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How Effective were Job-Retention Schemes during the COVID-19 Pandemic? A Microsimulation Approach for European Countries

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ABSTRACT: The COVID-19 pandemic had posed a dramatic impact on labor markets across Europe. Forceful fiscal responses have prevented an otherwise sharper contraction. Many countries introduced or expanded job-retention schemes to preserve jobs and support households. This paper uses a microsimulation approach (EUROMOD) and household data to assess the effectiveness of those schemes in stabilizing household income during the pandemic across European countries. Empirical evidence shows that job-retention schemes were effective in stabilizing income and, along with other measures, absorbed nearly 80 percent of market income shocks—almost doubling the extent of the automatic stabilization of the pre-pandemic tax and benefit systems. The large effects are related to the widespread use and scaling up of those schemes and a deep but short-lived disruption to labor markets during the pandemic. Along with other fiscal support measures, job-retention schemes helped mitigate the rise in the unemployment rate, by about 3 percentage points, and income inequality during the pandemic. Our results show that job-retention schemes were largely targeted, in which households more vulnerable to income losses, such as lower-income families, youth, and low-skilled workers, are able to stabilize their income.

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WORKING PAPERS

How Effective were Job-Retention Schemes During the COVID-19 Pandemic? A Microsimulation Approach for European Countries

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Contents

I. Introduction

The COVID-19 pandemic generated widespread economic disruptions and consequently led to a sharp deterioration in labor markets across Europe. Despite a dramatic economic contraction, the impact on employment appeared to be muted, with employment rate remaining at 0.7 percentage points below the pre-crisis levels, far above projections based on the pre-pandemic relationship between output growth and unemployment (Okun's relationship). Most of the adjustment in the labor markets was through a sharp reduction in working hours per worker, by 12 percent in the second quarter of 2020. These observations were in contrast with the experience of the United States, where the unemployment rate surged by 11 percentage points in the first two months of the pandemic, while working hours per worker fell moderately.

Swift and forceful fiscal support has cushioned the adverse impact of the pandemic. Yet the diverse experience in EU and US labor markets was likely driven by specific fiscal measures. Many EU countries introduced new or expanded the existing job-retention schemes which prevented a surge in unemployment, while the United States expanded the federal unemployment income support despite that many states had some form of job-retention schemes in place.[2] This is usually seen as a key contributing factor for different developments in the labor markets (Ando and others 2022; Giupponi, Landais, and Lapeyre 2022). Within the European Union, the design and coverage of job-retention schemes varied significantly across countries. Given that job-retention schemes can become a prominent tool for future shocks, it is therefore important to assess whether job-retention schemes are effective in terms of stabilizing household income and to what extent those schemes target well to workers vulnerable to job losses.

The paper uses a microsimulation approach (EUROMOD) and household data to assess the effectiveness of those schemes in stabilizing household income during the pandemic across EU countries. Our paper is related to Christl and others (2022) that analyzes the aggregate stabilization of tax and benefit systems during the pandemic. Our paper extends their analysis and quantifies not only the aggregate effects of pandemic-related fiscal support, including job-retention schemes, in stabilizing household income, but also focuses on the impact on different socio-economic groups, including age, gender, occupations, and level of educational attainment.

The paper is also related to other strands in the literature. First, it contributes to the literature on the size of automatic stabilizers—the built-in components in the budget that adjust automatically to cyclical changes in the economy. The paper uses a micro-simulation approach that relies on household data and detailed policies in the tax and benefit systems (Auerbach and Feenberg 2000; Dolls, Fuest, and Peichl 2012). It allows an analysis of the direct effects of specific tax or expenditure policies on household income during an adverse shock by household characteristics. Although the microsimulation approach does not account for feedback effects, other approaches using cyclical budget balances or semi-elasticities are likely less applicable in an environment of sharp adjustments and high uncertainty such as during the pandemic. The relationship between fiscal variables and output inherent in those approaches could change dramatically (for example, due to lockdown restrictions).[3]

Second, our microsimulation results provide an estimate on the degree of income stabilization of tax and benefit systems during the pandemic. This updates the previous estimates in the literature that focus on the

[2] The widespread use of job-retention schemes was in part mobilizing the EU funds under the temporary Support to mitigate Unemployment Risks in Emergency (SURE) instrument.

[3] Other approaches include the conventional *statistical* method that uses the cyclical component of the government budget balance or makes use of the semi-elasticities of revenue and expenditures (IMF 2015) or general equilibrium models. The general equilibrium modeling approach can estimate both direct and indirect effects of behavioral responses and their feedback (Krusell, Mukoyama, and Sahin 2010; McKay and Reis 2016).

pre-pandemic period, including (Coady and others 2023; Dolls, Fuest, and Peichl 2012; European Commission 2017; Mohl Mourre, and Stovicek 2019).

Third, the paper contributes to the research that examines the role of pandemic-related fiscal support in European labor markets. For example, Ando and others (2022) find that job-retention schemes across the euro area were crucial in mitigating the adverse impact of the pandemic, otherwise, unemployment rates could have risen further by another 2½ percentage points in 2020. Aiyar and Dao (2021) uses data on state-level *Kurzarbeit*, short-time work program in Germany, and finds that the unemployment rate would have increased by 3 percentage points without the job-retention schemes and consumption would have contracted even further. Giupponi, Landais, and Lapeyre (2022) compares the experience between EU and US policy responses and concludes that cyclical job-retention schemes can be an efficient and expedient way to complement unemployment insurance. Our paper supports these findings and provides further analyses across different household groups. The paper does not examine the effects of prolonged use of job-retention schemes on labor market allocations partly because those schemes were quickly phased out when labor markets recovered during the pandmeic, although some studies suggest the potential drawback on disincentives to work from such schemes if not withdrawn timely (Basso and others 2020).

The remainder of the paper is organized as follows. Section II discusses the impact of the pandemic on the EU labor markets and provides an overview of policies to protect workers against job and income losses. Section III describes the data and methodology of the microsimulations of the tax and benefit systems and the design of various scenarios. Section IV presents simulation results for the pre-pandemic automatic stabilizers and analyzes the extent of income stabilization in EU countries from job-retention schemes and other tax and benefit components during the pandemic. Section V concludes with some takeaways and policy implications.

II. Impact of the Pandemic on EU Labor Markets

During the COVID-19 pandemic, labor markets in the European Union adjusted mostly through reduction of hours worked per employee ('intensive margin') rather than employment levels (Figure 1). Average hours worked per worker dropped by almost 12 percent year-on-year in the second quarter of 2020, while employment fell by just under 3 percent over the same period. There was some variation across EU countries, depending on the differences in the severity of the pandemic and the sectoral structure.

The developments in EU labor markets are very different from those in the United States, where employment plunged by 12 percent at the onset of the pandemic but working hours per workers remained steady (Figure 1). The adverse impact of large decline in working hours but muted employment loss was in contrast to the global financial crisis. During the onset of the global financial crisis, the decline in employment was broadly similar to the drop in working hours per worker, and the decline was more protracted over several years.

The widespread use of job-retention schemes in EU countries has contributed to the muted loss of employment during the pandemic. Job-retention schemes encompass policies that subsidize workers' wages in firms that have reduced working hours but preserved workers' jobs, which broadly include short-time work schemes and wage subsidies. Before the pandemic, many EU countries had already some forms of job-retention schemes in place. Some schemes have always been active[4], such as *Kurzarbeit* in Germany and *Activité Partielle* in France, while other governments took action to introduce or expand those schemes to protect workers. During the pandemic, countries introduced new or expanded existing job-retention schemes by simplifying access,

[4] A firm can always apply but needs to prove that all the eligibility criteria are met.

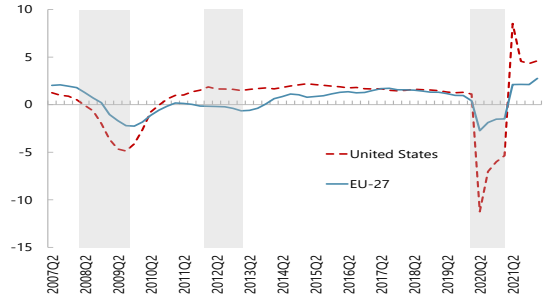
relaxing eligibility criteria, and raising the benefit levels (Table 1). Some schemes gave more generous support for workers in contact-intensive sectors that were affected the most, such as in Austria and Luxembourg.

At the beginning of the pandemic, an average of 14 percent of working-age population were under some job-retention schemes in the four largest EU economies (compared to 2 percent during the global financial crisis). More than half of EU countries had the take-up rate higher than 12 percent of working-age population. This dwarfed the increase of people receiving unemployment income support, which increased only modestly, by about 2 percentage points, given the muted impact on employment (Figure 1). The rise in unemployment rates in the EU during the pandemic was lower than predicted by the estimates based on the Okun's Law, partly reflecting the widespread use of job-retention schemes, as well as a drop in the labor force participation when workers did not actively search for a new job at the onset of the pandemic (Ando and others 2022). The average fiscal cost was about 2 percent of GDP in advanced EU economies (1.4 percent in emerging market economies in EU), about one-third of total fiscal support during the pandemic (Ando and others 2022).

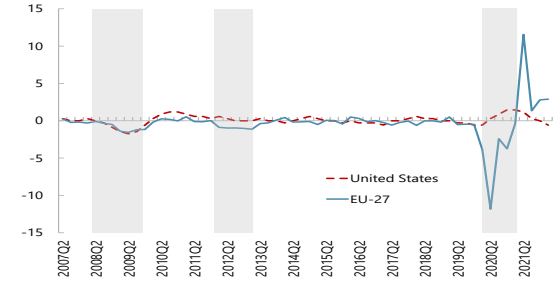
On the other hand, the US has also introduced a limited job-retention scheme to firms—the Paycheck Protection Program (PPP)—that provided small firms with loans to cover labor costs, forgivable if the payroll level was maintained. Some estimates suggest that PPP saved about 3.6 million jobs, equivalent to 2.2 percent of total employment (Autor and others 2022). In many cases, however, workers were temporarily laid off and received unemployment income support at the onset of the pandemic. The US scaled up its federal unemployment support by about 3 percent of GDP to provide weekly supplements to standard unemployment insurance, expand the eligibility to include independent workers, and extend the duration of the federal benefits.

Figure 1. Labor Market Developments in the European Union During the COVID-19 Pandemic

1. Employment Growth
(Percent, year-on-year)

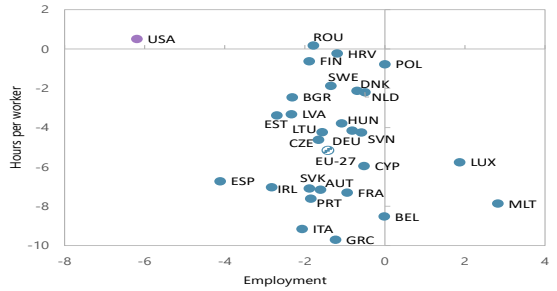


2. Growth in Average Hours per Worker
(Percent, year-on-year)



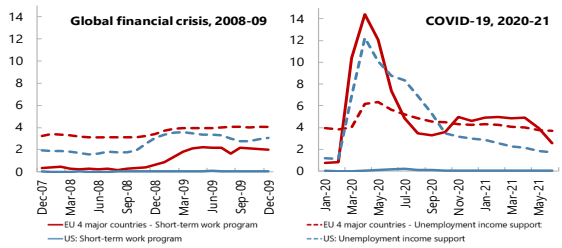
Sources: Eurostat, Bureau of Labor Statistics, and authors' calculations.
Note: Shaded areas refer to CEPR-based recessions for the EU countries and NBER recessions for the United States.

3. Changes in Employment and Working Hours, 2019-20
(Percentage change)



Sources: Bureau of Labor Statistics, Eurostat, and authors' calculations. The figure uses International Organization for Standardization (ISO) country codes.

4. Take-up of Job-Retention Schemes and Unemployment Income Support
(Percent of working-age population)



Sources: Giupponi, Landais, and Lapeyre 2022; and authors' calculations.
Note: Data for EU-4 is a weighted average of Germany, France, Spain, and Italy.

Table 1. Features of Job-Retention Schemes in Selected European Countries During the COVID-19 Pandemic

	Pre-existing job-retention scheme	Increased access and coverage	Increased generosity	New job-retention scheme	Take-up rate		Remarks
					Maximum	Average	
Austria	x	x	x		17.7	7.9	Longer duration, more flexible rules for extension of duration and administrative simplification. Up to 100 precent working time reduction in the hospitality sector.
Belgium	x	x	x		16.9	7.6	
Bulgaria				x			
Croatia				x			
Czech Republic	x	x	x		8.6	4.5	
Cyprus				x			
Denmark	x	x		x	7.3	3.5	Introduced temporararily with no membership in unemployment scheme required.
Estonia				x	14.4	3.3	
Finland	x	x	x		4.8	2.6	
France	x	x	x		20.6	8.8	No condition on type of contract, part or full time, seniority. The maximum duration is extended from 6 to 12 months. The subsidy is 70 percent of gross wage. Most employers do not bear any cost of hours no worked.
Germany	x	x	x		11.2	6.4	Firms can apply if 10 percent of their workforce is subject to reduction of hours (30 percent before). Replacement rate for lost earnings is raised to 70 and 80 percent (from 4th month and 7th month, respectively).
Greece				x	11.0	4.8	Available for employers with at least a 20 percent revenue loss. Only full-time dependent employees are eligible. Replacement rate for lost earnings is 60 percent of net wages.
Hungary				x	3.2	2.3	Job-retention scheme with 30-50 percent working time reduction.
Ireland	x			x	14.8	11.8	The existing short-time work was replaced by a temporary wage subsidy.
Italy	x	x	x		14.7	7.3	Firms of any size and from all sectors can apply. Evidence of economic need is no longer required. Employers do not bear any cost for hours not worked.
Latvia				x	5.0	3.2	Short-time work with full- and part-time reduction.
Lithuania				x	9.4	3.8	Short-time work with full- and part-time reduction.
Luxembourg	x	x	x		22.2	6.4	Up to 100 percent working time reduction; temporary workers and apprentices eligible.
Malta				x			Wage Supplement scheme provided eligible employees with a basic wage (March 2020-May 2022). Funds were forwarded via the employer.
Netherlands	x			x	23.8	14.2	The existing short-time work program was replaced by a temporary wage subsidy; employees received 100 percent of their wage.
Poland				x	6.3	2.4	
Portugal	x	x	x		12.0	4.5	
Romania				x			Short-time work program with up to 80 percent of reduced work time.
Slovakia	x	x	x		12.6	8.0	
Slovenia				x	13.4	5.6	
Spain	x	x	x		11.5	4.9	
Sweden	x	x	x		7.6	4.3	Larger working time reduction of 80 percent between May and July 2020.
United Kingdom				x	21.2	12.8	Replacement rate for unworked hours is 80 percent of gross salary. The cost of unworked hours faced by firms set at zero. All workers who were on payroll on March 19 are eligible.

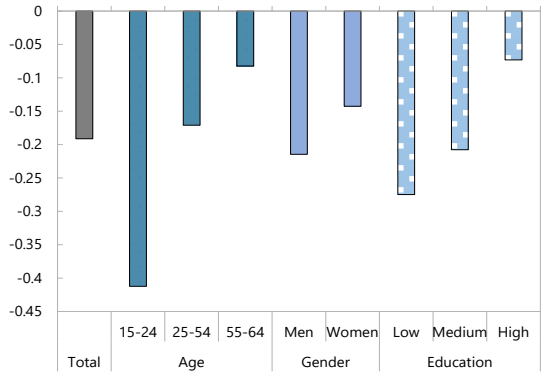
Sources: Ando and others (2022), Drahokoupil and Müller (2021), Giupponi, Landais, and Lapeyre (2022), and OECD (2020).
Note: The take-up rates of job-retention schemes refer to the maximum and the average of share of workers enrolled in job-retention schemes during March to December 2020. The indicators are expressed in percent of working-age population in the country.

The COVID-19 pandemic had a disproportionate impact on certain groups of workers. For example, young workers experienced the largest decline in employment and the largest rise in the unemployment rate between 2019 and 2020 (Figure 3). Workers with low-level of education also saw a large decline in employment rate, 5 percentage points on average at the EU level. In contrast, elderly and high-skilled workers were less affected, with their employment rates rising slightly by 1.7 and 2.4 percent, respectively. The findings that young and low-skilled workers were more sensitive to economic fluctuations coincided with empirical estimates before the pandemic. For example, pre-pandemic Okun's Law estimates suggest that unemployment rates of these groups are more responsive to output fluctuations (Figure 2), consistent with Ando and others (2022).

Figure 2. Relationship between Output Fluctuations and Labor Market Dynamics across Worker Groups

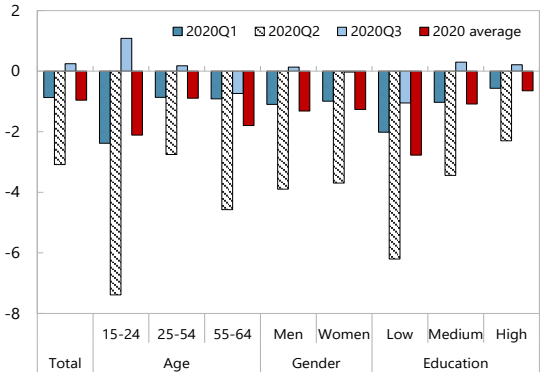
1. Estimated Okun's Law Coefficients, 1995-2019

(Coefficients, average across EU countries)



2. Actual Unemployment Rates Rose Less than Predicted Levels based on Okun's Law Estimates, 2020

(Percentage points, average)

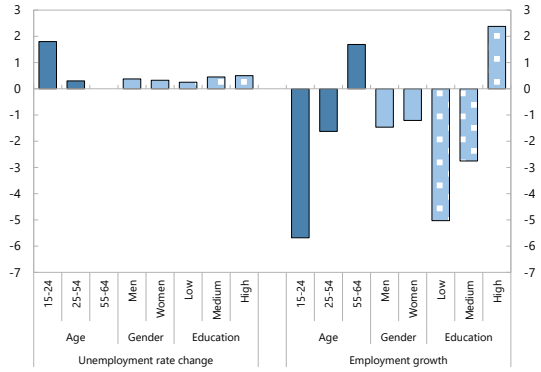


Sources: Eurostat and authors' calculations.
Notes: Okun's Law coefficient measures the impact of GDP growth on changes in the unemployment rate. The estimation sample includes 15 EU countries and covers the period during 1995Q1-2019Q4 (or earliest available). Coefficients for individual countries not statistically significantly at the 5 percent level are set to zero. Panel 2 shows the average prediction errors (the difference between the actual and predicted unemployment rates based on Okun's Law coefficients). Low education corresponds to less than primary and lower secondary. High education corresponds to tertiary education.

While job-retention schemes have contributed to preventing a surge in unemployment in EU countries, questions arise whether those schemes are effective to stabilize household incomes and target well to workers that are more vulnerable to job losses. The following section analyzes these by conducting micro-simulations.

Figure 3. EU-27: Changes in Unemployment Rates and Employment Growth, 2019-20

(Percentage points for changes in unemployment rate; percent for employment growth)



Sources: Eurostat and authors' calculations.

III. Data and Methodology

The analysis uses a microsimulation approach that quantifies how well existing tax and benefit systems or new policy measures buffer shocks to household market income (income before taxes and transfers). This approach allows a detailed analysis based on household characteristics, although it does not account for the feedback effects on aggregate income when policies change.

The analysis uses a static microsimulation model EUROMOD (version I4.0+) and microdata from the 2019 European Statistics on Income and Living Conditions (EU-SILC) for 26 EU countries. [5] The EUROMOD is a tax-benefit microsimulation model developed by the Joint Research Center (JRC) of the European Commission in collaboration with Eurostat and national teams from the EU countries. The model simulates country-specific direct tax liabilities and in-cash benefit entitlements for samples of representative households in EU countries (Sutherland and Figari 2013). The model allows us to calculate, in a comparable manner, the effects of tax and benefit policies on the income of individual households (see Annex I).

The paper conducts two sets of simulations to analyze how a change in taxes and benefits would stabilize income during an adverse shock.

1. The *first* set of simulations aims to assess to what extent income was stabilized in an adverse shock before the pandemic. The adverse shock is assumed to be a uniform 5-percent decline in market incomes of all households under the 2019 tax and benefit system (see Annex I). This help assess the size of automatic stabilizers—the built-in components in the budget that adjust automatically to cyclical changes in the economy—prior to the pandemic. The analyses simulate and compare two scenarios—the baseline and the income shock scenario. The baseline scenario is based on the tax-benefit system of individual EU countries in 2019 and the 2019 EU-SILC household-level microdata (assuming no major discretionary fiscal measures in 2019), while the income shock scenario is based on the 2019 tax-benefit system with a 5-percent decline in market incomes of all individuals in the 2019 EU-SILC microdata.

2. The *second* set of simulations assesses to what extent the announced fiscal support during the pandemic has stabilized household incomes. The analyses simulate and compare two scenarios—a "COVID-19" scenario and a counterfactual "no COVID-19" scenario. The COVID-19 scenario is based on the 2020 tax-benefit system and the 2019 EU-SILC microdata, adjusted to match the actual labor market conditions observed in 2020. The adjustment follows Christl and others (2022) and employs the Labor Market Adjustment (LMA) Add-on that simulates transitions between employment, unemployment and job-retention schemes based on the data from the European Labor Force Survey and other detailed administrative sources. [6] This scenario essentially captures how household incomes would change under a COVID-19 shock, taking into account the announced fiscal support measures. In the "no COVID-19" scenario, the analysis assumes that there were no pandemic-related labor market transitions (i.e., no rise in unemployment or decline in working hours as observed during the pandemic). The simulation uses the 2020 tax-benefit system and the latest available 2019 EU-SILC microdata.

In cases where the reference year of the microdata is different from that of the tax and benefit systems, the EUROMOD adjusts monetary variables in the microdata. The adjustment through uprating factors follows the

[5] The EUROMOD version I4.0+ is developed by the Institute for Social and Economic Research, University of Essex; Joint Research Centre, European Commission, 2022. The EUROMOD input files are based on 2019 EU-SILC microdata, which are made available by Eurostat for all EU countries except Germany.

[6] See the EUROMOD LMA Add-on documentation for further information.

EUROMOD modeling conventions. For example, an uprated adjustment is made to align the differences in reference years for household income (2018) and the tax and benefit system (2019).

The paper quantifies the extent of income stabilization by the tax and benefit system during an adverse income shock using an *income stabilization coefficient*, in line with the literature (Dolls and others 2012; Mohl, Mourre, and Stovicek 2019). The coefficient measures the average share of the market income shock that is absorbed by the tax and benefit system. It is defined as follows:

$$ISC = \left(1 - \frac{\sum_{h=1}^{N} \Delta Y_h}{\sum_{h=1}^{N} \Delta M_h}\right) \times 100 = \left(\frac{\sum_{h=1}^{N} \Delta T_h}{\sum_{h=1}^{N} \Delta M_h} + \frac{\sum_{h=1}^{N} \Delta S_h}{\sum_{h=1}^{N} \Delta M_h} - \frac{\sum_{h=1}^{N} \Delta B_h}{\sum_{h=1}^{N} \Delta M_h}\right) \times 100 \quad (1)$$

where ΔM_h (ΔY_h) is the change in market (disposable) income of household *h* following the shock. Variables ΔT_h, ΔS_h, and ΔB_h refer to the changes in personal income taxes, social insurance contributions, and social benefits, respectively. Social benefits include unemployment benefits, social assistance and housing benefits, family and education benefits, health and disability benefits. In the simulations of the COVID-19 shock, social benefits also include the monetary compensation received by workers on short-time work programs, wage subsidies, as well as similar schemes for self-employed, which the paper refers to broadly as job-retention schemes.[7] The income stabilization coefficient is equal to 100 percent when the market income shock is fully absorbed by the tax and benefit system. A zero coefficient means that the tax and benefit system does not compensate for income losses such that the change in disposable income (after taxes and transfers) is the same as the change in market income (before taxes and transfers).

IV. Simulation Results

A. Income stabilization before the pandemic

The first set of simulations suggests that the tax and benefit system in the EU countries, on average, can absorb 37 percent of an adverse income shock (5 percent decline in market income), reflecting the size of automatic stabilizers in the tax and benefit systems before the pandemic (Figure 4, panel 1). The estimates of income stabilization are in line with other estimates such as Mohl, Mourre, and Stovicek (2019) and Coady and others (2023), in which the latter finds that the size of automatic stabilizers had been stable during 2011-19 for the EU countries on average.[8]

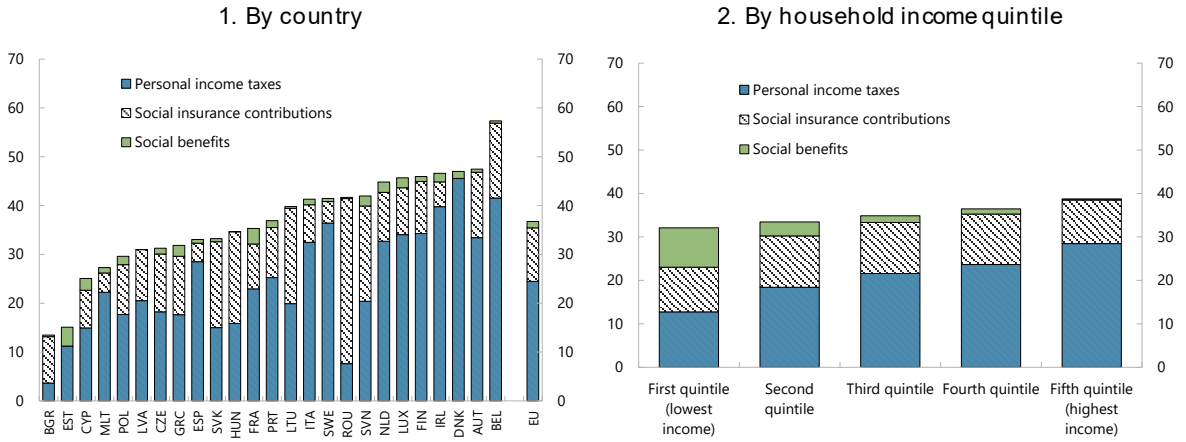
Within the tax and benefit system, personal income tax has been the largest contributor to the income stabilization during an adverse income shock. It absorbs 24 percent of the adverse income shock on average, accounting for more than half of the total income stabilization in most countries. However, there is considerable variation across countries in the EU, with coefficients ranging from 14 percent in *Bulgaria* to 57 percent in *Belgium*. The large variation reflects differences in the progressivity of the tax systems. Countries with more

[7] The complete list of monetary compensation schemes and other pandemic-related policies in the LMA Add-On is available in Christl and others (2022).

[8] Using the tax-benefit microsimulation model EUROMOD for 19 countries, Dolls and others (2012) assess the effectiveness of tax-benefit systems to provide income insurance through automatic stabilizers during the global financial crisis and find that automatic stabilizers absorbed 38 percent of a proportional market income shock in the EU, compared to 32 percent in the United States. European Commission (2017) analyzes the direct and total effects of automatic stabilizers on income in the 28 Member States for 2014 using the microsimulation model EUROMOD and the macrosimulation model QUEST, respectively. They estimate that the direct automatic income stabilization is about 33 percent on average, slightly higher than the total macro-based stabilization (29 percent) due to behavioral responses and macroeconomic feedback effects. Coady and others (2023) quantify the extent of automatic income and consumption stabilization in the EU prior to the COVID-19 pandemic, and find that, in 2019, tax-benefit policies absorbed 41 percent of the proportional market income shock on average, while only 15 percent of the market income shock was transmitted to household consumption.

progressive personal income taxes, such as *Belgium, Denmark,* and *Ireland*, tend to have higher stabilization from taxes, with personal income taxes absorbing at least 40 percent of the adverse income shock. This means that the applicable personal income tax would fall when households face an adverse hit in their income. Social insurance contributions and benefits are another key component of the automatic stabilizes in protecting households against income losses. Together they absorb a total of 12 percent of the income shock, amid large country variations.[9] In countries with limited progressivity of income taxes, such as *Bulgaria* and *Romania*, social protection systems contribute over 70 percent of income stabilization during adverse shocks.

Figure 4 Income Stabilization in EU before the COVID-19 Pandemic, 2019
(Percent, share of the shock absorbed by the tax and benefit system)



Source: Authors' calculations.
Note: Estimates are based on the EUROMOD I.40+ and microdata from the 2019 EU-SILC (excluding Germany) under the under the 2019 tax-benefit system and an illustrative 5-percent negative shock to market incomes for all households. For EU and each income quintile, the chart reports the average stabilization coefficients across countries. Income quintiles are calculated at the country level based on the household's market income in the baseline scenario. The difference between stabilization coefficients for top income quintile and the first income quintile is positive and statistically significant for 18 out of 26 EU countries. Social benefits include unemployment benefits, social assistance and housing benefits, family and education benefits, health and disability benefits. Pensions are excluded. Data labels in the figure use International Organization for Standardization (ISO) country codes. EU=European Union.

The size of income stabilization varies across household income distribution within a country, reflecting the progressivity of the tax system and the strength of the social protection system. Across the EU countries, household income tends to be stabilized more for higher-income households, with income stabilization coefficients ranging from 32 percent for the poorest income quintile to 39 percent at the top income quintile (Figure 4, panel 2). Nonetheless, social insurance and benefits play a more important role for lower-income households, contributing about two-thirds to the overall stabilization (20 percent out of 32 percent) relative to about one-quarter (10 out of 39 percent) for the households in the top income quintile. As for the social protection system, the social insurance contributions stabilize income by about 11 percent, broadly at the same degree across the household income distribution. In countries with stronger social safety nets, such as *Ireland, Luxembourg*, and *the Netherlands*, social benefits contribute more to the income stabilization at the lower end

[9] As the scenario considers a uniform 5-percent decline in household income without a change in unemployment, the income stabilization from unemployment insurance and assistance is muted. We have conducted alternative scenarios in which households face higher likelihood of unemployment in the event of an adverse income shock. The overall stabilization coefficient is similar to the baseline scenario, but unemployment income support would play a more important role, particularly in countries with strong unemployment income support systems. While the income stabilization coefficients are not entirely linear in the size of income shocks, alternative scenarios show that the income stabilization coefficients in individual countries are broadly unchanged if income shocks are between 0 and 10 percent.

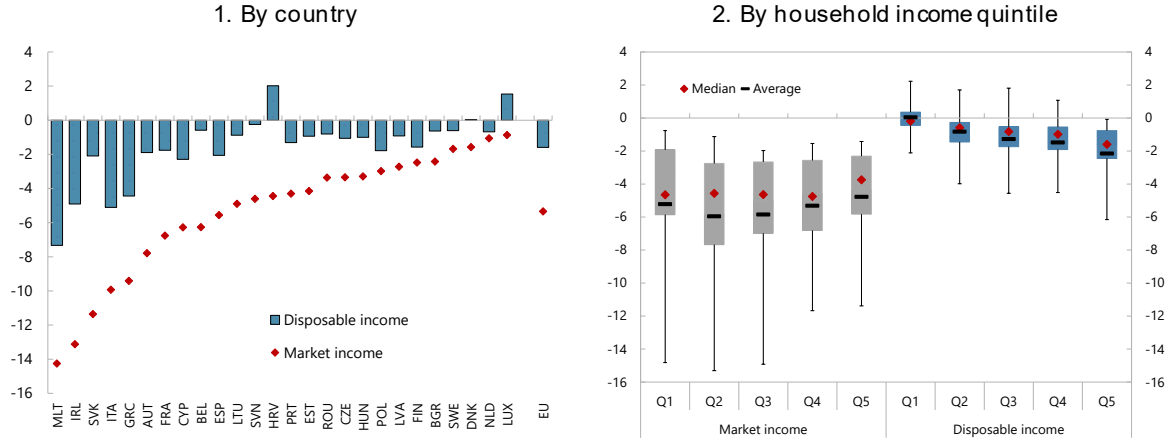
of the income distribution. In contrast, income taxes absorb a larger share of adverse income shocks for the high-income groups.

B. Income stabilization during the pandemic

Households suffered from a large decline in incomes during the pandemic, although the magnitudes vary across countries reflecting differences in labor market dynamics, severity of the pandemic, and policy responses. Simulations show that market incomes for households fell by 5.3 percent on average, with the largest drop of more than 10 percent in *Malta, Ireland, Italy, and Slovakia* (Figure 5). In contrast, some economies faced a smaller decline in market income, less than 2 percent (*Denmark, Luxembourg, the Netherlands*). Fiscal support measures mitigated part of the income shock, resulting in a milder drop of the disposable income (after taxes and transfers), by 1.6 percent in 2020. In a few countries, disposable income actually rose slightly because of large fiscal support measures at the onset of the pandemic (*Croatia, Denmark,* and *Luxembourg*).

Across the household income distribution, lower-income households tend to experience a larger decline in market incomes before accounting for fiscal support. For example, market incomes fell by a median of 4.6 percent for households in the lowest income quintile, while only by 3.7 percent for households in the top income quintile (Figure 5). Once accounting for the stabilization role of tax and benefit systems, the disproportionate impact on lower-income households was more than offset by pre-existing automatic stabilizers and fiscal support measures implemented during the pandemic. The disposable income after taxes and transfers remained broadly unchanged for lower-income households (implying fiscal measures were able to absorb the income shock), while it declined by about 2 percent for households at the top income quintile. These suggest that fiscal policy was impactful and progressive, mitigating largely the income shocks across the board, particularly for low-income households.

Figure 5. Simulated Changes in Market and Disposable Incomes During the Pandemic
(Percent)

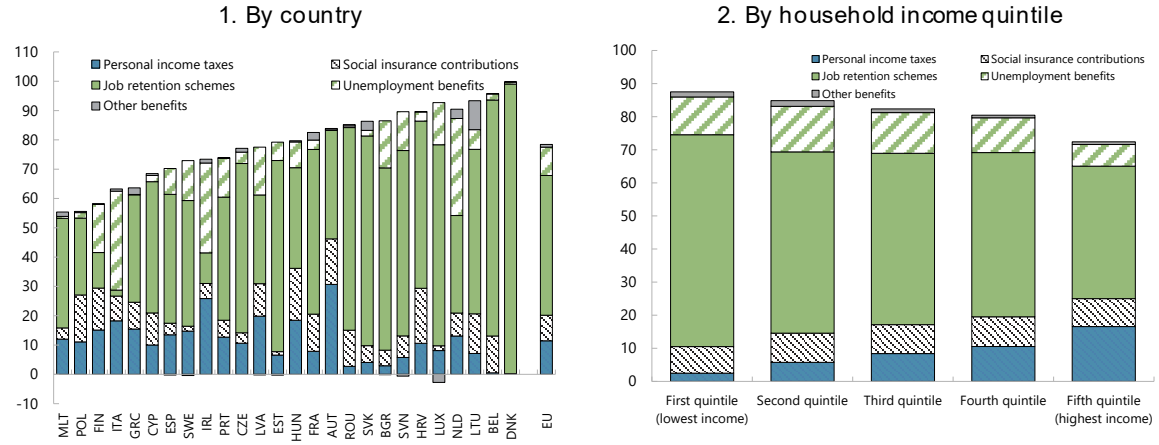


Source: Authors' calculations.
Note: Estimates are based on the EUROMOD I.40+ and microdata from the 2019 EU-SILC (excluding Germany). Labor market shock is simulated to replicate the 2020 labor market conditions using Labor Market Adjustment (LMA) Add-On. For EU and each income quintile, the average percentage change in market and disposable incomes across countries are reported. The box-whisker shows the variation across EU countries, with the interquartile range (box), and 5th and 95th percentiles (whiskers). Income quintiles are calculated at the country level based on the household's market income in the baseline "no COVID-19" scenario. Data labels in the figure use International Organization for Standardization (ISO) country codes. EU=European Union.

Fiscal support was impactful in stabilizing household incomes during the pandemic in the EU. Together with pre-existing automatic stabilizers, fiscal support had absorbed 78 percent of the decline in market incomes across countries (Figure 6), almost double the stabilization observed before the pandemic.[10] The income stabilization varied across countries, ranging from 55 percent in *Malta* and *Poland* to almost 100 percent in *Belgium* and *Denmark*. These explain large differences between changes in market and disposable incomes during the pandemic, as well as a relatively muted impact on the disposable income even in countries that faced a severe pandemic shock.

Among various components in the tax and benefit systems, job-retention schemes (including short-time work, wage subsidies, and other similar schemes for self-employed) had contributed significantly to stabilizing incomes. Such schemes preserved jobs and compensated workers for the reduction of working hours. They stabilized 47 percent of the income shock on average (or about 60 percent the overall income stabilization, i.e., 47 out of 78 percent), far exceeding other components such as personal income taxes or social insurance contributions (Figure 6). Job-retention schemes are more impactful in countries where workers receive a higher compensation rate for hours not worked, such as in *Czech Republic, Denmark,* and *Slovak Republic* (OECD 2021). As the EU countries only experienced a modest rise in unemployment rates during the pandemic, income stabilization from unemployment income support compensated for a mere 9 percent of the adverse shocks.

Figure 6. Income Stabilization after the COVID Shock, by Country and Income Level
(Percent, share of the shock absorbed by the tax-benefit system)

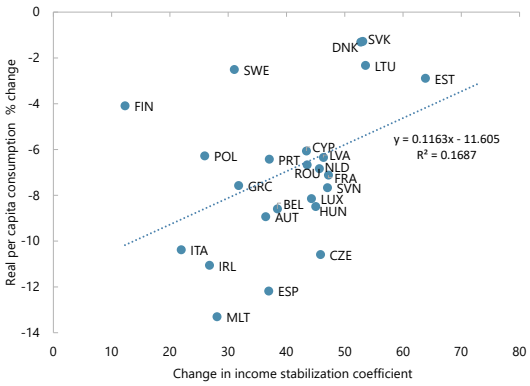


Source: IMF staff calculations.
Note: Estimates are based on the EUROMOD I.40+ and microdata from the 2019 EU-SILC (excluding Germany). Labor market shock is simulated to replicate the 2020 labor market conditions using Labor Market Adjustment (LMA) Add-On. The chart reports the average stabilization coefficients for EU countries and each household income quintile. Income quintiles are calculated at the country level based on the household's market income in the "no COVID-19" scenario. Job-retention schemes include compensation received by employees on short-time work schemes, wage subsidies, as well as similar schemes for self-employed. Other benefits include social assistance and housing benefits, family and education benefits, health and disability benefits. Pensions are excluded.

[10] Christl and others (2022) find that the European tax-benefit systems absorbed about 75 percent of the market income shock at the EU level during the pandemic in 2020, of which the monetary compensation (job-retention) schemes played a major role. They also estimated that consumption was largely stable (at 90 percent of the shocks) based on the marginal propensity to consume proxied by the likelihood of liquidity constraints before the pandemic. However, during the pandemic, consumption was restricted not just because of liquidity constraints or income deterioration but also because of lockdown restrictions and social distancing requirements. This suggests the stabilization of consumption cannot be easily estimated based on the pre-pandemic parameters.

Our estimates of the income stabilization coefficients have a strong correlation with the actual data. Countries with a strong income stabilization during the pandemic tend to experience a smaller decline in per-capita real disposable income and real per-capita private consumption expenditure at the aggregate level. It suggests some evidence of correlation, not necessarily a causation (Figure 7).

Figure 7. Correlation of Simulated Income Stabilization Coefficients and Actual Change in Per-Capita Consumption, 2019-20
(Percentage points)

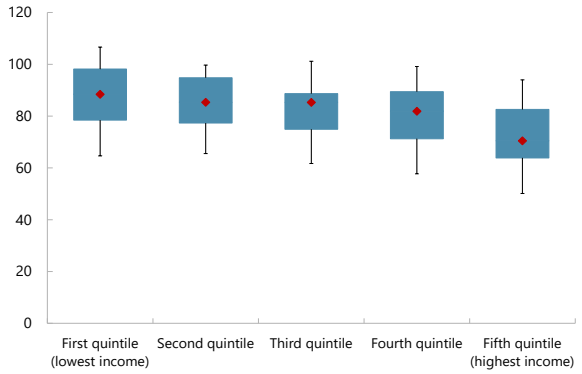


Source: Eurostat and authors' estimates.
Note: Consumption growth corresponds to the percentage change in real final consumption expenditure of households and non-profit institutions serving households in per capita terms between 2019 and 2020. The change in income stabilization coefficient is the difference between coefficients simulated during the pandemic and pre-pandemic levels.

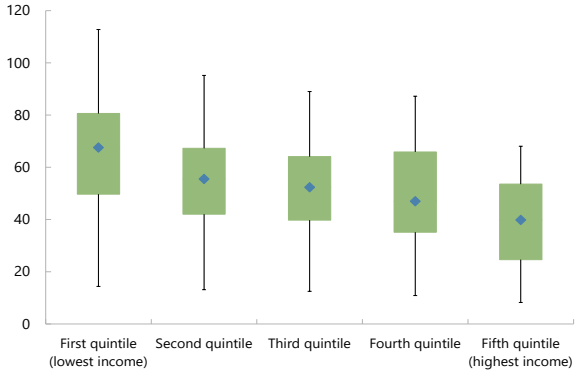
Simulations also allow an assessment on how job-retention schemes can stabilize income across income groups. For each country, we calculate the income stabilization coefficients for five income groups (quintiles) according to the household market income in the "no-COVID19" scenario. Results show that the tax and benefit systems, together with the pandemic-related support measures, stabilized household incomes more strongly for lower-income households. They absorbed 88 percent of the income shock during the pandemic for lower-income households, more than for households at the top quintile (72 percent of the income shock) (Figure 6, panel 2).[11] Job-retention schemes account for the bulk of the overall stabilization

Figure 8. Income Stabilization During the Pandemic across Households
(Percent, share of the shock absorbed by the tax-benefit system)

1. Income stabilization coefficient



2. Contribution of job-retention schemes



Source: Authors' calculations.
Note: Estimates are based on the EUROMOD I.40+ and microdata from the 2019 EU-SILC (excluding Germany). Labor market shock is simulated to replicate the 2020 labor market conditions using Labor Market Adjustment (LMA) Add-On. The box-whisker shows the variation across EU countries, with the median level (marker), interquartile range (box), and 5th and 95th percentiles (whiskers). Income quintiles are calculated at the country level based on the household's market income in the "no COVID-19" scenario. Job-retention schemes include compensation received by employees on short-time work schemes, wage subsidies, as well as similar schemes for self-employed.

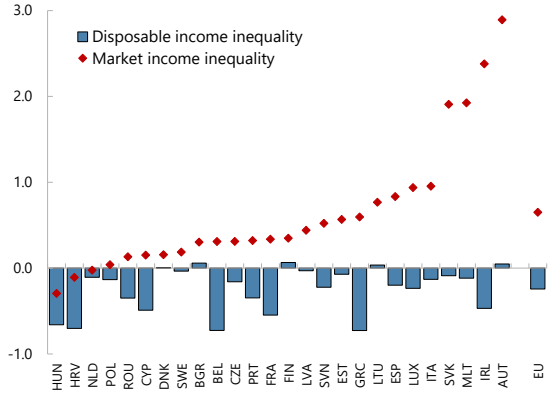
[11] Similarly, the temporary expansion of unemployment income support in the United States was more progressive with most benefits accruing to low-income workers (Ganong and others 2022).

across the board for all income groups, particularly for lower-income households compensating 64 percent of their income shocks. They contributed to the overall income stabilization much more than other components in the tax and benefit system. These results are robust across countries and household income groups, suggesting that job-retention schemes were impactful to protect household income and well targeted as they stabilized income more strongly for lower-income households (Figure 8).[12]

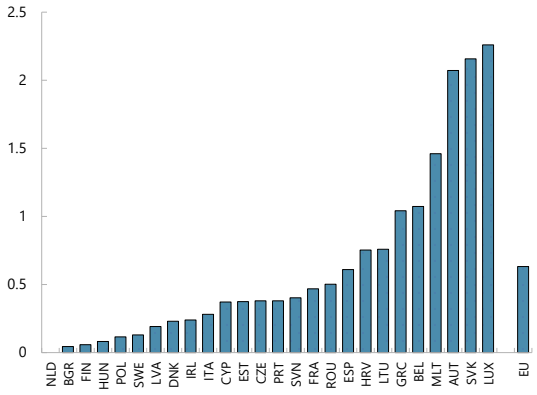
Fiscal measures during the pandemic helped protect households against large income losses. They also played a redistributive role by mitigating the rise in income inequality and protecting people's livelihoods. Simulations suggest that the pandemic could have led to a rise in the market income inequality—measured by Gini coefficients—by 0.65 percentage points as lower-income households were more disproportionately affected during the pandemic. Without job-retention schemes, the disposable income inequality could have risen by 0.38 percentage points compared to the "no COVID-19" scenario (Figure 9).[13] But once accounting for the pandemic-related fiscal support, the tax and benefit systems were able to protect household incomes, especially of lower-income groups. Inequality in disposable income during the pandemic had decreased by 0.24 percentage points on average. The impact of job-retention schemes on disposable income inequality varies across countries, reflecting differences in the design of job-retention schemes, the differences of the pandemic impact, and the heterogeneity of labor markets.

Figure 9. Redistribution Effects of Fiscal Measures During the Pandemic
(Change in Gini coefficients, percentage points)

1. Impact of the COVID Shock on Inequality



2. Impact of Job-Retention Schemes on Disposable Income Inequality



Source: Authors' calculations.
Note: Estimates are based on the EUROMOD I.40+ and microdata from the 2019 EU-SILC (excluding Germany). Labor market shock is simulated to replicate the 2020 labor market conditions using Labor Market Adjustment (LMA) Add-On. Panel 1 shows changes in Gini coefficients of market (disposable) income following the COVID shock (between "no COVID-19" scenario and the pandemic scenario). Panel 2 shows the change in Gini coefficients of disposable income under the pandemic scenario with and without job-retention schemes.

Certain workers were more vulnerable to adverse shocks. For example, workers in the contact-intensive sectors were exposed to greater job losses during the pandemic. A strong and effective job-retention scheme should have stabilized income for workers who are more vulnerable. Our simulation results compare the impact of job-retention schemes across different worker groups and assess if the stabilization effects are greater for

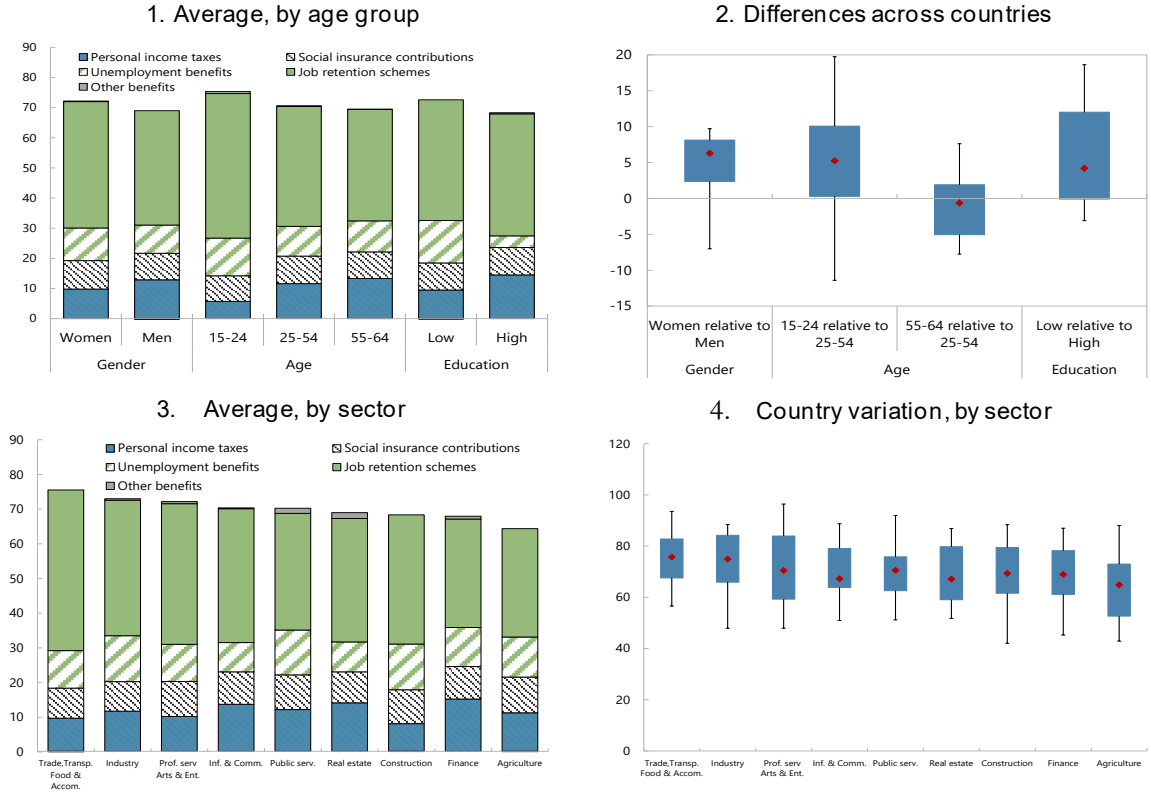
[12] In a few countries, the job-retention schemes stabilized more than 100 percent of the income shocks for the lowest income quintile because some schemes provided a lump sum support and may have more than compensated for the income losses for households earning very little income.

[13] The rise in disposable income inequality would also be affected by progressive income taxes and other means-tested benefits, which partly compensate for the decline in income even without the job-retention schemes.

vulnerable workers, such as young workers and those with low skills. We classify workers according to their age (18-24 years old, 24-55 years old, and 55-64 years old), gender, and education attainment (low-skilled and high skilled). Income stabilization coefficients are calculated for all individuals of the working age (aged 15-64) from the corresponding group j:

$$ISC^j = \left(1 - \sum_{i=1}^{N^j} \Delta Y_i / \sum_{i=1}^{N^j} \Delta M_i\right) \times 100 \qquad (2)$$

Figure 10. Simulated Income Stabilization Coefficients by Worker Groups and Sectors
(Percent, share of the shock absorbed by the tax-benefit system)



Source: Authors' calculations.
Note: Estimates are based on the EUROMOD I.40+ and microdata from the 2019 EU-SILC (excluding Germany). Labor market shock is simulated to replicate the 2020 labor market conditions using EUROMOD Labor Market Adjustment (LMA) Add-on. Panel 1 shows average stabilization coefficients across countries for each group. Job-retention schemes include compensation received by employees on short-time work schemes, wage subsidies, as well as similar schemes for self-employed. Other benefits include social assistance and housing benefits, family and education benefits, health and disability benefits. Pensions are excluded. Low level of education corresponds to upper secondary or below. High level of education corresponds to post-secondary and tertiary education. Panel 2 shows the variation across countries for each worker group. Panel 3 shows the average coefficients for each sector across countries. The boxes in panels 2 and 4 correspond to the interquartile range, the marker to the median, and whiskers to 5th and 95th percentiles.

Simulation results show that the income stabilization coefficients are on average stronger for workers aged 18-24 years old and those with lower educational attainment (Figure 10, panel 1). The tax and benefit systems, including the job-retention schemes, absorbed about 75 percent of the income losses for the young workers during the pandemic, compared to 70 percent of those aged 25 and older. Income stabilization was also stronger for workers with lower education (absorbing over 72 percent of the income shock) and females (72 percent). Job-retention schemes played an important role across all worker groups, absorbing almost half of the income shock for young workers and about 40 percent of the shock in other groups. Unemployment income

support also helped stabilize income during the pandemic, particularly for low-skilled workers. There is no major difference in the stabilization effects of social insurance contributions across worker groups.

Differences across worker groups were observed in many countries (Figure 10, panel 2). Income stabilization for females is stronger in over 80 percent of EU countries (by as much as 6 percentage points on average). Similarly, majority of countries have their tax and benefit systems stabilizing income more for young workers and those with lower levels of education.

The job-retention schemes also stabilized income more for workers in contact-intensive sectors that were affected the most by lockdown restrictions and social distancing (Figure 10, panel 3). Income stabilization was the strongest in trade, transport, food and accommodation sectors (absorbing 75 percent of income losses), while the stabilization is lower for less contact-intensive sectors such as finance and agriculture. Country variations remain large (Figure 10, panel 4).

C. Regression analysis

While the simulation results point to some differences across household income groups and worker characteristics in terms of the effectiveness of the job-retention schemes, a regression analysis would help assess whether those differences are statistically significant or not, controlling for other factors such as the size of pandemic-related support, and pre-existing social protection systems. The regression specification follows:

$$ISC_{i,c}^{COVID} = \alpha + X_{i,c}\beta + Y_c\gamma + D_c\delta + \varepsilon_{i,c} \qquad (3)$$

where $ISC_{i,c}^{COVID}$ is the income stabilization coefficient for an individual *i* from country *c* folllwing the pandemic shock. The income stabilization coefficient for an individual *i* is calculated as $ISC_i = (1 - \Delta Y_i/\Delta M_i) \times 100$. $X_{i,c}$ is a vector of individuals' characteristics, such as age, gender, the level of education, contact intensity of the sector that individual works, and the market income quintile the individual belongs to; Y_c is a vector of county-specific macro-fiscal variables, including allowance of the job-retention scheme (i.e. percent of lost income that a worker receives for hours not worked), the change in cyclically adjusted primary deficit between 2019 and 2020 in percent of potential GDP, a net replacement rate in unemployment, and a percentage change in the average number of hours worked per worker between 2019 and 2020. The specification includes a vector of country dummy variables D_c.

Estimation results provide evidence that the tax and benefit systems, alongside with the pandemic-related support, have stabilized income more strongly for female workers, workers employed in contact-intensive industries and those with lower level of education. The corresponding coefficients are positive and statistically significant (Table 2). The coefficients for those households in the lower-income quintiles tend to be higher, suggesting the tax and benefit systems are able to stabilize their income more in face of an adverse shock.

At the same time, empirical results show that countries with higher allowance rates of the job-retention schemes or more generous unemployment benefits tend to exhibit a stronger income stabilization. But the income stabilization effects are weaker in countries that experienced a larger decline in working hours for workers. Countries that have stronger counter-cyclical fiscal responses, as measured by the change in cyclically adjusted primary balance, have greater income stabilization, suggesting discretionary fiscal support can help stabilize income for individual households.

Table 2. Regression Results on Differences of Income Stabilization across EU Households

	Dependent variable: Income Stabilization Coefficient				
	(1)	(2)	(3)	(4)	(5)
Age between 15-24	1.953	1.602	1.594	-1.653	-0.772
Age between 55-64	-2.307***	-2.164**	-2.164**	-1.651**	-1.769**
Female	4.447***	4.027***	4.087***	1.740***	1.918***
Education level, low	4.937***	4.441***	5.064***	0.906	1.308
Contact-intensive		3.876***	5.593***	2.896***	2.607***
Contact-intensive × Education level, low			-2.383**	-0.597	-1.462
Market income, the lowest quintile				3.713	3.939
Market income, 20th to 40th percentile				3.813**	3.867*
Market income, 60th to 80th percentile				-3.605**	-3.253*
Market income, the top quintile				-11.40***	-11.13***
Job retention scheme allowance, percent of lost income					0.495***
Change in cyclically adjusted primary deficit 2020					2.378***
Net replacement rate in unemployment, percent of previous income					0.407***
Hours per worker, percentage change in 2020					0.372***
Numer of country dummies	25	25	25	25	16
Constant	80.70***	80.17***	79.76***	85.26***	14.67***
Observations	48,945	48,945	48,945	48,945	41,365
Number of countries	26	26	26	26	21

Source: Authors' estimates.
The table reports results of the pooled ordinary least squares estimation. The dependent variable is the individual's income stabilization coefficient estimated based on simulations in the EUROMOD I.40+ and microdata from the 2019 EU-SILC (excluding Germany). Labor market shock is simulated to replicate the 2020 labor market conditions using EUROMOD Labor Market Adjustment (LMA) Add-on. Income quintiles used to construct dummy variables are calculated at the country level based on the individual's market income in the "no COVID-19" scenario. Low level of education corresponds to upper secondary or below. Contact intensive sectors include trade, transport, food and accommodation, professional services, arts and entertainment. Standard errors are clustered at the country level. ***p<0.01, **p<0.05. *p<0.1

V. Policy Implications and Conclusions

Diverse and forceful fiscal responses during the pandemic opened new grounds to support households against large income or job losses. The preceding analyses on job-retention schemes provide some takeaways that can inform the policy design.

The use of job-retention schemes across the EU helped prevent widespread job losses and stabilized household incomes when people suffered from a severe shock. Such schemes have proved to be timely, effective, and well-targeted—providing significant income stabilization in general and particularly to those workers that are vulnerable to job and income losses. Our microsimulation approach points to the evidence that job-retention schemes during the pandemic absorbed nearly 80 percent of market income shocks—almost doubling the extent of the automatic stabilization of the pre-pandemic tax and benefit systems. In the absence of those schemes, unemployment rates in the EU could have risen by additional 3 percentage points and income inequality could have deteriorated further. Empirical results also show strong evidence that job-retention schemes were well-targeted, with stronger income stabilization of vulnerable households, such as lower-income families, youth, and low-skilled workers, after controlling for other factors.

Job-retention schemes are complementary to the unemployment income support because they work on different margins (working hours versus unemployment) and tend to insure different types of workers (Giupponi, Landais, and Lapeyre 2022). Both policies can provide a timely buffer and cushion the loss of labor

income. In case of a severe shock, governments are wary of the risks of massive layoffs, which could undermine the valuable employer-employee relationships, especially in countries with more rigid labor markets that are less capable to absorb unemployed workers quickly or in countries where social safety nets are inadequate. Job-retention schemes could help limit productivity losses from unemployment (IMF 2022).

Job-retention schemes can become a more prominent part of the resilience toolkit in response to adverse shocks. Once the job-retention schemes are in place, they can be expanded or broadened depending on the severity of the shocks, particularly to those who are not qualified or fall outside the regular unemployment income support, such as workers who have not worked long enough for the unemployment assistance. Experience during the pandemic shows that many governments can unwind the support through those schemes once economic conditions improve, as the take-up rates of those schemes have quickly returned to the pre-pandemic low levels. Nonetheless, it is crucial to link the generosity of those schemes to economic activity and incentivize workers and firms to return to normal working hours (Ando and others 2022). Job-retention schemes are best used in situations when the adverse shocks are deep but pose short-lived disruptions to labor markets. If the adverse shock turns out to be more persistent, preserving jobs through job-retention schemes would hinder necessary reallocation, and policies should gradually transition from protecting jobs to supporting workers and facilitating job-to-job transitions.

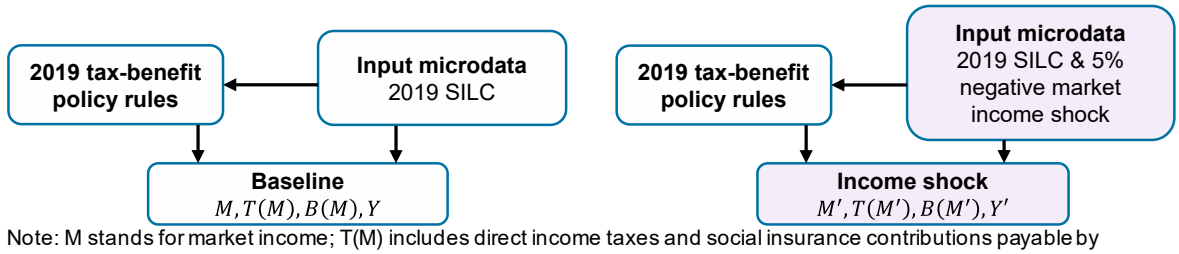
Annex I. Simulations of Shocks in EUROMOD

The annex describes how the simulations are conducted based on the household level data and the tax-benefit systems for EU countries. The simulations are done in EUROMOD version I4.0+ for all EU countries except Germany and United Kingdom.

The EUROMOD is a tax and benefit microsimulation model that simulates individual and household tax liabilities and benefit entitlements according to the policy rules in place in each country. It calculates, in a comparable manner and based on representative micro-data on individuals and households drawn from national household income surveys, the static effects of the tax and benefit system on household incomes for each country. EUROMOD aims to simulate as much as possible of the tax and benefit components of household disposable income, includng income taxes, social contributions, family benefits, housing benefits, social assistance and other income-related benefits. Some instruments, such as contributory benefits and pensions, are not simulated due to lack of information on previous employment and contribution history in the cross-sectional surveys and are taken directly from the data. Please see Sutherland and Figari (2013) for the detailed description of the EUROMOD model.

Two scenarios are simulated to assess the size of income stabilization prior to the pandemic. The baseline scenario uses the 2019 EU-SILC household-level microdata and the 2019 tax and benefit policies. In the scenario of a uniform market income shock, the simulation uses a negative 5-percent reduction of market income across all households with nonnegative income. We then compute changes in market and disposable incomes between the baseline and the uniform market income shock scenario for each household and calculate the income stabilization coefficients for each country. To estimate income stabilization across households' income distribution, income stabilization coefficients are calculated for every income quintile of each country.

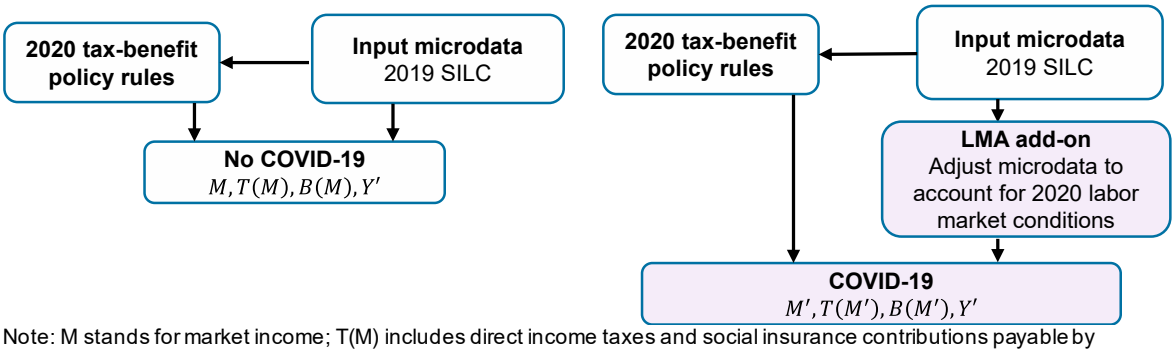
Annex Table I.1. Uniform Market Income Shock



Note: M stands for market income; T(M) includes direct income taxes and social insurance contributions payable by households, and B(M) is the benefits accrued to households. Y is the disposable income, which is market income net of taxes and transfers (Y=M-(T(M)-B(M)). Variables with an apostrophe denote the shock scenario.

We simulate two hypothetical scenarios to gauge the size of income stabilization during the pandemic. The "no COVID-19" scenario uses the 2019 EU-SILC household-level microdata and the 2020 tax-benefit policies. The "COVID-19" scenario is based on the 2020 tax-benefit policies and the 2019 EU-SILC microdata adjusted to match the 2020 labor market conditions. The Labor Market Adjustment (LMA) Add-on is used to adjust and simulate transitions between employment, unemployment and job-retention schemes based on the data from the European Labor Force Survey and other detailed administrative data. We then compute changes in market and disposable incomes between the "no COVID-19" and "COVID-19" scenarios and calculate the income stabilization coefficients for each country. To estimate income stabilization across households' income distribution and worker groups, income stabilization coefficients are calculated for every income quintile and worker group of each country, respectively.

Annex Table I.2. COVID-19 Shock



Note: M stands for market income; T(M) includes direct income taxes and social insurance contributions payable by households, and B(M) is the benefits accrued to households. Y is the disposable income, which is market income net of taxes and transfers (Y=M-(T(M)-B(M)). Variables with an apostrophe denote the shock scenario.

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