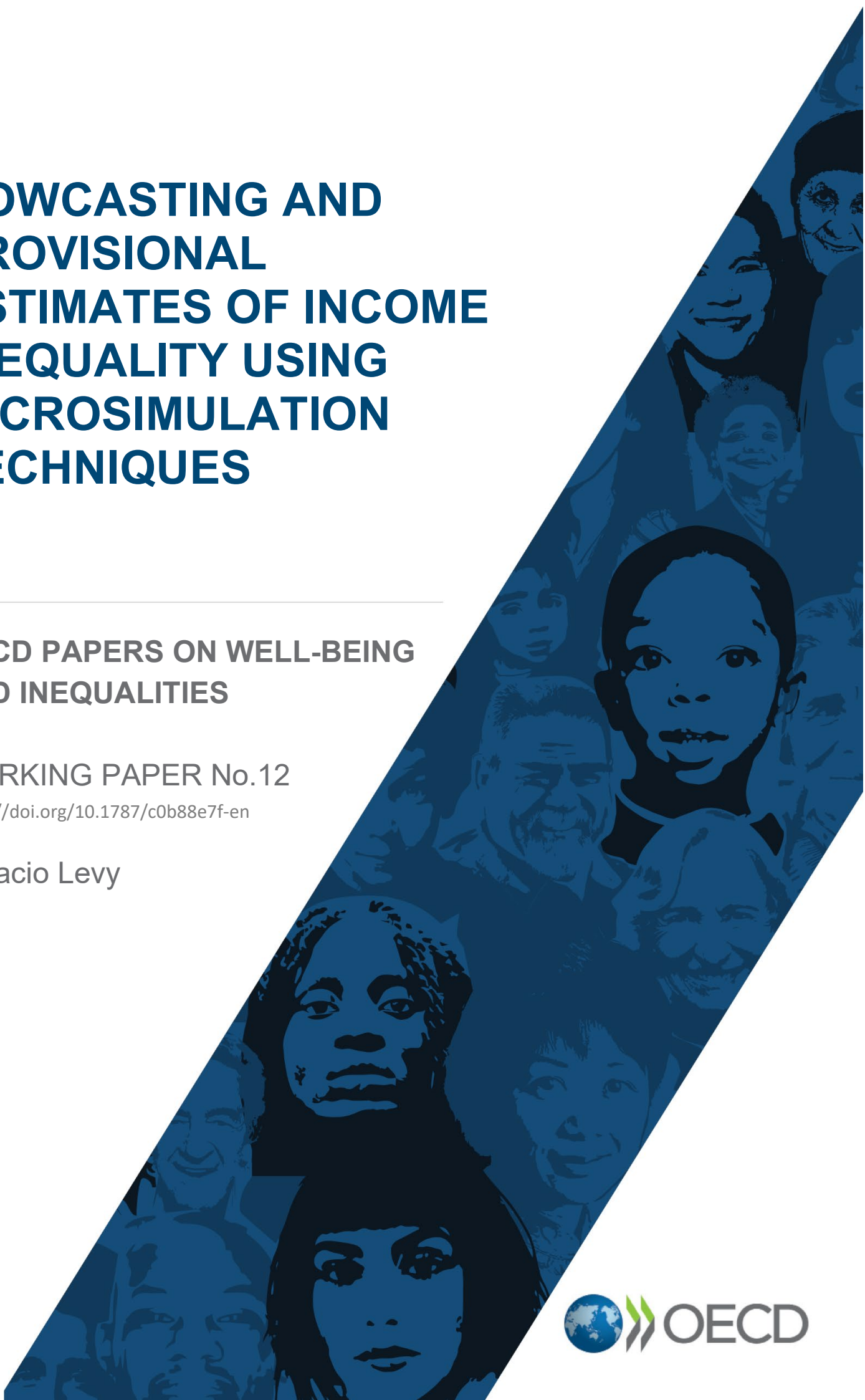
NOWCASTING AND PROVISIONAL ESTIMATES OF INCOME INEQUALITY USING MICROSIMULATION TECHNIQUES



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Abstract

The OECD Income Distribution Database (IDD) plays a leading role in providing evidence, and in monitoring and analysing international income distribution statistics to inform policy debate. In most OECD countries, official income distribution statistics are usually delivered with time lags varying from two to three years. This paper examines the growing use by statistical offices of nowcasting techniques based on microsimulation models to produce more timely provisional estimates, and examines the advantages and challenges associated with these techniques. The paper also presents provisional estimates of income inequality in 2020 for a selection of OECD countries, based on a compilation carried out by the OECD Secretariat in collaboration with Eurostat and national statistical offices. Finally, it discusses potential future developments and applications of these techniques.

Résumé

La base de données de l'OCDE sur la répartition des revenus (IDD) joue un rôle de premier plan dans la fourniture de preuves, ainsi que dans le suivi et l'analyse des statistiques internationales sur la répartition des revenus, afin d'éclairer le débat politique. Dans la plupart des pays de l'OCDE, les statistiques officielles sur la répartition des revenus sont généralement fournies avec un décalage temporel de deux à trois ans. Ce document examine l'utilisation croissante par les offices statistiques de techniques de prévision immédiate basées sur des modèles de microsimulation pour produire des estimations provisoires plus rapides, et examine les avantages et les défis associés à ces techniques. Le document présente également des estimations provisoires de l'inégalité des revenus en 2020 pour une sélection de pays de l'OCDE, sur la base d'une compilation réalisée par le Secrétariat de l'OCDE en collaboration avec Eurostat et les offices statistiques nationaux. Enfin, il aborde les développements et applications potentiels de ces techniques.

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1 Introduction

For decades, the OECD has been producing and analysing income inequality evidence to monitor economic-social progress and to inform the policy debate. Several OECD reports have contributed to the public and policy understanding of income inequality, analysing its trends, causes, consequences and remedies needed to address them (OECD, 2008[1]; 2011[2]; 2015[3]; 2018[4]; 2019[5]; 2021[6]). Much of this analysis has rested on the *OECD Income Distribution Database* (IDD) (2021[7]), which relies on comparable protocols and definitions applied by national contact points (mainly in national statistical offices, NSOs) to countries' official survey and administrative data. The *IDD* is one of the most reputable and extensively used databases for international analysis of income distributions (Gasparini and Tornarolli, 2015[8]).

Unlike macroeconomic statistics (e.g. Gross Domestic Product, GDP), inflation or unemployment), income inequality indicators are usually published with a considerable delay. Inequality indicators are estimated using data from household surveys, which, in most OECD countries, require considerable time to collect, to process and to publish. Compounding these delays is the fact that the income concept used by surveys and administrative data refers to the calendar or fiscal year preceding the survey (or, less often the preceding 12 months).

Since the global financial crisis, the need for more timely estimates has become more prominent. The increasing public interest on income inequality in recent years has strengthened the need for more timely data. There is also considerable political demand for more frequent updates of income inequality statistics, as a key requirement for its wider adoption as a "beyond GDP" indicator (Stiglitz, Fitoussi and Durand, 2018[9]; Gentiloni, 2021[10]). In the G20 Bali Leaders' Declaration, G20 countries supported a new Data Gap Initiative (DGI), which includes as policy priorities the "distribution of household income and wealth" and the improvement of "timeliness and granularity of official statistics" (IMF, 2022[11]). The OECD contributes to this initiative through the Expert Groups on Distributive National Accounts (EG DNA) and on Distributional Financial Accounts (EG DFA) (Zwijnenburg et al., 2021[12]; Coli et al., 2022[13]).

National and international statistical offices have therefore taken a number of steps to accelerate the data production process, while not fully solving the problem. For example, in the *OECD Income Distribution Database (IDD)* – which relies on income distribution indicators produced by national statistical offices – the most common latest year available, in its December 2021[1] release, was 2019 (for 21 countries); among the remaining countries, the latest available observation was 2018 in 11 countries, 2017 in 3, and 2014 in one (see Section 2).

More timely official income distribution statistics are important for the policy debate. In the absence of timely official statistics, the resulting information void may be filled in by alternative estimates based on data and methods that are not comparable to indicators produced by national statistical offices. In France, for example, early estimates produced by charitable organisations suggested that the number of income-poor people in France had increased by one million in 2020 as a result of the COVID-19 crisis (Le Monde,

[1] December 2021 refers to the latest release when the nowcasting exercise started. The OECD updates the IDD data several times a year as part of its efforts to improve timeliness. The most recent IDD update at the time of writing was November 2022 and the most common latest available year was 2019.

2020[14]). This development was not confirmed by the later estimates produced by the French Statistical Office – INSEE (Buresi and Cornuet, 2021[15]; Tavernier, 2021[16]; Garnero and Guillaneuf, 2022[17]).

Timely official estimates are widely available for macroeconomic indicators. Following the global financial crisis, national and international statistical offices have taken a number of steps to accelerate the production of macroeconomic statistics, using nowcasting techniques. Since 2016, for example, Eurostat publishes preliminary estimates of quarterly GDP about 30 days after the end of the quarter (Eurostat, 2021[18]). In 2020, the OECD introduced a Weekly Tracker of economic activity for 46 OECD and G20 countries using Google Trends search data (Woloszko, 2020[19]). Nowcasting techniques use newly available data that strongly correlate with the indicator of interest to arrive at early estimates for the present or for the recent past (Zwijnenburg, 2016[20]).

Nowcasting income inequality is in general more challenging than nowcasting macro-economic indicators, partly because it requires estimating income data at different points of the distribution. Three main approaches have been used to estimate timely income distribution indicators. A first approach relies on *alternative microdata sources* (including big data), a second approach, similar to the one used for macroeconomic nowcasting, relies on *time-series econometric modelling of selected points of the household income distribution*, and a third approach relies on adjusting microdata from previous years using nowcasting methods based on *microsimulation modelling* (for details, see Section 3).

The statistical office of the European Union (Eurostat) has tested a variety of models within these approaches and concluded that nowcasting based on microsimulation models was the "preferred approach" for data producers and main users (Eurostat, 2020[21]). The national statistical offices of Canada, France, Sweden and the United Kingdom have also used nowcasting methods based on microsimulation modelling to provide more timely provisional income inequality indicators for the year 2020 (Eurostat, 2020[22]; Office for National Statistics, 2020[23]; Statistics Canada, 2021[24]; Buresi and Cornuet, 2021[15]; Helgeson, Lindstrom and Hofsten, 2018[25]). In Australia, the National Centre for Social and Economic Modelling (NATSEM) at the University of Canberra, undertakes work to nowcast income inequality using microsimulation methods (Li et al., 2021[26]).

Microsimulation models are widely used for *ex ante* and "what if" analysis of the impact of taxes and benefits (Figari, Paulus and Sutherland, 2015[27]). Microsimulation can also be used to impute information not collected in household surveys. In the United States, for example, the Supplemental Poverty Measure (Fox and Burns, 2021[28]) and the estimates feeding the *IDD*, rely on the Current Population Survey (CPS) complemented with simulations from the CPS tax model (O'Hara, 2004[29]).

The national statistical offices that rely on nowcasting methods based on microsimulation modelling report these estimates as either "experimental statistics" or "early estimates" (Statistics Canada, 2021[24]; Eurostat, 2020[21]). Since the estimates are subject to several sources of uncertainty (e.g. model biases, sampling error, data inconsistencies), Eurostat currently publishes results using a Rounded Uncertainty Interval (RUI) rather than as "point estimates" (Eurostat, 2020[22]) (see Section 3).

The importance of more timely estimates of income inequality has been brought to the fore by the OECD 2020 Ministerial Council Meeting's request to develop a Dashboard to Monitor a Strong, Resilient, Green and Inclusive Recovery from the COVID-19 crisis (OECD, 2021[30]). Income inequality was selected as one of the dashboard's indicators to assess the "inclusive" aspects of the recovery. While as a rule, only indicators referring to 2020 were included in the dashboard, in the case of income inequality *IDD* data referring to earlier years were included as "space holders", pending more recent estimates. As a result,

the OECD Secretariat is taking steps to produce timely indicators for both income inequality based on nowcasting methods (OECD, 2021[30]).[2]

Against this background, the Secretariat started work to understand how microsimulation modelling-based nowcasting can be used to produce more timely estimates of income inequality and other selected indicators of income distribution (e.g. relative poverty). This paper describes their advantages and challenges relative to other methods and presents provisional nowcast estimates of income inequality in 2020[3] for a selection of OECD countries, based on a compilation carried out by the Secretariat in collaboration with Eurostat and national statistical offices. Finally, it discusses potential future developments and applications of these techniques.

[2] A similar situation applies to Greenhouse Gas (GHG) emissions, where the most recent official estimates refer to 2019. In these areas as well, the OECD (in association with the IEA and the IMF) is currently aiming to produce quarterly estimates of GHG emissions from production.

[3] The year 2020 was the latest for which nowcasting evidence was available when the analysis was being carried out. At the time of writing, some estimates for 2021 were available.

2 Timeliness of income inequality indicators

Income inequality indicators are published less frequently and with a longer delay than other official statistics such as GDP, inflation or the unemployment rate. Income inequality indicators are typically measures based on household surveys, administrative data (in countries with comprehensive population registers), or on a combination of the two. In most OECD countries, these data require considerable time to collect, process and publish.

To take adequate, informed and effective policy measures, policymakers need timely, reliable and comparable statistics to monitor the current situation and identify the impacts of their policies on inequality. In recent years, the global financial crisis and the COVID-19 pandemic have triggered/reinforced the demand for high quality and timely indicators, leading NSOs to re-assess the accuracy/timeliness trade-off and take steps that have been evaded in the past.

National and international statistical offices have taken several steps to accelerate and streamline the production process of household income surveys. Deadlines for data collection and transmission have been shortened. Administrative data have been increasingly used to replace at least part of the information formerly collected through survey interviews, although mainly to reduce the burden on respondents and increase the accuracy of the data (Jantti, Törmälehto and Marlier, 2013[31]). Provisional data for 2020 have been published ahead of the release of final statistics (Alaminos, Di Meglio and Dupré, 2021[32]; Buresi and Cornuet, 2021[15]; Statistics Canada, 2021[24]).[4]

The above-mentioned measures have considerably reduced the publication time of household surveys and income inequality indicators. However, they have not fully solved the problem. There are still considerable gaps between the period measured and time of publication. To some extent, these gaps are inevitable given that, in some countries, household surveys are not carried out every year (see Table 2.1). Furthermore, in most countries, income data refers to the calendar year preceding the interview, in order to collect information on some income items (e.g. dividends, tax payments). For administrative data, on the other hand, the constraint might be the deadlines for completing tax returns (usually done after the end of the fiscal year) and the need to merge, clean and process data from different administrative sources.

Despite recent improvements, there is still a two-to-three-year delay in the publication of internationally comparable income inequality indicators. In its December 2021 release, the *OECD Income Distribution Database (IDD)* included 2020 data for only one country, 2019 for 21 countries, 2018 for 11 countries, 2017 for 3 countries and 2014 for one country (see Table 2.1). The delay tends to be smaller in countries relying fully or partially on administrative records than in countries collecting data through household surveys; in Table 2.1, 2019 or 2020 are the latest years available in about two-thirds of countries using administrative records, while this is the case in just above half of countries using household surveys. Table 2.1 also suggests that data are more timely in countries using a weekly or monthly period for income

[4] In the European Union, measures introduced as part of the Integrated European Social Statistics Regulation (IESS) in 2019 should improve the timeliness of social indicators produced by Eurostat using data from European Union Statistics on Income and Living Conditions (EU-SILC) by at least 6 months (Alaminos, Di Meglio and Dupré, 2021[32]).

assessment, when surveys are collected every year, although the number of countries where this is the case is possibly too small to draw conclusions.[5]

Table 2.1. Income inequality indicators tend to be published with a two-to-three-year gap

OECD Income Distribution Database (IDD), latest data available in the December 2021 release.

Country	Most recent available year*	Frequency of data collection	Assessment period	Nature of source	Data source
Australia	2017/18[a]	Biennial	Week/month [d]	Household survey	Survey of Income and Housing
Austria	2019	Annual	Year	Survey + administrative records	EU Survey of Income and Living Conditions (processed by OECD Secretariat)
Belgium	2019	Annual	Year	Survey + administrative records	EU Survey of Income and Living Conditions (processed by OECD Secretariat)
Canada	2019 [a]	Annual	Year	Survey + administrative records	Canada Income Survey
Chile	2017	Every 2 or 3 years	Month [e]	Household survey	CASEN
Costa Rica	2020 [a]	Annual	Month [f]	Household survey	Encuesta Nacional de Hogares (Enaho)
Czech Republic	2019	Annual	Year	Household survey	EU Survey of Income and Living Conditions (processed by OECD Secretariat)
Denmark	2018 [a]	Annual	Year	Administrative records	Danish Law Model System
Estonia	2019	Annual	Year	Survey + administrative records	EU Survey of Income and Living Conditions (processed by OECD Secretariat)
Finland	2019[a]	Annual	Year	Survey + administrative records	EU Survey of Income and Living Conditions and national Income Distribution Statistics (processed by Statistics Finland)
France	2019	Annual	Year	Survey + administrative records	Enquête Revenus Fiscaux et Sociaux
Germany	2018 [a]	Annual	Year	Household survey	German Socioeconomic Panel (all Länder)
Greece	2019	Annual	Year	Household survey	EU Survey of Income and Living Conditions (processed by OECD Secretariat)
Hungary	2019	Annual	Year	Household survey	EU Survey of Income and Living Conditions (processed by OECD Secretariat)
Iceland	2017	Annual	Year	Administrative records	EU Survey of Income and Living Conditions (processed by OECD Secretariat)
Ireland	2018	Annual	Year	Survey + administrative records	EU Survey of Income and Living Conditions (processed by OECD Secretariat)
Israel	2018 [a]	Annual	Month	Household survey	CBS Household Expenditure Survey (HES)
Italy	2018	Annual	Year	Survey + administrative records	EU Survey of Income and Living Conditions (processed by OECD Secretariat)
Japan	2018	Every 3 years [c]	Year	Household survey	Comprehensive Survey of Living Conditions
Korea	2018[a]	Annual	Year	Survey +	Survey of Household Finances and Living Conditions

[5] In countries that use week or month as income assessment period, the survey is usually carried out throughout the year to account for seasonality. In those where the survey collects information on the previous calendar year, it is usually carried out in a specific period.

Country	Most recent available year*	Frequency of data collection	Assessment period	Nature of source	Data source
				administrative records	
Latvia	2019[a]	Annual	Year	Survey + administrative records	EU Survey of Income and Living Conditions (processed by OECD Secretariat)
Lithuania	2019	Annual	Year	Survey + administrative records	EU Survey of Income and Living Conditions (processed by OECD Secretariat)
Luxembourg	2019	Annual	Year	Household survey	EU Survey of Income and Living Conditions (processed by OECD Secretariat)
Mexico	2018[a]	Biennial	Month [g]	Household survey	Survey of Household Income and Expenditure
Netherlands	2019 [a]	Annual	Year	Administrative records	Integral Income and Wealth Survey (IIV)
New Zealand	2014/2015[b]	Annual	Year	Household survey	Household Economic Survey
Norway	2019 [a]	Annual	Year	Administrative records	Income Statistics for Household
Poland	2018	Annual	Year	Household survey	EU Survey of Income and Living Conditions (processed by OECD Secretariat)
Portugal	2019	Annual	Year	Household survey	EU Survey of Income and Living Conditions (processed by OECD Secretariat)
Slovak Republic	2019	Annual	Year	Household survey	EU Survey of Income and Living Conditions (processed by OECD Secretariat)
Slovenia	2019	Annual	Year	Survey + administrative records	EU Survey of Income and Living Conditions (processed by OECD Secretariat)
Spain	2019	Annual	Year	Survey + administrative records	EU Survey of Income and Living Conditions (processed by OECD Secretariat)
Sweden	2019 [a]	Annual	Year	Administrative records	Income Distribution Survey (HEK), with integrated register data (TRIF)
Switzerland	2018 [a]	Annual	Year	Survey + administrative records	Survey of Income and Living Conditions
Türkiye	2018 [a]	Annual	Year	Survey + administrative records	Survey of Income and Living Conditions
United Kingdom	2019/2020 [a]	Annual	Week [h]	Household survey	Family Resources Survey
United States	2019 [a]	Annual	Year	Household survey	Annual Social and Economic Supplement to the Current Population Survey

Note: * Available in December 2021.
(p) provisional; [a] At time of publication, more recent data have been delivered and included in latest IDD updates; [b] 2020/2021 data had been collected by NSI but was yet available in the IDD for its release in December 2021. In this (unreleased) data, the survey relies on administrative records for some sources of income. At the time of writing, the National Statistical Office of New Zealand was preparing revised data going back to 2007 and up to 2020/21.[c] While the large sample survey is conducted every three years, a small survey is conducted in the interval years, but data are not made available to the OECD. [d] Period reported varies depending on usual payment period: regular wages and salaries, superannuation and other regular income can be in weeks or months; irregular wages and salaries is yearly; government payments is fortnightly except for lump sums; most investment income is annual. [e] The reporting period is the last month for most income components, but the last year for some components (like stock dividends, withdrawals of profits, sales of seasonal products and some public transfers). [f] Regular cash bonuses, profit-sharing bonuses and gratuities, including once-a-year and seasonal bonuses are reported for the last year, while income from self-employment is declared by period and then turned into a monthly estimate. [g] Income data collected for the last six months. [h] The FRS asks respondents for the last amount received and the period covered and uses these two pieces of information to convert to a weekly amount.
Source: OECD (2021[7]), *OECD Income Distribution Database* (IDD), http://oe.cd/idd.

3 Nowcasting methods based on microsimulation modelling

The previous section has shown that despite the significant progress achieved in recent years, there is a delay in the publication of income inequality indicators based on household survey data. Given the demand for more timely inequality indicators, national and international statistical offices, as well as academics and researchers, have been exploring alternative strategies, including nowcasting methods.

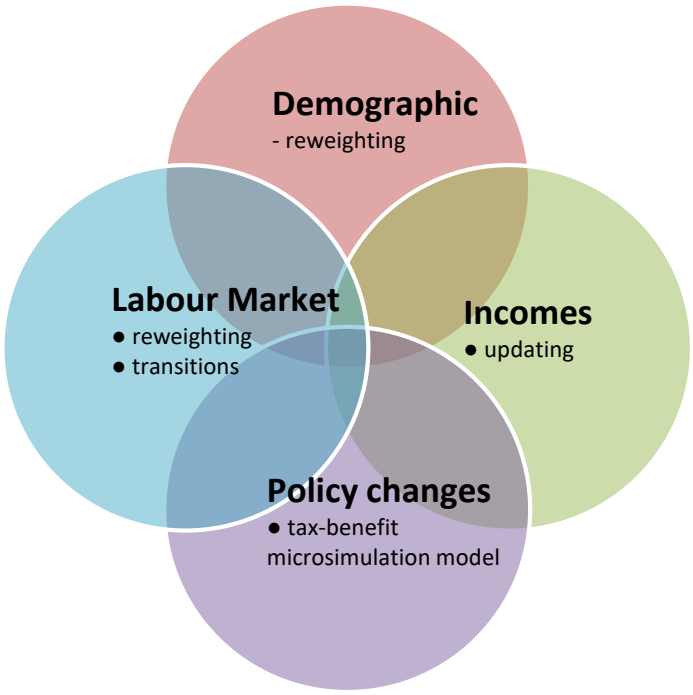
Nowcasting techniques are widely used to estimate timely macroeconomic indicators, especially GDP (Giannone, Reichlin and Small, 2008[33]; Kapetanios et al., 2020[34]; Mazzi and Mitchell, 2020[35]). In contrast to forecasting, which relies on projections and assumptions about future economic circumstances, nowcasting uses data that are already available for the period of interest and that are meaningfully related to the indicator to be "nowcasted". For macroeconomic indicators, nowcasting models use time-series econometric techniques with available real-time data (Bok et al., 2018[36]). Since 2016, Eurostat produces flash estimates of quarterly GDP about 30 days after the end of the quarter (Eurostat, 2021[18]). In 2020, the OECD introduced a Weekly Tracker of economic activity for 46 OECD and G20 countries using Google Trends search data (Woloszko, 2020[19]).

Nowcasting based on microsimulation modelling is different from macroeconomic nowcasting. Rather than focusing on the total amount of the variable of interest (e.g. GDP), nowcasting based on microsimulation modelling uses a granular approach, which adjusts individual-level data from household surveys based on information derived from other (more timely) sources (O'Donoghue and Loughrey, 2014[37]). Income inequality indicators are then computed based on the "nowcasted" microdata. Alongside nowcasting based on microsimulation, other approaches used to estimate timely income distribution indicators include alternative microdata sources and time-series econometric modelling (see Box 3.1 for details).

Nowcasting based on microsimulation modelling uses a combination of data sources and techniques. Typically, it involves adjusting and updating the microdata of a household income survey from a previous year to reflect socio-economic and demographic changes that took place between the period when the data were collected and the time of interest. Usually, these adjustments are carried out in stages to reflect changes in: (1) demographics (e.g. household structure and population ageing); (2) labour market conditions (e.g. employment); (3) income components (e.g. earnings, capital and property income); and (4) policies (e.g. taxes and social transfers). These changes are observed and measured through tools and sources that are either updated more frequently or published faster than household income surveys. This includes national accounts and labour force surveys, as well as tax-benefit microsimulation models, which reflect the latest tax and benefit legislation, and that account for the interactions between taxes and benefits and the changes introduced in the previous stages (see Figure 3.1).[6]

[6] See Navicke, Rastrigina and Sutherland (2013[53]), O'Donoghue and Loughrey (2014[37]) and Eurostat (2020[21]) for a detailed methodological explanation of nowcasting based on microsimulation modelling.

Figure 3.1. Adjustments and interactions in nowcasting based on microsimulation modelling



Box 3.1. Other methods used to generate more timely income distribution estimates

Alternative microdata sources

This approach relies on using data from other household surveys or administrative records than the one used to compute official measures of income inequality. The main advantage of this approach is that estimates are based on "real-time" microdata, thus reflecting actual living conditions and inequality thereof. In addition, the costs of carrying out the analysis are relatively low when these alternative microdata source already exists. In contrast, costs can be quite high if a new source needs to be developed and implemented. Other disadvantages are potential methodological inconsistencies between the alternative data source and the source used to compute official statistics. Such inconsistencies may lead to biases and incorrect inferences on how living conditions, including income inequality, have changed. Furthermore, this approach may put at risk international comparability if these data sources are not methodologically consistent across countries. This general approach encompasses different variants.

Alternative surveys may take the form of special versions of existing household surveys or of completely different surveys. Special versions of existing surveys may result from expedite measures to collect and prepare the data (e.g. collecting data from only part of the sample of the reference survey, using a shorter questionnaire with just a selection of questions, or applying fewer data processing procedures). In Germany and the United Kingdom, established household panel surveys had special data collections added in order to investigate the impact of COVID-19 on living conditions and inequalities (Grabka, 2021[38]; Crossley et al., 2021[39]).

Examples of completely different household surveys include the on-line panel survey used to track income inequality during COVID-19 in France, Germany, Italy, and Spain (Clark, D'Ambrosio and

Lepinteur, 2021[40]) and the real-time labour survey fielded in Germany, the United Kingdom and the United States (Adams-Prassl et al., 2020[41]). Likewise, the U.S. Census Bureau introduced the Household Pulse Survey to collect and disseminate near real-time data on the social and economic effects of coronavirus on American households (Fields and Shin, 2021[42]). Eurostat also uses alternative data sources to compute flash estimates of income inequality in some countries. In Romania, income inequality estimates are based on current income data from the Household Budget Survey. In the Netherlands, estimates are based on provisional national register data (Eurostat, 2020[21]).

In recent years, microdata based on administrative records have been increasingly used by National Statistical Offices and researchers for statistical purposes and analysis, including on income inequality. Using administrative data reduces the burden on survey respondents, the costs of collection and the probability of survey error. Furthermore, administrative records are particularly well suited for the production of continuous data updates as once data collection procedures are well established, its replication is relatively simple (Jantti, Törmälehto and Marlier, 2013[31]). However, not all administrative records are suitable for the production of timely indicators. In fact, the collection of some administrative records "can cause timeliness problems due to late data delivery by data owners and due to extensive practices intended to ensure internal consistency" (Jantti, Törmälehto and Marlier, 2013[31]).

Some administrative records can be available at almost real-time speed. This is the case, for example, of private sector data on transactions from bank accounts and credit cards (Aspachs et al., 2020[43]; Bounie et al., 2020[44]; Carvalho et al., 2021[45]). Recently, some real-time inequality trackers have been developed by combining administrative data from different sources, such as private companies (Chetty, Friedman and Stepner, 2020[46]), tax microdata, national accounts and other public data sources (Blanchet, Saez and Zucman, 2022[47]). From an international perspective, the main challenge with this approach is to ensure international comparability, as data access and methodological approaches differ considerably across countries.

Time-series econometric modelling

Similar to nowcasting models used for macroeconomic indicators, this approach aims to predict either a specific inequality indicator or a selection of points of the household income distribution (e.g. deciles or quintiles). Thus, income inequality indicators are estimated directly, rather than being derived from an entire distribution, as in nowcasting based on microsimulation modelling.

Predictive models can be constructed using regression models and algorithms. Applied methods include Stepwise Regression, General Linear Models (GLM), Lasso Selection, Random forest, Gradient boosting, Neural network and Support vector machines (SVM) (Eurostat, 2020[21]; Murtin, 2020[48]). Predicting variables consist typically of readily available data from national accounts, labour statistics and other official sources (e.g. GDP, inflation, unemployment rate, self-employment rate, wage rate, hours worked per worker, long-term interest rates).

The key advantages of this approach are its simplicity and relatively low cost. Yet, estimating these models face a number of challenges: data series are small and subject to breaks; inequality indicators tend to be quite stable across time thus providing little variance for estimations; the sign of the correlation between inequality indicators and some macroeconomic variables can change under certain conditions, e.g. during economic recessions. Furthermore, this approach generates estimates of various inequality indicators independently from each other, without ensuring consistency between them. In case of inconsistencies, results may be difficult to interpret and to fail to explain trends.

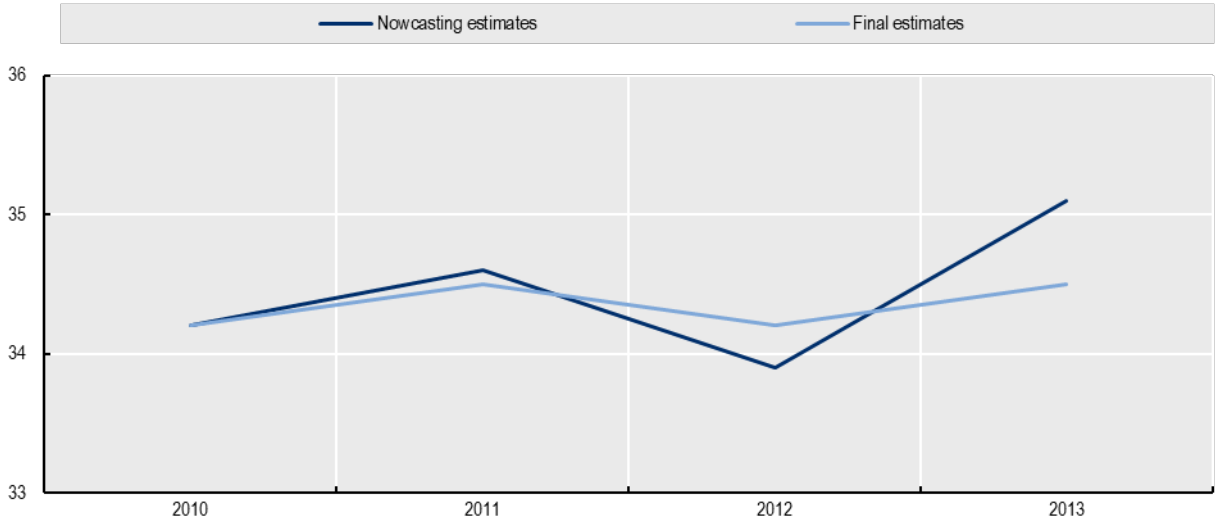
Eurostat has experimented with macro-economic time series modelling (METS) to estimate income distribution indicators. However, such techniques usually underperformed compared with nowcasting based on microsimulation (Eurostat, 2018[49]). Since 2018, Eurostat no longer uses these techniques to compute flash estimates of income inequalities and poverty indicators (Eurostat, 2020[21]).

The statistical office of the European Union (Eurostat) has tested a variety of approaches to generate more timely estimates of income distribution indicators, selecting the most robust method for each country based on its specific situation and data circumstances. For most countries,[7] Eurostat concluded that nowcasting based on microsimulation models was the "preferred approach for both main users and the National Statistical Institutes (NSIs) given the possibilities for further detailed analyses and the link with policy changes" (Eurostat, 2020[21]). Similarly, the UK Office of National Statistics has found that "while nowcast estimates do not perfectly reflect changes in the distribution of income, particularly when examining smaller sub-groups of the population, they provide an early indication of what the full survey-based data may show" (Office for National Statistics, 2020[23]). The taskforce that guided the selection of indicators for the "OECD Dashboard to Monitor a Strong, Resilient, Green and Inclusive Post-COVID-19 Recovery" agreed that nowcasting based on microsimulation "provides the best tool to produce more timely flash estimates of income inequality" (OECD, 2021[30]).

Evidence also suggests that nowcasting based on microsimulation models can be better suited to predict inflection points in indicators' time series, such as those that may take place after an economic shock or major policy reform. Estimating turning points in time-series is generally challenging for all nowcasting techniques, particularly when inflections result from a turnaround in the correlation between dependent and explanatory variables. Based on tax-benefit microsimulation models, this approach accounts for the impact of tax-benefit changes on different types of households and at different points of the income distribution. Likewise, the approach captures the responses of taxes and benefits to changes in circumstances (e.g. in the demography, in the macro economy, in the labour market). Such flexibility has proved useful in predicting changes in the direction of income inequality in Portugal, although with sizeable differences between the nowcasted estimate and the final estimate (see Figure 3.2) (see Section 4 for a discussion on the accuracy of nowcasted estimates).

Figure 3.2. Nowcasting based on microsimulation models can predict changes in income inequality trends

Nowcasted estimates and final income inequality measures of Gini coefficient in Portugal, 2010 to 2013



Source: Junqueira (2015[50]), "Using micro-simulation in EU-SILC for early estimates of income: strengths and limitations", https://www.ine.pt/scripts/DGINS-2015/presentations/S2_P4_INE.pdf.

[7] In Romania, income inequality estimates are based on current income data from the Household Budget Survey. In the Netherlands, estimates are based on provisional national register data (Eurostat, 2020[21]).

In recent years, the statistical offices of the European Union, Canada, France, Sweden and the United Kingdom have used nowcasting methods based on microsimulation modelling to generate more timely provisional estimates of various income inequality indicators (Eurostat, 2020[22]; Office for National Statistics, 2020[23]; Statistics Canada, 2021[24]; Buresi and Cornuet, 2021[15]; Helgeson, Lindstrom and Hofsten, 2018[25]). Eurostat's approach is based on early work carried out by the University of Essex, which developed nowcasting based on the microsimulation model (EUROMOD) for EU countries (Rastrigina et al., 2016[51]). Building on that work, a taskforce was created to produce "Flash estimates on income distribution". The taskforce included staff from Eurostat, the European Commission's Joint Research Centre (JRC), national statistical offices and experts from academia and international organisations (Eurostat, 2020[22]). Based on a recommendation of the taskforce, the data requirements of the EU tax-benefit microsimulation model (EUROMOD) have been incorporated to the process of data delivery from NSOs to Eurostat for the EU household income survey "European Union Statistics on Income and Living Conditions" (EU-SILC), so as to speed up the nowcasting process (Eurostat, 2020[52]).

Microsimulation models are widely used for both *ex ante* and "what if" analysis of the impact of changes in taxes and benefits (Figari, Paulus and Sutherland, 2015[27]). In particular, they are applied to assess the effect of policy reforms on many variables, including government budget, work incentives, impacts on specific socio-economic groups and on the income distribution. Microsimulation can also be used to impute information not collected in household surveys. In the United States, for example, the Annual Social and Economic Supplement (ASEC) of the Current Population Survey (CPS), does not collect information on taxes paid or tax credits received by survey respondents. As a result, some headline income and poverty indicators based on post-tax (i.e. disposable) income, including the US Census Bureau Supplemental Poverty Measures (Fox and Burns, 2021[28]) and the *OECD IDD*, rely on simulations from the CPS ASEC tax model (O'Hara, 2004[29]).

Despite their advantages relative to other techniques, estimates produced by nowcasting methods based on microsimulation are subject to the same types of statistical (sampling and non-sampling) errors as analyses based on survey data (Office for National Statistics, 2020[23]) as well as additional sources of uncertainty and bias. Being based on a representative sample rather than overall population, survey results may be subject to sampling error, which may affect how changes in the values of an indicator should be interpreted, especially in the short-term. In practice, this means that small, short-term movements should be treated as indicative only, and be considered alongside medium- and long-term patterns in the series (Office for National Statistics, 2020[23]).

Both survey data and nowcasting estimates may also be subject to non-sampling errors, resulting from a range of sources, such as coverage error, non-response error and measurement error. Nowcasting methods based on microsimulation add additional sources of non-sampling error. For example, estimates will reflect the assumptions used in the simulation of tax and benefit rules, judgments on tax evasion and non-take up of benefits, methods used for uprating incomes and monetary parameters of the model, adjustments for socio-demographic and labour-market changes, and exclusion of potential behavioural responses (Navicke, Rastrigina and Sutherland, 2013[53]).

Nowcasting estimates may also be subject to methodological and measurement inconsistencies between the household survey data to be "nowcasted" and the external sources used to "nowcast" it. These inconsistencies may lead to biases if there are significant differences in the levels and trends of the socio-economic characteristics that the nowcasting aims to adjust.[8] In such cases, calibrations may need to be applied (Eurostat, 2020[21]). On the other hand, microsimulations can improve the accuracy of estimates relative to survey-based measures by simulating the exact rules of the tax and benefit system (Office for National Statistics, 2020[23]). In addition, changes in nowcasted estimates may exhibit more reliable trends

[8] Eurostat has found that the evolution of employment observed in EU-SILC and LFS are not always consistent for the same year (Eurostat, 2020[21]).

than comparisons of point estimates from two different survey years. Since baseline and new results are based on a single underlying sample, changes in nowcasted estimates have lower standard errors due to covariance in the data (Goedemé et al., 2013[54]).

Rastrigina et al. (2016[51]) assessed the performance of nowcasting estimates of relative income poverty rates for 2011-2015 for EU countries by comparing the predictions with actual EU-SILC indicators for the same years. The comparison showed that, in most cases, the two measures follow the same trends, and that the EU-SILC measure fall within the boundaries of the nowcasted confidence intervals. In some countries where this is not the case, discrepancies were most likely caused by different developments in employment trends as measured by the EU-SILC and the EU Labour Force Surveys (LFS). Other factors explaining these discrepancies included differences in the evolution of major income sources between EU-SILC and the nowcasting estimates (based on macroeconomic data), revisions in the EU-SILC data, and simulation errors.

While many methodological issues affect the statistical accuracy and reliability of nowcasts based on microsimulation, there are also other arguments that make such estimates attractive and useful for both analysts and policy makers. This methodology not only enables estimating the expected changes in income indicators, but also allows attributing such changes to the four main factors described in Figure 3.1: demographics, labour market status, incomes, and tax-benefit policies. This can be achieved by using some (but not all) parts of the nowcasting toolbox, while holding others constant. For example, by simulating changes in tax and benefit policies while keeping constant underlying population characteristics, or by estimating the impact of labour market changes on income inequality in the absence of a policy response. On top of these decompositions, the underlying information gathered and used to simulate the components of the nowcasting model may also provide relevant insights for analysts and policy makers and help assess the implications of specific policies or economic shocks.

4 Provisional estimates of income inequality for the OECD Income Distribution Database

This section presents provisional income inequality estimates for the year 2020 for a sub-set of indicators of the *Income Distribution Database (IDD)*. These provisional estimates were derived from data produced by Eurostat and the national statistical offices of France, Canada and the United States, adjusted to be comparable with the standardised *IDD* time series. Indicators comprise the quintile share ratio (S80/S20 ratio) and intermediate measures that help understand the processes underlying recent changes in income inequality. In particular, this section presents estimates of recent changes in the levels and distribution of labour income, and income growth by income quintiles. These provisional estimates feature in the Progress Report on the OECD Dashboard to Monitor a Strong, Resilient, Green and Inclusive Recovery (OECD, 2022[55]).

Producing provisional estimates of income inequality

Data sources

Provisional OECD-type income inequality estimates were derived from data produced by Eurostat, the French Statistical Office (INSEE), Statistics Canada and the US Census Bureau (Section 4 explains how the estimates produced by the above NSOs were adjusted by the Secretariat to fit *IDD* time series):

- Provisional estimates for 2020 by Eurostat, INSEE and Statistics Canada were produced using nowcasting methods based on microsimulation modelling and when released were described by these agencies as “early estimates”, “flash estimates” or “experimental statistics” (Eurostat, 2021[56]; Buresi and Cornuet, 2021[15]; Statistics Canada, 2021[24]).
- Provisional estimates for the United States, presented in this section, were computed by the OECD Secretariat using publicly available microdata from the Annual Social and Economic Supplement (ASEC) of the Current Population Survey (CPS).[9]
- Provisional estimates for other OECD countries, computed by national statistical offices, have not been identified so far. The Secretariat looks forward and welcomes co-operation with national experts to fill the current data gaps.

[9] The *IDD* measures for the United States are also based on the CPS/ASEC; however, they are based on microdata from the Census Bureau’s internal data, rather than on the public-use file. Unlike the public-use, the internal file applies a higher and more stable top-coding threshold, and hence it provides more accurate measures of the top end of the distribution (OECD, 2012[82]).

Eurostat

Since 2016, Eurostat releases early estimates of income inequality and poverty[10] for EU member states some months after the end of the calendar year (usually between June and September of the following year). For most countries, Eurostat early estimates for 2019 and 2020 rely on microdata from EU-SILC 2018, which collects income data from 2017[11], adjusted through more recent data from the Labour Force Survey (LFS), administrative or survey statistics (e.g. national accounts, Labour Cost Index), and tax-benefit rules, as simulated by the EU microsimulation model EUROMOD[12] (Eurostat, 2021[56]). Final estimates for Sweden (and France in 2018 and 2019) are based on national microsimulation models (Eurostat, 2021[57]).

In comparison to previous years, Eurostat's nowcasting for 2020 accounted for the specific circumstances produced by the COVID-19 crisis. Given the large effects of the crisis on the labour market, Eurostat's nowcasting methodology was extended to account for quarterly transitions between employment, non-employment and job retention schemes (e.g. short-time work monetary compensation schemes, partial or temporary unemployment schemes, furlough schemes). Furthermore, the model accounted for "hours/months" lost in these transitions for a more refined assessment of the impact on income. For example, in 2020 many people were out of employment in Q2 and back in employment in Q3. Quarterly transitions with estimation of hours lost allows to estimate the number of months a person was unemployed or working on a part-time basis while at a job retention scheme. The probabilities of these transitions were estimated for different age group, sex, economic sector, occupation and type of contract (temporary and permanent) using detailed distributional information on job losses and short-term work schemes from the Labour Force Survey and administrative data (Eurostat, 2021[57]). Similarly, the microsimulation model EUROMOD was adapted to simulate the temporary tax and benefit policy measures introduced in different countries to support households affected by the crisis. EUROMOD contains most of the discretionary policy measures exceptionally introduced or activated by national governments, including job retention schemes and income support to self-employed workers (Eurostat, 2021[57]).

In order to highlight the uncertainty of estimates, Eurostat presents headline income, inequality and poverty estimates at the country level using Rounded Uncertainty Intervals (RUI),[13] which are ranges of possible values that account for expected variation associated with several sources of uncertainty (e.g. model biases, sampling error, data inconsistencies) (Eurostat, 2020[22]). By construction, the upper and lower limits of RUI are not symmetric to the "actual" (point) estimate. Hence, the middle point of RUI is different from the point estimate, although it is close to it. Furthermore, extreme values of the nowcasted estimates, where the uncertainty interval is entirely beyond a certain threshold, are censored. Eurostat uses this approach "to minimise misinterpretation and misuse due to disregarding the uncertainty of the estimate"

[10] The inequality and income distribution indicators presented by Eurostat include at-risk-of-poverty (AROP), using a threshold set at 60 % of the national median equivalised disposable income, income quintile share ratio (QSR), income deciles, AROP by age groups and in work poverty, see the following website for details: https://ec.europa.eu/eurostat/cache/experimental_statistics/income-inequality-and-poverty-indicators/Flash-estimates-2020-Country-profiles.html.

[11] Eurostat usually produces estimates using income data with a lag of two years. For 2020, however, given the need to introduce several methodological developments and to anticipate the publication of results, estimates were produced using income data with a lag of three years (i.e. from 2017).

[12] EUROMOD, the European Union tax-benefit microsimulation model, was originally maintained, developed and managed by the Institute for Social and Economic Research (ISER) at the University of Essex (Sutherland and Figari, 2012[80]). Since 2021, EUROMOD is maintained, developed and managed by the EC Joint Research Centre (JRC), in collaboration with Eurostat and national teams from the EU Member States (Eurostat, 2021[56]).

[13] For more details about Rounded Uncertainty Intervals (RUI), see Section 5 of Eurostat (2020[22]).

(Eurostat, 2021[56]). Given the unprecedented effect of the COVID-19 crisis and the use of a relatively new methodological approach, the level of uncertainty of the 2020 estimates is higher than for previous years.

As part of an ongoing collaboration to improve and further disseminate nowcasting techniques to produce more timely income inequality estimates, Eurostat has shared with the Secretariat additional estimates, including on the relative (percentage) changes of the quintile share ratio for labour income, average disposable income and average labour income by quintiles. Among these additional estimates, the ones based on disposable income are reported as Rounded Uncertainty Intervals and the ones based on labour income as point estimates.

Eurostat's "flash estimates" are assessed based on a Quality Assessment Framework developed and validated by the dedicated Taskforce (see Section 4). This framework analyses inconsistencies in the input data, performs several intermediate quality checks and assesses the performance of estimates based on different methods (Eurostat, 2020[22]).

INSEE

Since 2015, INSEE produces flash estimates of income inequality and poverty using nowcasting based on microsimulation (Fontaine and Sicsic, 2015[58]). For 2020, the estimates rely on microdata from *Enquête Revenus Fiscaux et Sociaux* (ERFS) for 2018, which is recalibrated on the basis of a range of official statistics for 2020 to account for changes in population structure, employment and wages. Changes in tax-benefit rules between 2019 and 2020 are simulated based on the microsimulation model INES, developed by INSEE, the *Direction de la Recherche, des Études, de l'Évaluation et des Statistiques* (DREES) and the *Caisse Nationale d'Allocations Familiales* (CNAF) (Buresi and Cornuet, 2021[15]).

While the income concepts used in the nowcasted and the final data (i.e., the survey data used to estimate official estimates) are very close, some methodological differences may affect the lower part of the distribution (Fontaine and Sicsic, 2015[58]). For 2020, the uncertainty around the accuracy of flash estimates is higher than in previous years, given considerable income and policy changes, which required using additional assumptions.[14]

Usually, INSEE carries out the nowcasting by running the microsimulation model on data from the previous year to be nowcasted. For 2020, however, tax-benefit simulations were carried out using data from 2018 (i.e. two years before), instead of 2019 (Buresi and Cornuet, 2021[15]).

Statistics Canada

Statistics Canada publishes quarterly estimates of Distributions of Household Economic Accounts (DHEA) from the year 1999 (Statistics Canada, 2022[59]). Estimates are computed using the microsimulation model "Social Policy Simulation Database and Model" (SPSD/M) and published as "experimental estimates" (Statistics Canada, 2021[24]). SPSD/M's database combines data from the Canadian Income Survey (CIS), the Survey of Household Spending (SHS), and federal government administrative data from the Annual Income Estimates for Census Families and Individuals (T1FF). SPSD/M estimates changes in wages and salaries by incorporating data from the Labour Force Survey by industry and wage level. The model calculates taxes and transfers at the federal and provincial levels.

Indicators include income, consumption, savings and wealth, and their sub-components by household characteristics (e.g. income quintile, household type and age group). The estimates are aligned with the System of Macroeconomic Accounts (MEA) following the recommendations of the *OECD's Expert Group on Disparities within the National Accounts* framework. As a result, the contents and amounts of household disposable income and its sub-components are adjusted to align with the definitions and magnitudes of

[14] See Box 1 (Income change assumptions and uncertainty linked to the 2020 exercise) in Buresi and Cornuet (2021[15]).

income concepts in national accounts (Statistics Canada, 2022[60]). Since nowcasting estimates for other countries are not aligned to national accounts, the comparability of Canadian results with other countries is limited.

Fitting external provisional estimates to the OECD IDD

As already mentioned, provisional estimates from Eurostat and national statistical offices were adjusted to fit the time series of the *OECD IDD*. The fitting was carried out by applying the relative change observed in the indicators of the donor databases (i.e. from Eurostat and the national statistical offices) to the indicators of the recipient database (i.e. *IDD*). The use of relative changes minimises biases produced by data and methodological differences between donor and recipient databases.

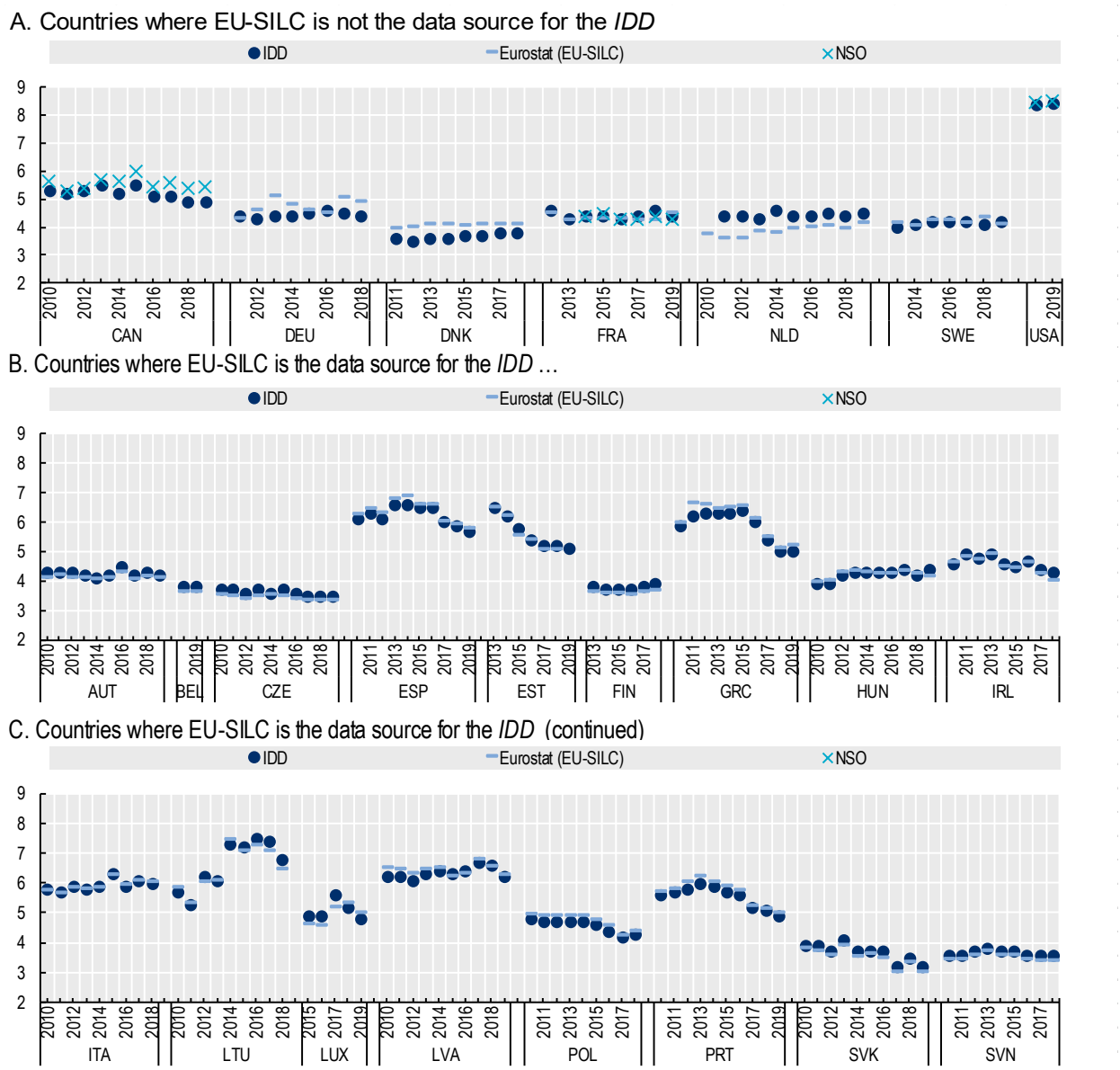
Methodological differences (e.g. slightly different income definitions and equivalence scales) usually lead to small differences between the indicators in the *IDD* and in the donor database. The differences between the indicators tend to be larger, when the data source of the donor database is not the same as the *IDD*. Eurostat's provisional estimates are based on data from the EU-SILC. In Denmark, France, Germany, the Netherlands and Sweden, however, *IDD* indicators come from other sources (see Table 2.1). National results for France are based on data from ERFS, which is the data source for *IDD* indicators. For Canada, provisional estimates are partly based on the same data source as the *IDD* – the Canada Income Survey (CIS). However, while IDD relies exclusively on CIS data, provisional estimates produced by Statistics Canada rely on CIS data augmented by simulations with SPSD/M and adjusted to national accounts (see Section4). For the United States, the data sources are the same, although the donor data may underestimate inequality due to a lower top-coding threshold (see Section 4).

Figure 4.1 shows levels of income inequality as captured by the S80/S20 ratio from the *IDD*, Eurostat, INSEE, Statistics Canada and U.S. Census Bureau for the years 2010 to 2019. The largest differences between *IDD* and other series are observed in Denmark, Germany and the Netherlands[15], which are countries where the underlying data used to compute IDD indicators and provisional estimates are not the same.

[15] For the Netherlands, the IDD estimates based on the Income Panel Survey show systematically higher levels of income inequality than Eurostat estimates which are based on EU-SILC. This difference had been documented in the IDD quality report for the Netherlands (OECD, 2013[83]) and has remained somewhat constant over the past 15 years.

Figure 4.1. Inequality indicators differ more when underlying data sources are not the same

S80/S20 ratio for disposable income in the *IDD* and in alternative data sources, 2010-2019



Note: Results in this figure refer to the income reference year instead of the survey year. In the case of Eurostat and US Census Bureau, the income reference year refers to the year before the survey year.

Source: OECD (2021[7]), *Income Distribution Database*, https://oe.cd/idd; Eurostat (2022[61]), Income quintile share ratio S80/S20 for disposable income by sex and age group – EU-SILC survey, https://ec.europa.eu/eurostat/databrowser/view/ILC_DI11$DEFAULTVIEW/default/table; (Buresi and Cornuet, 2021[15]), *Estimation avancée du taux de pauvreté monétaire et des indicateurs d'inégalités – Insee Analyses – 70* (*base de données*), https://www.insee.fr/fr/statistiques/5762455; Statistics Canada (2021[62]), Distributions of household economic accounts for income, consumption and saving of Canadian households, fourth quarter 2020 (tables), https://www150.statcan.gc.ca/n1/daily-quotidien/210907/dq210907a-eng.htm; US Census Bureau (2021[63]), *Current Population Survey Annual Social and Economic Supplements* (database), https://www.census.gov/data/datasets/time-series/demo/cps/cps-asec.2021.html.

Provisional estimates of income inequality in 2020

This section presents provisional estimates of inequality in disposable income for 2020, based on the methodology described in the previous section. Results suggest that, on average, in 2020, people in the top 20% of the distribution were between 4.1 and 5.1 times richer than people in the bottom 20%, across 24 OECD countries with available data (see Figure 4.2). This ratio between the disposable income received by the richest and poorest 20% of people (S80/S20 or the quintile share ratio) is lowest in the Czech Republic, Slovak Republic and Slovenia, where it ranges between 2.8 and 3.9. In contrast, in the United States, the income of the richest 20% of people was 7.5 times higher than of the poorest 20%.

Provisional estimates suggest that despite a possible downtrend in income inequality due to massive governments' intervention in the wake of the pandemics, inequality of household disposable income has not changed significantly between 2019 and 2020. Final estimates for 2019 (or earlier years) indicate a quintile share ratio of 4.7, on average across the 24 OECD. Since the uncertainty interval for 2020 (4.1 to 5.1) encompasses the estimate for 2019 (4.7) the differences between these two years are not statistically significant. The results do indicate, however, a potential decrease in income inequality, on average across these countries, as the estimate for 2019 is considerably closer to the upper than the lower limit of the uncertainty interval. This finding is in line with Eurostat's results, which indicate a significant fall in income inequality at the EU-27 level (Eurostat, 2021[64]) and the declines in income inequality observed in Canada and the United States.[16]

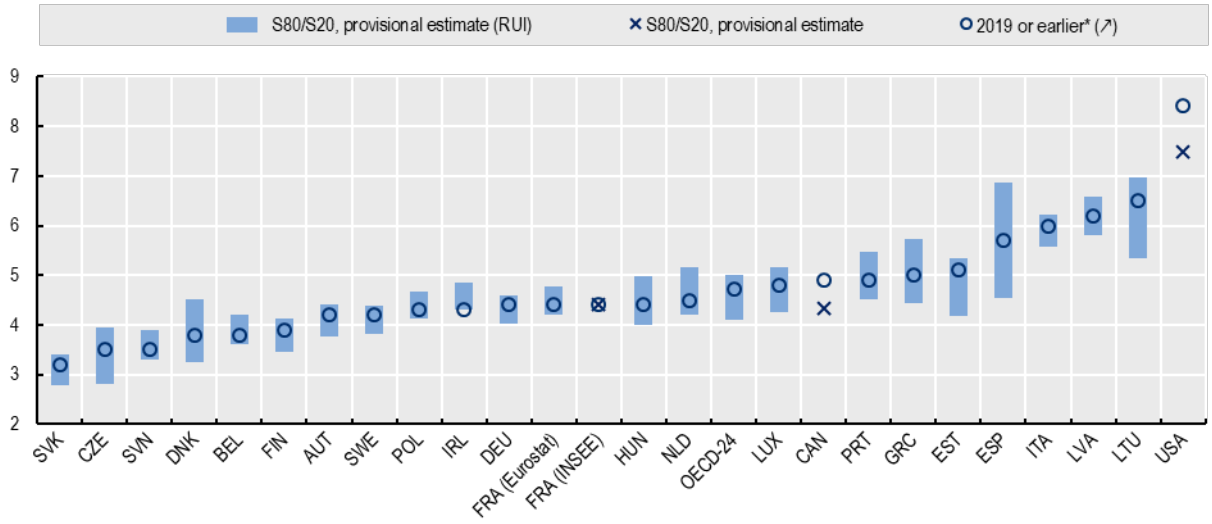
Among countries where indicators are presented as uncertainty intervals, there are no statistically significant changes, except for a rise in inequality in Ireland. Results also suggest that inequality may have potentially decreased in Estonia and Lithuania.

In the case of France, it is reassuring that results produced by INSEE and Eurostat are quite similar (INSEE 4.4 and Eurostat 4.2-4.8). As described in Section 4, these estimates are based on work carried out independently by two different groups (INSEE and Eurostat), using two different microsimulation models (INES and EUROMOD) and microdata from two different household surveys (ERFS and EU-SILC).

[16] These results are in line with national evidence. According to Statistics Canada, "the gap between the highest and lowest income earners – calculated as the difference between the top two and bottom two quintiles' respective shares of total disposable income – shrunk to the lowest level ever recorded in the data series" (Statistics Canada, 2021[62]). According to the US Census Bureau, post-tax income inequality in 2020 is statistically lower than in 2019 at the 90 percent confidence level (Shrider et al., 2021[81]).

Figure 4.2. Provisional estimates suggest that, on average in the OECD, after tax-transfer income inequality has not changed significantly

Provisional estimates of household disposable income inequality for 2019 (actual data) and 2020 (provisional data), measured by the quintile share ratio (S80/S20)



Note: Provisional estimates based on nowcasting methods using micro-simulation techniques, except for the United States, which are based on survey data. For EU countries, estimates of inequality of disposable income are published by Eurostat within Rounded Uncertainty Intervals. In Canada, income estimates are aligned to the aggregates underpinning the Canadian System of Macroeconomic Accounts (CSMA).
Source: OECD calculations based on Eurostat (2021[65]), *Income inequality and poverty indicators – Experimental statistics* (database), https://ec.europa.eu/eurostat/web/experimental-statistics/income-inequality-and-poverty-indicators; Buresi and Cornuet (2021[15]), *Estimation avancée du taux de pauvreté monétaire et des indicateurs d'inégalités – Insee Analyses – 70 (base de données)*, https://www.insee.fr/fr/statistiques/5762455; Statistics Canada (2021[62]), Distributions of household economic accounts for income, consumption and saving of Canadian households, fourth quarter 2020 (tables), https://www150.statcan.gc.ca/n1/daily-quotidien/210907/dq210907a-eng.htm; US Census Bureau (2021[63]), *Current Population Survey Annual Social and Economic Supplements* (database), https://www.census.gov/data/datasets/time-series/demo/cps/cps-asec.2021.html; and OECD (2021[7]), *Income Distribution Database*, https://oe.cd/idd.

Conversely, provisional estimates indicate a considerable rise of inequality in labour income[17], reflecting the large economic shock brought about by the COVID-19 spread. Between 2019 and 2020, the quintile share ratio of labour income increased by 1.2 percentage points, on average across the 21 OECD countries with available data (see Figure 4.3). In fact, according to this indicator, labour income inequality increased in all observed countries – with the exception of Canada, for which the income concept is not strictly comparable to that of other countries[18]. Rises in the S80/S20 ratio of labour income were particularly large in Ireland, Belgium, the United States and Estonia, where increases exceeded 2.5 percentage points.

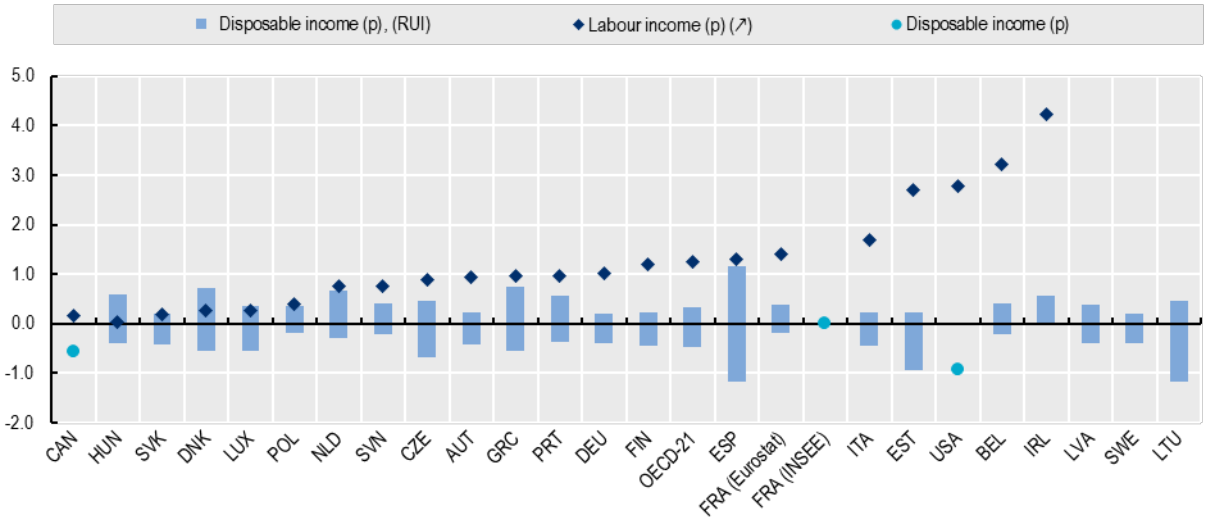
[17] Labour income includes income from dependent employment (i.e. wages and salaries) and self-employment income.

[18] Based on the Canadian System of Macroeconomic Accounts (CSMA), labour income estimates for Canada are based on the SNA concept of "Compensation of employees". This concept is similar to "Income from Employment" as defined in the 2011 Canberra Handbook on (micro) Income Statistics (UNECE, 2011[84]). Wages and salaries account for the bulk of both "compensation of employees" and "Income from Employment". However, unlike Income from Employment, Compensation of Employees excludes income from self-employment, while it includes employer's social contributions, and severance payment (known as "retirement allowances"). CSMA classifies income from self-employment under the concept of "mixed incomes", a concept that also includes "rental income, actual and imputed". According to Statistics Canada, "rental income, actual and imputed" accounts for more than half of "mixed incomes" (Statistics Canada, 2022[60])

In 13 of the 21 countries covered in Figure 4.3, the change in labour income inequality was significantly larger than the change in disposable income inequality.

Figure 4.3. Provisional estimates indicate a considerable rise of inequality of labour income

Absolute change in inequalities of labour and disposable income between 2019 (actual data) and 2020 (provisional data), measured by the income quintile share ratio (S80/S20)



Note: (p) Provisional estimates based on nowcasting methods using micro-simulation techniques, except for the United States, which are based on survey data. For EU countries, estimates of inequality of disposable income are published by Eurostat within Rounded Uncertainty Intervals, estimates based on labour income are reported as point estimates. In Canada, income estimates are aligned to the aggregates underpinning the Canadian System of Macroeconomic Accounts (CSMA). Quintile share ratios of labour income are ranked by equivalised household disposable income in Canada and the United States, and by labour income in EU countries.
Source: OECD calculations based on Eurostat (2021[65]), *Income inequality and poverty indicators – Experimental statistics* (database), https://ec.europa.eu/eurostat/web/experimental-statistics/income-inequality-and-poverty-indicators; Buresi and Cornuet (2021[15]), *Estimation avancée du taux de pauvreté monétaire et des indicateurs d'inégalités – Insee Analyses – 70* (base de données), https://www.insee.fr/fr/statistiques/5762455; Statistics Canada (2021[62]), Distributions of household economic accounts for income, consumption and saving of Canadian households, fourth quarter 2020 (tables), https://www150.statcan.gc.ca/n1/daily-quotidien/210907/dq210907a-eng.htm; US Census Bureau (2021[63]), *Current Population Survey Annual Social and Economic Supplements* (database), https://www.census.gov/data/datasets/time-series/demo/cps/cps-asec.2021.html; and OECD (2021[7]), *Income Distribution Database*, https://oe.cd/idd.

Provisional estimates suggest that the rise in *labour income* inequality was driven by falls in the earnings of lower-income households, i.e. those in the bottom 20% of the distribution. Between 2019 and 2020, lower-income households experienced a considerable fall in labour income (Figure 4.4, Panel A). On average, higher-income households have also experienced labour incomes falls, but to a much lesser extent (Figure 4.4, Panel B).

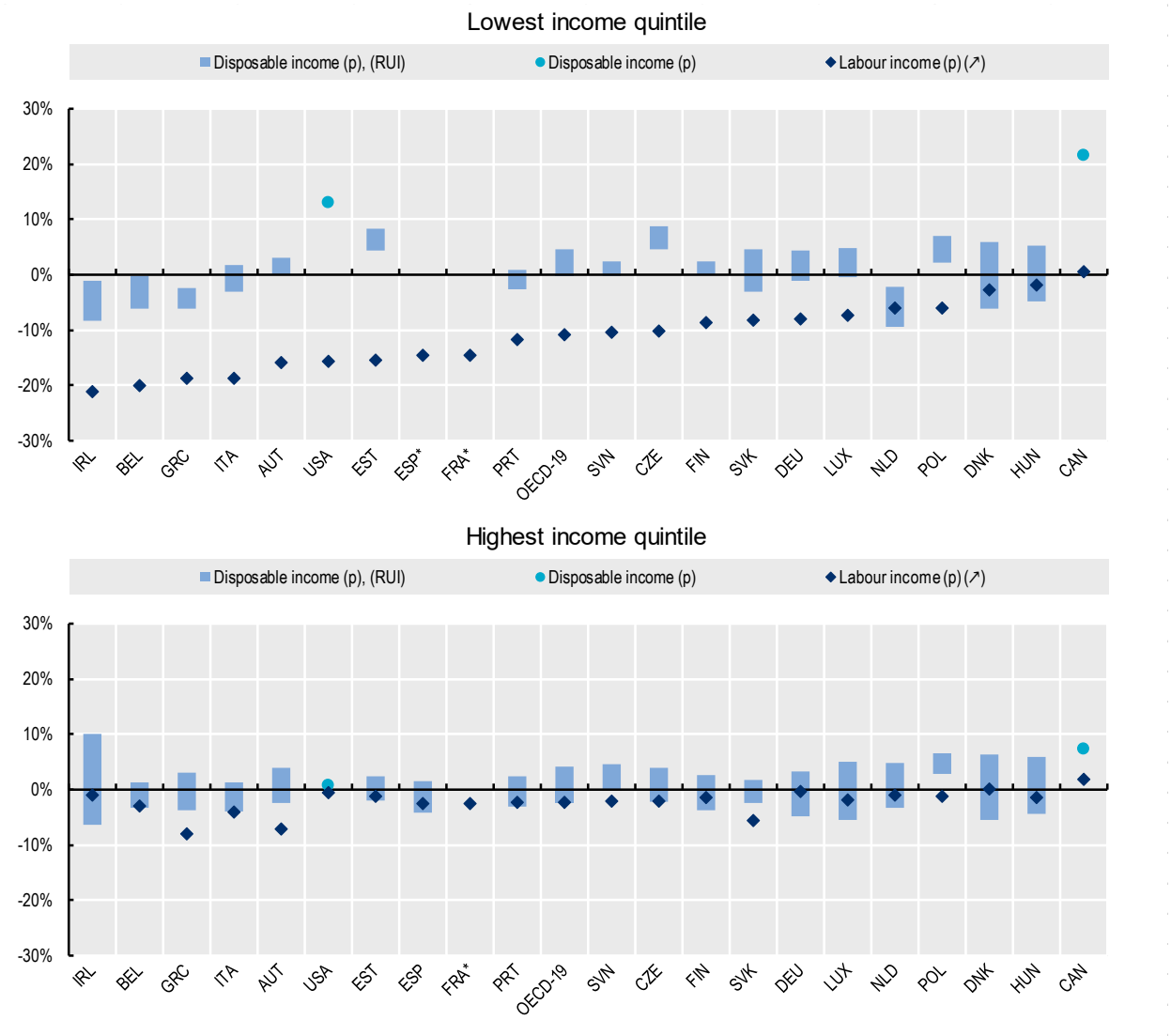
In contrast, the *disposable* income of lower-income households has potentially increased, or at least stagnated, in nominal terms, on average across 19 OECD countries with available data. For higher-income households, changes in disposable income are less considerable. Since taxes and social transfers account for the bulk of differences between labour and disposable income, this finding suggests that tax-benefit policies have cushioned the negative impact of the pandemic on household incomes in 2020, particularly among lower-income households, thus potentially reducing income inequality.

Evidence from recent studies confirms the significant cushioning effect of the tax-benefit system and of additional policy measures. According to a recent study for EU countries "tax-benefit systems absorbed a significant share of the COVID-19 shock and were able to offset – in most countries – the regressive nature

of the shock on market incomes" (Christl et al., 2022[66]). Evidence from Eurostat suggests that monetary compensation schemes for reduced working hours and lay-offs have played a major role in cushioning income losses across all income groups, and particularly among those with lower incomes (Eurostat, 2021[56]). In Canada, households, particularly in the lower and middle part of the income distribution, recorded "unprecedented increases in current transfers in the second quarter, as governments' COVID-19 support measures were implemented to help mitigate negative impacts from the pandemic" (Statistics Canada, 2021[24]). In the United States, "stimulus payments, enacted as part of economic relief legislation related to the COVID-19 pandemic, moved 11.7 million individuals out of poverty. Unemployment insurance benefits, also expanded during 2020, prevented 5.5 million individuals from falling into poverty" (Fox and Burns, 2021[28]).

Figure 4.4. Provisional estimates suggest that lower-income households had considerable falls in labour income but not in disposable income

Relative change in labour income (earnings) and disposable income between 2019 (actual data) and 2020 (provisional data), in nominal prices



Note: Provisional estimates based on nowcasting methods using micro-simulation techniques, except for the United States, which are based on survey data. For EU countries, estimates of inequality of disposable income are published by Eurostat within Rounded Uncertainty Intervals, estimates based on labour income are reported as point estimates. In Canada, income estimates are aligned to the aggregates underpinning the Canadian System of Macroeconomic Accounts (CSMA). Quintile share ratios of labour income are ranked by equivalised household disposable income in Canada and the United States, and by labour income in EU countries.
Source: OECD calculations based on Eurostat (2021[65]), *Income inequality and poverty indicators – Experimental statistics* (database), https://ec.europa.eu/eurostat/web/experimental-statistics/income-inequality-and-poverty-indicators; Statistics Canada (2021[62]), Distributions of household economic accounts for income, consumption and saving of Canadian households, fourth quarter 2020 (tables), https://www150.statcan.gc.ca/n1/daily-quotidien/210907/dq210907a-eng.htm; US Census Bureau (2021[63]), *Current Population Survey Annual Social and Economic Supplements (database),* https://www.census.gov/data/datasets/time-series/demo/cps/cps-asec.2021.html; and OECD (2021[7]), *Income Distribution Database*, https://oe.cd/idd.

Accuracy of estimates

Comparing provisional and final estimates

Comparisons of provisional estimates with final measures for earlier years can help assess the capacity of the methods and the potential accuracy of their results. However, discrepancies may be larger in the presence of economic shocks, as the COVID-19 recession in 2020. In fact, Eurostat and INSEE had introduced new methodological developments in order to account for the specific circumstances created by the COVID-19 crisis in the production of their estimates for 2020 (see Section 4).

Based on the same method used to compute provisional estimates for 2020 (see Section 4), provisional estimates were computed for earlier years for which data are available (from 2017 to 2019 for most EU countries; from 2011 to 2019 for Canada; and 2019 for the United States). Figure 4.5 presents provisional estimates for these earlier years based on data produced by Eurostat[19] for EU countries (in the form of intervals), and by National Statistical Offices for Canada, France and the United States (as point estimates) (see Section 4) comparing them to final indicators.

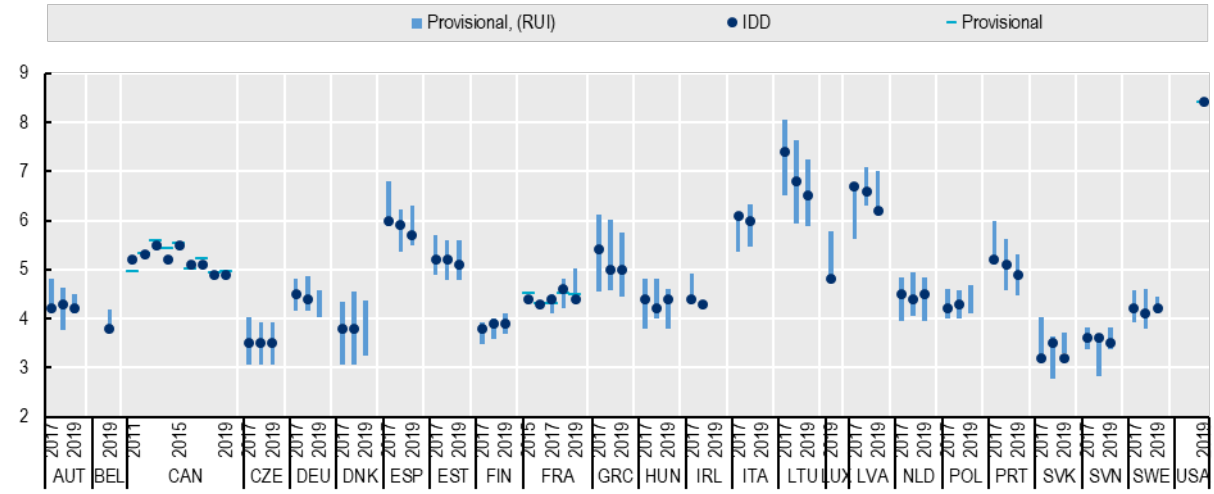
Regarding results based on Eurostat data, for most EU countries final measures are within the Rounded Uncertainty Intervals of provisional estimates. For those cases where these measures fall outside the interval, in most cases the final measure is very close to the lower or the upper limits of these intervals (e.g. France in 2019, Italy in 2017, Latvia in 2017 and Slovak Republic in 2017 and 2019). The only exception is Luxembourg in 2017 and 2018, due to a break in the series.

Most provisional point estimates based on data from National Statistical Offices are also very close to final measures. In Canada, France and the United States, most differences between provisional estimates and final measures are below 2%, and in all cases below 5%.

[19] The methods applied by Eurostat to produce estimates have changed substantially throughout the years. Until 2016, estimates for several countries were based on macro models. Since then, nowcasting methods based on microsimulation have been progressively improved (e.g. treatment of current incomes, or calibration methods).

Figure 4.5. In previous years provisional estimates were broadly in line with final measures

Provisional estimate and IDD measures of the quintile share ratio (S80/S20)



Note: Provisional estimates based on nowcasting methods using micro-simulation techniques, except for the United States, whose estimates are based on (public use) survey data. For EU countries, estimates of inequality of disposable income are published by Eurostat in the form of Rounded Uncertainty Intervals. For Canada, preliminary estimates are aligned to the aggregates underpinning the Canadian System of Macroeconomic Accounts (CSMA). Quintile share ratios of labour income are based on individuals ranked by equivalised household disposable income in Canada and the United States, and by labour income in EU countries.

Source: OECD calculations based on Eurostat (2021[65]), *Income inequality and poverty indicators – Experimental statistics* (database), https://ec.europa.eu/eurostat/web/experimental-statistics/income-inequality-and-poverty-indicators; Buresi and Cornuet (2021[15]), *Estimation avancée du taux de pauvreté monétaire et des indicateurs d'inégalités – Insee Analyses – 70 (base de données)*, https://www.insee.fr/fr/statistiques/5762455; Statistics Canada (2021[62]), Distributions of household economic accounts for income, consumption and saving of Canadian households, fourth quarter 2020 (tables), https://www150.statcan.gc.ca/n1/daily-quotidien/210907/dq210907a-eng.htm; US Census Bureau (2021[63]), *Current Population Survey Annual Social and Economic Supplements* (database), https://www.census.gov/data/datasets/time-series/demo/cps/cps-asec.2021.html, and OECD (2021[7]), *Income Distribution Database*, https://oe.cd/idd.

Comparison of 2020 provisional estimates with external evidence

The provisional estimates for 2020 presented in this paper are also broadly in line with external evidence from other studies based on similar or alternative methods to produce timely estimates. Table 4.1 compares provisional and external estimates on whether changes between 2020 and a reference period are "considerable" and "no considerable".

Changes in inequality based on the provisional estimates presented in Table 4.1 are flagged as "considerable" when S80/S20 estimates for 2019 are outside of the Rounded Uncertainty Interval of 2020 estimates in Figure 4.2. External evidence is based on various sources (e.g., reports, articles and studies), which use different methodological approaches, such as inequality indicator, income concept, baseline and assessment period.[20] Similarly, changes in estimates from external evidence are treated as "considerable" when differences between estimates for the assessment period and the baseline are larger than the standard deviation of changes across all countries.

For most countries, external evidence suggests that income inequality changes in 2020 were not considerable, which is in line with provisional estimates. Conversely, external evidence and provisional estimates do not always align regarding countries with considerable inequality changes. A study based on online surveys suggests a considerable decline in income inequality in Italy and Spain (Clark, D'Ambrosio

[20] See Table A A.1 for details about the key methodological approaches used by each paper.

and Lepinteur, 2021[40]). In contrast, two studies suggest that income inequality has increased in Spain, one using real-time data from bank accounts (Aspachs et al., 2020[43]) and another combining sampling reweighting and microsimulations (Almeida et al., 2021[67]). Using the same tools and data as Eurostat, but a different approach to account for labour market transitions, Christl et al. (2022[66]) find that income inequality has decreased in Ireland. Using data from administrative tax and income registers at the Swedish Tax Agency, results by Angelov and Waldenström (2021[68]) show that income inequality increased during the pandemic in Sweden.

Table 4.1. External evidence also suggests small changes in income inequality for most countries

Potential changes in income inequality in 2020 according to provisional estimates and other studies

Provisional estimates	Country	External evidence		
		Considerable inequality fall	No considerable inequality change	Considerable inequality rise
Considerable inequality fall	CAN			
Considerable inequality fall	USA		[15]	
No considerable inequality change	AUT		[1] [9] [10]	
No considerable inequality change	BEL		[1] [6] [10]	
No considerable inequality change	CZE		[1] [10]	
No considerable inequality change	DEU		[1] [8] [11] [10] [12]	
No considerable inequality change	DNK		[1] [10]	
No considerable inequality change	ESP	[11]	[6] [10]	[1] [3]
No considerable inequality change	EST			
No considerable inequality change	FIN		[1] [10]	
No considerable inequality change	FRA		[1] [11] [10]	
No considerable inequality change	GRC		[1] [10]	
No considerable inequality change	HUN			
No considerable inequality change	ITA	[11]	[1] [7] [5] [6] [14] [10]	
No considerable inequality change	LUX		[1] [10]	
No considerable inequality change	LTU	[1]	[10] [18]	
No considerable inequality change	LVA		[1] [10]	
No considerable inequality change	NLD		[1] [10]	
No considerable inequality change	POL		[1] [10]	
No considerable inequality change	PRT		[1] [10]	
No considerable inequality change	SVK		[1] [10]	
No considerable inequality change	SVN		[1] [10]	
No considerable inequality change	SWE		[1] [10]	[2]
Considerable inequality rise	IRL	[10]	[13] [1]	

Note: In the case of estimates presented with Rounded Uncertainty Intervals (see Section 4), changes in inequality indicated as "considerable" when S80/S20 estimates for 2019 are outside of the Rounded Uncertainty Interval of 2020 estimates in Figure 4.2. For external estimates, changes are indicated as "considerable" if their absolute amount is larger than the standard deviation across countries. Most external studies assess changes in inequality using the Gini coefficient, with standard deviation equal to 1.12 percentage points of the Gini coefficient. In the studies using the S80/S20, the standard deviation is 0.53. For provisional estimates, the standard deviation of the S80/S20 is 0.56. See Table A.1 for methodological details of each paper.

Source: Adapted from [1] (Almeida et al., 2021[67]), "The impact of COVID-19 on households´ income in the EU", https://doi.org/10.1007/s10888-021-09485-8; [2] (Angelov and Waldenström, 2021[68]), "COVID-19 and income inequality: Evidence from monthly population registers", https://dx.doi.org/10.2139/ssrn.3885421; [3] (Aspachs et al., 2020[43]), "Real-time inequality and the welfare state in motion: Evidence from COVID-19 in Spain", https://ssrn.com/abstract=3674894; [4] (Brewer and Tasseva, 2021[69]), "Did the UK policy response to Covid-19 protect household incomes?" https://doi.org/10.1007/s10888-021-09491-w. [5] (Brunori et al., 2020[70]), "Distant and Unequal. Lockdown and Inequalities in Italy". https://ideas.repec.org/p/frz/wpaper/wp2020_13.rdf.html. [6] (Cantó et al., 2021[71]), "Welfare Resilience at the Onset of the COVID-19 Pandemic in a Selection of European Countries: Impact on Public Finance and Household Incomes". https://doi.org/10.1111/roiw.12530. [7] (Carta and de Philippis, 2021[72]), "The impact of the COVID-19 shock on labour income inequality: evidence from Italy". https://dx.doi.org/10.2139/ssrn.3828129. [8] (Christl et al., 2021[73]), "The role of short-time work and discretionary policy measures in mitigating the effects of the COVID-19 crisis in Germany". https://dx.doi.org/10.2139/ssrn.3848334. [9] (Christl et al., 2022[74]), "COVID-19 and (gender) inequality in income: The impact of discretionary policy measures in Austria". https://doi.org/10.1186/s41937-022-00084-6. [10] (Christl et al., 2022[66]), "Assessing the cushioning role of tax-benefit systems on households' income in the euro area during the COVID-19 pandemic: a microsimulation analysis". https://doi.org/10.2765/619470. [11] (Clark, D'Ambrosio and Lepinteur, 2021[40]), "The Fall in Income Inequality during COVID-19 in Five European Countries". http://www.ecineq.org/milano/WP/ECINEQ2020-565.pdf. [12] (Grabka, 2021[38]), "Income inequality in Germany stagnating over the long term, but decreasing slightly during the coronavirus pandemic". https://doi.org/10.18723/diw_dwr:2021-17-1. [13] (O'Donoghue et al., 2021[75]), "A Microsimulation Analysis of the Distributional Impact over the Three Waves of the COVID-19 Crisis in Ireland". https://doi.org/10.34196/ijm.00237. [14] (Gallo and Raitano, 2020[76]), "SOS incomes: Simulated effects of COVID-19 and emergency benefits on individual and household income distribution in Italy". http://www.ecineq.org/milano/WP/ECINEQ2020-566.pdf. [15] (Han, Meyer and Sullivan, 2020[77]), "Income and Poverty in the COVID-19 Pandemic". https://doi.org/10.3386/w27729. [16] (Li et al., 2021[26]), "Estimating the Impact of Covid-19 and Policy Responses on Australian Income Distribution Using Incomplete Data". https://doi.org/10.1007/s11205-021-02826-0. [17] (Lustig et al., 2020[78]), "The Impact of COVID-19 Lockdowns and Expanded Social Assistance on Inequality, Poverty and Mobility in Argentina, Brazil, Colombia and Mexico". https://ideas.repec.org/p/inq/inqwps/ecineq2020-558.html. [18] (Gabnytė, Čižauskaitė and Navickė, 2021[79]), "Nowcasting poverty and inequality in the context of economic growth and Covid-19 pandemic in Lithuania".

5 Conclusions and next steps

More timely indicators of income inequality are increasingly demanded, given the growing public and policy interest in distributive issues. Timeliness is a key requirement for a wider adoption of income distribution statistics as complementary to macro-indicators, such as GDP (Stiglitz, Fitoussi and Durand, 2018[9]; Gentiloni, 2021[10]). Recent support by G20 leaders to the new Data Gap Initiative (IMF, 2022[11]). is a clear example that the distribution of household economic well-being and the improvement of timeliness and granularity of official statistics are high-level policy priorities.

This paper has documented the methods and data used by the Secretariat to compute more timely indicators of income inequality. The paper also presented evidence based on these provisional estimates of income inequality in 2020 for a selection of 24 OECD countries.

Provisional estimates of income inequality in 2020 were derived from data produced by Eurostat and the national statistical offices of France, Canada and the United States. For the United States, provisional estimates were computed by the OECD Secretariat using publicly available microdata referring to 2020 from the Annual Social and Economic Supplement (ASEC) of the Current Population Survey (CPS). Provisional estimates for EU countries, France and Canada were produced by Eurostat, INSEE and Statistics Canada using nowcasting methods based on microsimulation modelling.

Nowcasting based on microsimulation modelling is a granular approach increasingly used by statistical offices to generate more timely estimates of income inequality. It adjusts and updates microdata of household income surveys from a previous year with information derived from other (more timely) sources. These adjustments reflect the social, economic, demographic and tax-benefit policy changes that took place between the period when the data was collected and the time of interest. Income inequality indicators are computed based on the adjusted ("nowcasted") microdata. Comparisons with alternative methods to compute timely indicators of income inequality have shown that nowcasting based on microsimulation is the "preferred approach" for data producers and for users (Eurostat, 2020[21]). Furthermore, this method has been found to be better suited than others are in predicting inflection points in indicators' time series, such as those produced by macroeconomic and policy changes.

Provisional estimates were computed by fitting the estimates from Eurostat and national statistical offices to the time series of the *OECD Income Distribution Database*. Comparisons for earlier years suggest that these provisional estimates are usually consistent with actual values of indicators included in the *OECD Income Distribution Database*. However, discrepancies may be larger in the presence of large economic shocks, such as the COVID-19 recession in 2020.

The estimates presented in this paper suggest that, in most countries, inequality in household disposable income, (as measured by the S80/S20 ratios) has not changed significantly between 2019 and 2020. Provisional estimates for 2020 are not statistically different from final estimates for 2019, for most countries and on average across the 24 OECD countries with available data. These preliminary results suggest, however, a significant decline in income inequality in Canada, Italy and the United States. In addition, these preliminary estimates point to a considerable rise of inequality in labour income, driven by substantial falls in the earnings of lower-income households across most OECD countries.

Comparing inequality trends between labour and disposable income suggests a considerable cushioning effect of the tax-benefit system and of extraordinary policy measures introduced by governments to

mitigate the negative impacts of the COVID-19 pandemic on household incomes, particularly among lower-income households.

Besides generating more timely income inequality estimates, nowcasting based on microsimulation has several valuable features for income distribution and policy analyses. As a granular approach, it can be used to compute many other indicators based on household microdata data, such as poverty and income by socio-economic groups (e.g. age, gender, household type). Nowcasting techniques can also be used to assess the impact of recent policy measures both on household income and on government budget. Furthermore, through "what if" scenarios the same techniques can be applied for *ex ante* and *ex post* policy analysis, such as the decomposition of the impact of demographic, labour market and tax-benefit changes, which can be valuable for policy making.

Based mostly on estimates published by Eurostat and national statistical offices, this current exercise has computed a rather small number of indicators (i.e. the S80/S20 ratio featuring in the OECD recovery dashboard). While estimates for EU countries were produced using a common and harmonised methodology, estimates for the United States and, especially, Canada (where income concepts are aligned to national accounts) may not be fully comparable with those available for other OECD countries. Such approach is the best possible in the short term, particularly given the need to produce timely indicators for the OECD Dashboard on the Recovery. Going forward, efforts should focus on improving the cross-country comparability of nowcasted estimates, consolidating the methodology, broadening the scope of countries, and exploring the possibility of further increasing the timeliness and frequency of results.

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Annex A. Methodological characteristics of external sources

Table A.1. Key methodological characteristics of papers in Table 4.1

Inequality measure, income concept, method to estimate timely indicator, baseline and assessment period to measure inequality change

Paper no.	Paper	Inequality Indicator	Income concept	Method	Baseline	Assessment Period
[1]	Almeida et al (2021)	Gini	Disposable Income	Re-weighting	no COVID	2020
[2]	Angelov et al (2021)	Gini	Labour income	Current Income: Admin data	2019	2020
[3]	Aspachs et al (2020)	Gini	Labour income	Current Income: Special Data	Nov 2019	Nov 2020
[4]	Brewer and Tasseva (2021)	Gini S80/S20	Disposable Income	Microsimulation nowcasting	no COVID	Apr-May 20
[5]	Brunori et al (2020)	Gini	Disposable Income	Microsimulation nowcasting	no COVID	Mar-Apr 2020
[6]	Cantó et al (2022)	Gini	Disposable Income	Microsimulation nowcasting	2018	Apr 2020
[7]	Carta and De Philippis (2021)	Gini	Labour income	Microsimulation nowcasting	Q4 2019	Q2 2020
[8]	Christl et al (2021)	Gini S80/S20	Disposable Income	Microsimulation nowcasting	no COVID	2020
[9]	Christl et al (2021)	Gini S80/S20	Disposable Income	Microsimulation nowcasting	no COVID	2020
[10]	Christl et al (2022)	Gini	Disposable Income	Microsimulation nowcasting	no COVID	2020
[11]	Clark et al (2020)	Gini	Disposable Income	Current Income: Special Survey	Jan 2020	Jan 2021
[12]	Grabka (2021)	Gini S80/S20	Disposable Income	Current Income: Special Survey	2019	2021
[13]	O'Donoghue et al (2021)	Gini S80/S20	Disposable Income	Microsimulation nowcasting	Dec 2019	26-01-2021
[14]	Gallo et al (2020)	Gini	Disposable Income	Re-weighting	no COVID	2020
[15]	Han et al (2020)	S80/S20	Total Income	Current Income: Existing Survey	Jan 2020	May 2020
[16]	Li et al (2021)	Gini	Disposable Income	Microsimulation nowcasting	Feb 2020	Jun 2020
[17]	Lustig et al (2020)	Gini	Total income	Microsimulation nowcasting	2019	2020
[18]	Gabnytė, Čižauskaitė and Navickė (2021)	Gini S80/S20	Disposable Income	Microsimulation nowcasting	2019	2020

Note: Changes have been classified by comparing them to the variation of the evidence across countries. The threshold used to differentiate between "not significant" and "considerable" change is the standard deviation of inequality changes across countries. For provisional estimates, changes in inequality are measured by the S80/S20, as presented in Figure 4.2. In the case of estimates presented with Rounded Uncertainty Intervals (see Section 4), changes in inequality are measured as the difference between the distance between the upper and lower limits of the provisional estimate for 2020 and the final estimate for 2019. The standard deviation for this indicator is 0.56 percentage points of the S80/S20. For external studies, most evidence of changes in inequality is measured using the Gini coefficient (with standard deviation equal to 1.12 percentage points of the Gini coefficient), although a few studies use the S80/S20 (with standard deviation of 0.53). See Table A.1 for methodological details of each paper.

Source: Adapted from [1] (Almeida et al., 2021[67]), "The impact of COVID-19 on households´ income in the EU", https://doi.org/10.1007/s10888-021-09485-8; [2] (Angelov and Waldenström, 2021[68]), "COVID-19 and income inequality: Evidence from monthly population registers", https://dx.doi.org/10.2139/ssrn.3885421; [3] (Aspachs et al., 2020[43]), "Real-time inequality and the welfare state in motion: Evidence from COVID-19 in Spain", https://ssrn.com/abstract=3674894; [4] (Brewer and Tasseva, 2021[69]), "Did the UK policy response to Covid-19 protect household incomes?" https://doi.org/10.1007/s10888-021-09491-w. [5] (Brunori et al., 2020[70]), "Distant and Unequal. Lockdown and Inequalities in Italy". https://ideas.repec.org/p/frz/wpaper/wp2020_13.rdf.html. [6] (Cantó et al., 2021[71]), "Welfare Resilience at the Onset of the COVID-19 Pandemic in a Selection of European Countries: Impact on Public Finance and Household Incomes". https://doi.org/10.1111/roiw.12530. [7] (Carta and de Philippis, 2021[72]), "The impact of the COVID-19 shock on labour income inequality: evidence from Italy". https://dx.doi.org/10.2139/ssrn.3828129. [8] (Christl et al., 2021[73]), "The role of short-time work and discretionary policy measures in mitigating the effects of the COVID-19 crisis in Germany". https://dx.doi.org/10.2139/ssrn.3848334. [9] (Christl et al., 2022[74]), "COVID-19 and (gender) inequality in income: The impact of discretionary policy measures in Austria". https://doi.org/10.1186/s41937-022-00084-6. [10] (Christl et al., 2022[66]), "Assessing the cushioning role of tax-benefit systems on households' income in the euro area during the COVID-19 pandemic: a microsimulation analysis". https://doi.org/10.2765/619470. [11] (Clark, D'Ambrosio and Lepinteur, 2021[40]), "The Fall in Income Inequality during COVID-19 in Five European Countries". http://www.ecineq.org/milano/WP/ECINEQ2020-565.pdf. [12] (Grabka, 2021[38]), "Income inequality in Germany stagnating over the long term, but decreasing slightly during the coronavirus pandemic". https://doi.org/10.18723/diw_dwr:2021-17-1. [13] (O'Donoghue et al., 2021[75]), "A Microsimulation Analysis of the Distributional Impact over the Three Waves of the COVID-19 Crisis in Ireland". https://doi.org/10.34196/ijm.00237. [14] (Gallo and Raitano, 2020[76]), "SOS incomes: Simulated effects of COVID-19 and emergency benefits on individual and household income distribution in Italy". http://www.ecineq.org/milano/WP/ECINEQ2020-566.pdf. [15] (Han, Meyer and Sullivan, 2020[77]), "Income and Poverty in the COVID-19 Pandemic". https://doi.org/10.3386/w27729. [16] (Li et al., 2021[26]), "Estimating the Impact of Covid-19 and Policy Responses on Australian Income Distribution Using Incomplete Data". https://doi.org/10.1007/s11205-021-02826-0. [17] (Lustig et al., 2020[78]), "The Impact of COVID-19 Lockdowns and Expanded Social Assistance on Inequality, Poverty and Mobility in Argentina, Brazil, Colombia and Mexico". https://ideas.repec.org/p/inq/inqwps/ecineq2020-558.html. [18] (Gabnytė, Čižauskaitė and Navickė, 2021[79]), "Nowcasting poverty and inequality in the context of economic growth and Covid-19 pandemic in Lithuania".