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The Effects of Job Retention Schemes on Employment Preservation during the COVID-19 Epidemic in Euro Area Countries

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In this paper, we analyse the effects of different job retention (JR) schemes take-ups on the preservation of employment during the COVID-19 pandemic in euro area countries. We find that JR schemes in euro area countries helped reduce job losses during the pandemic. The most effective in preserving employment were take-ups of the most extensively updated pre-existing short-time work (STW) schemes that were more generous and included nonstandard workers. However, the impact of JR schemes was less than the overall employment preservation achieved. In contrast to the Great Recession, macroeconomic measures of economic support also helped preserve jobs during the pandemic as well. Corresponding differences in sectoral employment preservation effects show that such macroeconomic support led to more jobs being kept, especially in the group of vulnerable service sectors.

Key Words: COVID-19 pandemic, job retention schemes, short-time work schemes, macroeconomic measures

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INTRODUCTION

Job retention (JR) schemes feature among the key instruments for mitigating the effects of the lockdowns on employment and social hardship introduced or extended by different countries in response to the crisis. Such schemes provided strong income support to workers with reduced working hours, reduced income losses, bolstered aggregate demand, and significantly lowered the number of jobs at risk of being terminated due to liquidity constraints (OECD 2021).

JR schemes can take the form of short-time work (STW) schemes that directly subsidise hours not worked, such as Germany's *Kurzarbeit* or France's *Activité partielle.* They can also include wage subsidy (WS) schemes that subsidise hours worked, and can in addition be used to top up the earnings of workers with reduced hours, such as the Netherlands' Emergency Bridging Measure (*Noodmatregel Overbrugging Werkgelegenheid,* NOW) or the JobKeeper Payment in Australia.

 A crucial aspect of all these JR schemes is that employees keep their contracts with the employer even if their work is fully suspended. According to an OECD assessment (OECD 2020a), in the second quarter of 2020, when take-up rates peaked, JR schemes were being implemented in almost all OECD countries, covering around 60 million workers. In comparison, during the Great Recession, JR schemes only included some 6 million workers, even though 16 OECD countries launched JR schemes or had implemented the schemes already early on in the crisis and 7 OECD countries had introduced new schemes during that period (Hijzen and Venn 2011).

However, research on the impact of JR schemes on employment preservation in the pandemic has brought mixed results. Adams-Prassl et al. (2020) find that in Germany, with a well-established short-time work (STW) scheme, 34% of employees in work at the onset of the pandemic had been asked to reduce their hours to benefit from this scheme. In April 2020, only 5% of German workers had lost their jobs compared to the USA and the UK where the respective figures were 20% and 17% of individuals (Adams-Prassl et al. 2020). Similarly, the JobKeeper Payment scheme in Australia is estimated to have saved one in five jobs (Bishop and Day 2020). In contrast, OECD analysis based on the take-up[1] of JR schemes in OECD countries shows JR schemes had a relatively small effect on employment (compared to data on employment in hours decline), according to which removing the JR schemes would have led to a drop in employment of between 6% and 11% (OECD 2021).

Besides the high costs, an intriguing aspect of running intensive JR schemes might be the 'deadweight effects,' namely, the risk of supporting jobs that actually do not need support (OECD 2021). Thus, governments could be reluctant to use the existing support schemes once they discover their limited reach. This might explain why in most EU (developed) countries scheme cover grew strongly in the second quarter of 2020 but eased considerably already by the next quarter to fall behind the second quarter level in almost every country. This was also seen

[1] Take-up rates refer to actual use and are calculated as a share of total employees in short-time work (OECD 2020a).

during the second and third waves of epidemic when the pick-up in economic activity continued, even though in the most of these countries scheme cover remained available until the middle of 2022.

In addition to JR schemes, EU countries sought to reduce the harmful effects of the lockdowns on economic activity, employment, and social hardship by launching other powerful fiscal and monetary measures, which had strong and different effects in various sectors of economic activity and hence also on employment. Given that JR schemes were simultaneously operating alongside those policy measures, evaluating the effects of JR schemes by only considering firm-based empirical evidence on the pure take-up of JR schemes' cover could be biased. Moreover, while evaluating the employment preservation effects of such take-ups, one must also consider the sectoral different intensity of the impact of the economic support measures. Sectoral use of JR schemes during the COVID-19 pandemic is quite unlike that seen in the Great Recession. During the first three waves of the epidemic, JR schemes affected employment across many sectors and types of firms, whereas in the Great Recession almost 80% of JR scheme take-ups were concentrated in manufacturing (OECD 2020a).

In this paper, we analyse the effects of different job retention (JR) schemes' take-ups on employment preservation during the COVID-19 pandemic in euro area countries considering the complete portfolio of policy measures and sectoral effects as a crucial non-policy-related factor. We find that JR schemes in the euro area countries helped reduce job losses during the pandemic. The most effective in retaining employment were take-ups of the most extensively updated, pre-existing short-time work (STW) schemes that were generous and included non-standard workers. However, the impact of JR schemes take-ups was less than the achieved level of employment that was preserved. Corresponding differences in sectoral employment preservation effects show that macroeconomic support eased the loss of employment especially in the group of vulnerable service sectors.

Our study complements previous research (Hijzen and Venn 2011; Aiyar and Dao 2021) since assessments of what determines the size and quarterly dynamics of JR schemes take-ups support, and their employment preservation effects by sectors and based on macroeconomic data are rare or only partial. The study contributes to the literature on the implementation and effectiveness of various JR scheme take-ups in different countries regarding several COVID-19 waves and sectors. In addition, the effects of other macroeconomic (non-JR schemes) measures on employment as well as potential sectoral differences in such macroeconomic employment support are also presented.

LITERATURE REVIEW

Although in the Great Recession JR schemes covered ten times fewer workers than in the recent pandemic, their implementation and effectiveness soon became a subject of academic research. As early as 2011, the OECD conducted a detailed analysis of JR schemes' impact and role during the Great Recession (Hijzen and Venn 2011). The study describes the characteristics of the schemes implemented (albeit, it deals solely with STW schemes) and evaluates their effectiveness in preserving employment in the short and long run (in bust and recovery). It underlines two important potential shortcomings of these schemes. First, it assessed that the impact on jobs was smaller than the potential number of jobs saved, indicating weak targeting and, second, that the schemes led to greater labour segmentation if limited to workers holding permanent contracts.

Similar ambition and results may be seen in a study by Boeri and Bruecker (2011). They found that STW helped reduce job losses during the Great Recession. Still, according to their macroeconomic estimates, the number of jobs saved was less than the full-time equivalent jobs involved in these programmes, in some cases pointing to sizeable deadweight costs entailing the same moral hazard problems as those arising with the provision of unemployment insurance. Workers and employers might collude to extract payments from the state even when incentives for reductions in hours would not be required to avoid layoffs as the firm was no longer facing a negative demand shock.

The performance of JR schemes during the recovery period of the Great Recession episode was analysed in by Hijzen and Martin (2013). They found that STW raises the output elasticity of working time and helps preserve jobs in the sizeable context of a recession by making employment less elastic with respect to output. A key finding was that the timing of STW was crucial.

One can also find several papers dealing with JR schemes' performance during the Great Recession in specific countries. See, for example, Bellmann, Gerner, and Upward (2015) regarding Germany, Calavrezo, Duhautois and Walkoviak (2009) analysing the situation in France, and Siegenthaler and Kohl (2019), describing the Swiss experiences with JR schemes during the Great Recession and afterwards.

As the pandemic developed, many studies tracked the initial impact of the COVID-19 induced crisis on the USA and European countries regarding employment, hours worked, and income (International Labour Organization 2020; 2021; Zimpelmann et al. 2021; Cotofan et al. 2021; Anderton et al. 2020). Gangopadhyaya and Garrett (2020) compared the level of unemployment in both crises: the Great Recession and COVID-19. They found that during the Great Recession unemployment in the USA reached 10%, while during the pandemic unemployment spiked at 12.8%. Anderton et al. (2020) analysed the COVID-19 pandemic's impact on the euro area labour market from the perspective of the cumulative contribution of four specific economic shocks to changes in total hours worked and the labour force: a technology or productivity shock, a shock in the labour supply (via a shock to labour force participation), a shock giving rise to an increase in the demand for labour, and a wage bargaining shock.

The OECD (2020a) analyses the JR schemes that OECD countries relied on during the (first wave of) the COVID-19 pandemic. The OECD estimates that STW schemes typically allow reduced working time at zero cost to firms, while WS schemes generally permit larger reductions in labour costs than STW schemes, yet are associated with greater fiscal costs or weaker income protection for workers. Due to the better targeting of STW subsidies to firms likely to experience financial difficulties, they are probably more effective at saving jobs than WS schemes. According to OECD simulations based on the single-hit scenario, STW subsidies reduce the share of jobs at risk by 10 percentage points from 22%, whereas this is only 7 percentage points under WS. A smaller section of the study also discusses the sectoral dimension of the JR schemes' effects.

Another study for G20 countries (OECD 2020b) finds that diverse working arrangements offered less security and were concentrated in affected sectors. Workers in a range of employment forms that vary from a full-time wage and salary work under a permanent contract – such as self-employed workers, those on temporary, on-call or part-time contracts, and informal economy workers – have been very vulnerable to the job and income losses triggered by the pandemic.

An OECD (2020c) study stresses that the sectors most directly affected by the COVID-19 containment measures account for around 40% of total employment and these sectors employ a large share of nonstandard workers, i.e., part-time workers, self-employed, and workers hired under fixed-term contracts. Relative to permanent employees, temporary workers have a higher risk of losing their jobs and less chance of being enrolled in short-time work schemes.

[120] The OECD (2021) devotes a separate chapter to the JR schemes in place during the first three waves of epidemic. The paper tackles the size and volatility of the JR schemes take-ups, deals with sectoral differences in take-ups, as well as the dependence of employment support on the size of workers income.

Several studies of JR scheme effectiveness have looked at programmes in particular countries, yet their results are also inconclusive. Smaller estimates than expected are also evident in an IMF study for Germany (Aiyar and Dao 2021), whereas estimated effects of the JobKeeper Payment scheme in Australia show just the opposite – much higher effects, with the JR scheme being estimated to have saved the job of one in five employees (Bishop and Day 2020). Results also differ significantly for studies of the same scheme and country, such as studies of the Paycheck Protection Program (PPP) used in the USA (Autor et al. 2020; Hubbard and Strain 2020).

DATA, DESCRIPTIVE STATISTICS OF MAIN VARIABLES AND HYPOTHESES

Data

We can generally capture the observations made in the previous sections in the following equation:

$$\textit{Job preservation} = f(\textit{JR schemes, macroeconomic effects of the portfolio of fiscal and monetary measures, sectors}) \quad (1)$$

We explain the sources of data and construction of the main variables below.

Our analysis is based on quarterly data from the first quarter of 2019 until the second quarter of 2021 (Q1 2019–Q2 2021) for 19 euro area countries and 9 sectors. For each sector and euro area country, we take seasonally adjusted data on employment in hours and employment in persons from Eurostat (https://ec.europa.eu/eurostat). We normalise employment data by setting the average employment level achieved in 2019 for each country as 1. This allows us to construct the employment preservation indicator as a ratio of employment in persons and employment in hours, which serves as the main dependent variable in the research. With the employment preservation indicator, for each quarter, country and sector, we measure the level of employees per number of hours used relative to the average in 2019 so as to capture the relative level of employees who remained in employment despite the decline in the number of working hours. For instance, in the second quarter of 2020, i.e. during the first COVID-19 wave, the ratio for Germany is 1.10. This indicates that in this quarter Germany recorded a level of employed persons that was 10% higher than the level observed in working hours. It is thus evident that the number of employees in Germany dropped considerably less than the number of working hours. This was actually the case for all euro area countries.

To assess the impacts of different JR schemes, we use the OECD classification whereby countries use five types of JR schemes, namely, besides the four STW schemes also WS (OECD 2020a). According to the OECD study, 23 countries with a pre-existing STW scheme rapidly adjusted their STW scheme to cope with the COVID-19 crisis (OECD 2020a). They applied different combinations of three key changes: (1) simplifying access and extending coverage; (2) extending coverage to non-permanent workers; and (3) making them more generous. Boeri and Bruecker (2011) argue that making the benefits more generous provides the subject workers with stronger support while granting access for nonstandard jobs means that better targeting can be achieved since workers holding nonstandard jobs – i.e. the self-employed and workers with temporary or part-time dependent employment – are very vulnerable to job and income losses.[2] However, employers have little or zero incentive to use STW for nonstandard jobs as they know these workers can be fired at little or no cost, meaning access for nonstandard jobs should probably be combined with more generous STW benefits.

A number of countries have introduced temporary WS in response to the COVID-19 crisis that can be used by firms for hours worked (like standard wage subsidies) as well as for hours not worked (like STW

[2] On average, across the OECD countries, the sectors most directly affected by the COVID-19 containment measures account for around 40% of total employment. These sectors employ a large proportion of 'nonstandard workers,' i.e. part-time workers, self-employed and workers hired under fixed-term contracts. This proportion is generally highest in entertainment industries, hotels and restaurants (OECD 2020c).

TABLE 1 Types of JR Schemes Used during the COVID-19 Pandemic in the Euro Area

Stw1, Least updated, pre-existing STW scheme: Increased access and coverage with more generous benefits	Austria, Belgium, Luxembourg, Slovak Republic
Stw2, Updated, pre-existing STW scheme: increased access and coverage and access for workers in nonstandard jobs	Italy, Portugal
Stw3, Most extensively updated, pre-existing STW scheme: increased access, coverage, benefit generosity and access for workers in nonstandard jobs	Germany, Spain, Finland, France
Stwn, New (not previously existing) STW scheme	Greece, Lithuania, Latvia, Slovenia, Cyprus
Ws, New wage subsidy scheme	Estonia, Ireland, Netherlands, Malta

NOTES Based on data from OECD (2020a).

schemes), e.g., Australia, Canada, Estonia, Ireland, New Zealand. WS are reserved for firms experiencing a significant decline in revenue. In some countries, the size of the actual subsidy only depends on the wage bill (before programme participation) and not the decline in business activity (OECD 2021).

Table 1 presents different types of JR schemes used during the COVID-19 crisis in the euro area. It reveals important cross-country differences in the JR schemes used: 10 countries that adjusted their pre-existing STW schemes; 5 countries with new STW schemes, and 4 countries with wage subsidy schemes.

Data on the total portfolio of economic support measures were collected from the Oxford COVID-19 Government Response Tracker (GitHub 2022). The Oxford COVID-19 Government Response Tracker (OXCGRT) provides a systematic set of cross-national, longitudinal measures of government responses for more than 180 countries since 1st January 2020 (Hale et al. 2021). At present, it includes 19 policy indicators covering closure and containment, health and economic policies. To make it easier to describe government responses in aggregate, OXCGRT calculates simple indices that combine individual indicators to provide an overall measure of the intensity of government response across a family of indicators. These indices are: (1) GRI (all categories); (2) stringency index (containment and closure policies sometimes referred to as lockdown policies); (3) CHI (containment and closure and health policies); and (4) ESI (economic support measures). The ESI index is composed of economic policy response indicators which include income support, debt/contract relief for households, fiscal measures and giving international support indicators.[3] We used the ESI index as an aggregate measure of the economic support for the period Q1 2019–Q2 2021 for 19 euro area countries.

To be able to determine how much the macroeconomic effects of the portfolio of fiscal and monetary measures (used to mitigate the damage caused by the lockdown measures) helped preserve employment in addition to the actual JR scheme take-up effects, we must control for macroeconomic effects and their sectoral dimension on the trajectory of JR take-ups. Lockdown effects and the corresponding employment lossvaried considerably between sectors. Hence, we use employment data for the A10 sections of the broad NACE structure of EU countries.

Lockdown measures were quantified by using the corresponding stringency index which embraces all indicators on containment and closure policies (school closure, workplace closure, cancellation of public events, restrictions on the size of gatherings, halting of public transport, stay-at home requirement, limitations on internal movement, restrictions on international travel), constructed and published on the Oxford COVID-19 Government Response Tracker (Hale et al. 2021). Specific NPI indicators (restrictions on the size of gatherings and school closure) used while constructing the instruments are collected from the same source.

Descriptive Statistics of Main Variables and Operative Hypotheses

Table 2 presents descriptive statistics of the most important model variables for euro area countries: employment preservation ratio, normalised employment in persons, normalised employment in hours, government's economic support measures, and government's containment measures for each quarter from Q1 2020 until Q2 2021.

The levels of employment in persons and employment in hours in euro area countries were at their lowest in the second quarter of 2020, and while the maximum drop in the average level of employment per person per country did not exceed 7.6% (Spain), unemployment in hours dropped substantially more, notably on average by 12.7% compared to the average for 2019, to reach a maximum decrease of 27.2% in the case of Greece. For the entire period under observation, the normalised level of employment in persons was higher than the level of

[3] The way composite indices are calculated is described in Hale et al. (2021).

TABLE 2 Descriptive Statistics

Item		2020 Q1	2020 Q2	2020 Q3	2020 Q4	2021 Q1	2021 Q2
Mean	Employment preservation ratio	1.028	1.122	1.021	1.037	1.037	1.019
	Employment in person ∅2019 = 1	1.009	0.989	0.995	0.998	0.997	0.997
	Employment in hours ∅2019 = 1	0.978	0.873	0.975	0.963	0.962	0.991
(a)	Economic support measures	12.10	78.04	74.83	75.73	76.52	74.92
	stwn_take-up	0.078	0.085	0.028	0.050	0.053	0.033
	ws_take-up	0.130	0.158	0.121	0.094	0.085	0.080
	stw1_take-up	0.104	0.180	0.060	0.073	0.094	0.067
	stw2_take-up	0.044	0.145	0.053	0.053	0.056	0.046
	stw3_take-up	0.103	0.250	0.069	0.071	0.114	0.054
(b)	stringency	19.21	68.95	46.92	61.93	69.53	60.21
	gatherings	0.74	3.40	2.59	3.76	3.91	3.69
	school	0.66	2.37	1.50	1.59	2.11	1.67
SD	Employment preservation ratio	0.041	0.116	0.040	0.056	0.071	0.053
	Employment in person ∅2019 = 1	0.007	0.021	0.018	0.016	0.022	0.014
	Employment in hours ∅2019 = 1	0.025	0.068	0.020	0.026	0.031	0.028
(a)	Economic support measures	5.490	14.750	17.470	16.270	17.170	17.400
	stwn_take-up	0.040	0.046	0.018	0.035	0.034	0.021
	ws_take-up	0.125	0.070	0.057	0.066	0.041	0.042
	stw1_take-up	0.045	0.039	0.024	0.029	0.035	0.031
	stw2_take-up	0.034	0.067	0.018	0.028	0.037	0.031
	stw3_take-up	0.061	0.061	0.030	0.046	0.000	0.000
(b)	stringency	5.28	7.46	10.58	10.10	10.96	8.46
	gatherings	0.33	0.43	0.99	0.38	0.27	0.44
	school	0.23	0.44	0.59	0.37	0.55	0.48

Continued on the next page

employment in hours. This difference is most pronounced in the second quarter of 2020 and shrinks slowly afterwards.

The employment preservation ratio was at its highest during the peak of both epidemic waves. Still, there is quite a high cross-country heterogeneity in the preservation ratios, reflecting differences in the intensity of policy responses to the pandemic and the sectoral composition of the economies (Anderton et al. 2020).

The JR support measures were at their lowest in Q1 2020, increased considerably in Q2 2020 and remained at elevated levels for the remaining quarters of the observation period. For all types of JR schemes,

TABLE 2 *Continued from the previous page*

Item		2020 Q1	2020 Q2	2020 Q3	2020 Q4	2021 Q1	2021 Q2
min	Employment preservation ratio	0.984	1.079	1.079	1.036	1.030	0.988
	Employment in person ∅2019 = 1	0.994	0.924	0.952	0.963	0.933	0.966
	Employment in hours ∅2019 = 1	0.917	0.728	0.931	0.907	0.892	0.917
(a)	Economic support measures	4.120	54.120	37.500	36.410	37.500	37.500
	stwn_take-up	0.022	0.029	0.005	0.001	0.001	0.001
	ws_take-up	0.030	0.058	0.044	0.002	0.054	0.042
	stw1_take-up	0.038	0.129	0.020	0.024	0.043	0.020
	stw2_take-up	0.015	0.063	0.032	0.021	0.011	0.006
	stw3_take-up	0.043	0.190	0.039	0.025	0.114	0.054
(b)	stringency	11.66	57.89	27.92	41.81	49.12	46.09
	gatherings	0.31	2.42	0.48	2.50	3.03	2.49
	school	0.31	1.47	1.00	1.00	1.00	1.00
max	Employment preservation ratio	1.080	1.080	1.080	1.040	1.030	0.990
	Employment in person ∅2019 = 1	1.020	1.010	1.010	1.030	1.030	1.010
	Employment in hours ∅2019 = 1	1.030	0.940	0.940	0.990	1.000	1.020
(a)	Economic support measures	26.370	100	100	100	100	100
	stwn_take-up	0.134	0.150	0.055	0.118	0.091	0.060
	ws_take-up	0.304	0.242	0.177	0.140	0.142	0.138
	stw1_take-up	0.147	0.228	0.080	0.099	0.139	0.107
	stw2_take-up	0.091	0.242	0.080	0.089	0.094	0.086
	stw3_take-up	0.163	0.310	0.098	0.116	0.114	0.054
(b)	stringency	37.85	81.85	66.47	76.83	86.16	73.32
	gatherings	1.67	4.00	4.00	4.00	4.00	4.00
	school	1.25	3.00	2.89	2.49	3.00	2.71

NOTES Row headings are as follows: (a) government's support measures, (b) government's containment measures. Based on data from Eurostat (https://ec.europa.eu/eurostat), OECD (2000a), and Oxford COVID-19 Government Response Tracker (GitHub 2022). Employment variables are normalised on the basis ∅2019 = 1; index of economic support variable, Stringency index, School closing and Gatherings are used as defined in the Oxford COVID-19 Government Response Tracker (GitHub 2022). Types of JR schemes defined as suggested in the OECD (2020a) study.

the highest level of take-ups was reached in the second quarter of 2020 while afterwards they declined and stayed quite stable. In the second quarter of 2020, the level of scheme use (take-ups) reached a maximum level of 31% (Italy) for scheme type stw2 (a pre-existing STW scheme with updated access and coverage as well as access for workers holding nonstandard jobs) with a mean value of 25% of scheme take-ups. The lowest level of take-ups was reached in all quarters in those countries with new STW schemes (stwn), even though they had an average level (7.8%) of take-up in Q2 2020 with a corresponding minimum level of almost 2.8% (Latvia).

The containment and closure policies index (stringency, measured from 1 to 100) is at its lowest in Q1 2020 and its highest in Q2 2021. Overall, the mean value increased after Q3 2020 and remained high through the other periods. A similar pattern occurred with the indicator Restriction on the size of gatherings (ordinal values, 1–5), while the indicator School closure (ordinal values 1–5) was at its highest in Q2 2020 (2.37), but later relaxed.

Against this background and the literature reviewed, we test the following hypotheses:

1. Changes in the employment preservation ratio over time can be to a larger degree explained by changes in JR scheme take-up rates.
2. Changes in the preservation indicator over time are also influenced by changes in other support measures (fiscal and monetary) that governments have implemented during the pandemic.
3. Among different JR schemes, the most effective at preserving employment levels were take-ups of already existing STW schemes that had been most extensively updated.

MODEL

In normal times, Okun's law[4] suggests that employment in persons depends on employment in hours, the cyclical phase of economic activity (Burggraeve, de Walque, and Zimmer 2015), as well as sectoral and country characteristics (Crivelli, Furceri, and Toujas-Bernaté 2012). However, in the pandemic, policymakers have supported employment preservation (our dependent variable) directly by using JR schemes and indirectly through macroeconomic policy support to the economy.

We start the description of the equation composing our model of employment preservation with the equation for employment to appropriately encompass the relationship between employment in persons and employment in hours (Burggraeve et al. 2015). Explanatory variables of the model for employment in persons are therefore employ-

[4] Okun's Law is an empirically observed relationship between unemployment and losses in a country's production (Prachowny 1993).

ment in hours, JR scheme take-up rates, economic support measures, and time fixed effects. To encompass large differences in the potential effects of economic support between sectors, economic support variable effects are specified separately for five groups of sectors. Corresponding explanatory variables are defined as a product of the sectoral group indicator variable and economic support variable. Time fixed effects are included to account for any other time-specific effects on the employment in persons variable that might have affected penetration rates in the countries under study.

If EP_{ijt} is employment in persons and EH_{ijt} employment in hours, $JR_{it} \cdot dum\_jr_{ik}$ the take-up of JR scheme k (for country i take-up JR_{it} and scheme dum_jr_{ik}), $ES_{it} \cdot dum\_es_{il}$ sectoral economic support (for country i economic support ES_{it} and sector dum_es_{il}), dum_t time indicators embracing potential other (undisclosed) yet systematic factors' effects on persons employed dynamics, U_i unobservable country effects, U_j unobservable sector effects and ε_{ijt} the error term, then the conceptual version of the model for employment may be formally written as

$$
\begin{aligned}
EP_{ijt} = {} & F(EH_{ijt}, JR_{it} \cdot dum\_jr_{ik}, ES_{it} \cdot dum\_es_{il}, \\
& dum_t, U_i, U_j, \varepsilon_{ijt}),
\end{aligned} \tag{2}
$$

where index i stands for country, j for sector, t for time, k for type of scheme and l for sectoral group.

Regarding the specification of the function F, it is assumed that there is a linear dependence of EP_{ijt} on the elasticity of EH_{ijt} and the increments of other variables stated such that the complete specification of the estimable operative version of the model for EP_{ijt} is the following:

$$
\begin{aligned}
EP_{ijt} = {} & EH_{ijt}^{\alpha} \cdot \exp\Big(\sum_k \beta_k JR_{it} \cdot dum\_jr_{ik} + \sum_l \gamma_l ES_{it} \cdot dum\_es_{il} \\
& + \sum \delta_t dum_t + U_i + U_j + \varepsilon_{ijt}\Big).
\end{aligned} \tag{3}
$$

Sectoral groups are defined by sectors of the A10 sections of the broadest NACE sectoral classification. These groups of sectors are defined according to the potential extent of their lockdown exposure (manufacturing, construction, utilities, vulnerable services, non-vulnerable services, public sector). Types of JR schemes are specified according to the classification used in OECD (2020a).

We analyse the period Q1 2019–Q2 2021. The period is extended to the beginning of 2019 to identify the effects of modifications made to JR schemes at the start of the epidemic (14 euro area countries modified an already existing STW scheme in Q1 2020, as well as potential other systematic (but undisclosed) time-specific impacts on employment during the epidemic episode (parameters σ_t) as well as to increase the accuracy of the estimated dependence of the employment preservation indicator.

Since for estimated relation (3) parameter α did not significantly differ from 1,[5] the estimable starting operative version of the model specification for employment preservation is defined as follows:

$$\log\frac{EP_{ijt}}{EH_{ijt}} = \sum_k \beta_k JR_{it} \cdot dum\_jr_{ik} + \sum_l \gamma_l ES_{it} \cdot dum\_es_{il} + \sum_t \sigma_t dum_t + U_i + U_j + \varepsilon_{ijt}, \quad (4)$$

where index i stands for country, j for sector, t for time, k for type of scheme and l for sectoral group.

This starting version of the model is estimated and analysed in three steps; in each step, specification of the previous step is further simplified to allow specific characteristics of the model to be analysed.

In step one, the starting version of the model specification (4) is used to check the potential existence of specific time effects influencing employment preservation in the epidemic episode.

In step two, the model is estimated in its basic specification as

$$\log\frac{EP_{ijt}}{EH_{ijt}} = \sum_k \beta_k JR_{it} \cdot dum\_jr_{ik} + \sum_l \gamma_l ES_{it} \cdot dum\_es_{il} + U_i + U_j + \varepsilon_{ijt}. \quad (5)$$

Notably, the basic specification differs from the starting specification only in (missing) time dummies. Since it encompasses both theoretically important factors – the take-up of different JR scheme effects as well as the sectoral macroeconomic effects, a discussion of the basic model estimates represents the core of the analysis in this paper.

A robustness check of the main basic model conclusions is made in step three when the model is estimated without any explicit specification of the sectoral differences, therefore formally in the following specification:

[5] Corresponding estimates are available from the author upon request.

TABLE 3 Hausman Test

Model	χ^2	P
Starting model	Asymptotic assumptions violated	
Basic model	42.9	0.00
Robust model	16.1	0.01

NOTES Hausman test values and significance; the data for the starting model violate the asymptotic assumptions of the test.

$$\log\frac{\mathrm{EP}_{ijt}}{\mathrm{EH}_{ijt}} = \sum_k \beta_k \mathrm{JR}_{it} \cdot dum\_jr_{ik} + \gamma_l \mathrm{ES}_{it} + U_i + U_j + \varepsilon_{ijt}. \quad (6)$$

The presented stepwise simplification of the model specification enables the explicit focusing on (testing of) the crucial questions (hypotheses) of the study embraced in the stated paper research question.

RESULTS

The model (4) is estimated on panel data (where the observation unit is country, sector in a quarter) for 19 euro countries and 9 sectors in the period Q1 2019–Q2 2021. Due to missing data, there are 1,330 complete observations.

Because of the high possibility that unobservable individual effects for country and sectors are present,[6] a fixed effects estimator should be used as it excludes country and sector time-invariant variables' impacts and gives consistent parameter estimates. Nonetheless, Hausman's test is conducted to test for the presence of fixed effects and whether the more efficient random effects estimator could also be used. Table 3 presents values of Hausman's test for all three model specifications analysed (starting specification, basic specification, robust specification). Hausman's test does not enable the use of a random effects estimator in any model variant and thus all three models are estimated with fixed effects.

The possible endogeneity of economic support measures as well as the JR scheme take-up rates leads us to run an instrumental version of the fixed effects regression (the instrumental estimator GMM is used).[7]

[6] Crivelli et al. (2012) suggest a set of determinants of cross-country variations of employment growth consisting of the following variables: (a) Structural and Policy Variables (labour market policies, product market policies, and government size), (b) Product market regulations, like labour market regulations, (c) government size, (d) macroeconomic variables, and (e) demographic variables.

[7] Economic support measures and the associated JR scheme take-ups are highly endoge-

TABLE 4 Starting Model Estimates

Explanatory variables	Coefficient	*t*-stat	*P*
support(−1)	0.00085	1.03	0.303
support_con(−1)	−0.00000	−0.00	0.998
support_vul(−1)	0.00049***	2.89	0.004
support_nvul(−1)	−0.00000	−0.01	0.998
support_uti(−1)	−0.00021	−1.07	0.285
support_pub(−1)	−0.00015	−0.78	0.438
takeup_ws	0.76782***	2,93	0.003
takeup_stw3	2.77364***	3.51	0.000
takeup_stw2	1.22646***	4.68	0.000
takeup_stw1	1.66697***	4.28	0.000
takeup_stwn	0.91449***	3.37	0.001
dum_stwo	0.10218***	3.37	0.001
dum_2019q2	0.00576	0.85	0.396
dum_2019q3	0.00293	0.43	0.666
dum_2019q4	0.00278	0.41	0.683
dum_2020q1	−0.01192	−0.86	0.390
dum_2020q2	−0.03714	−0.92	0.360
dum_2020q3	−0.06888	−1.00	0.319
dum_2020q4	−0.05189	−0.78	0.436
dum_2021q1	−0.06727	−0.99	0.320
dum_2021q2	−0.05736	−0.85	0.398
_cons	−0.06921***	−3.42	0.001

Continued on the next page

The instruments used are a stringency index, lockdown variables for public gatherings and school closures, dummies for sectors and the type of JR schemes as well as the combination (products) of these variables. We used instrument variables representing pandemic containment measures as they are defined in relation to the state of the pan-

nous to labour market conditions since they were mainly used to alleviate the short-term effects of the COVID policy measures constraining social mobility on employment and temporary unemployment (Bole, Prašnikar, and Rop 2021). For instance, firms tend to place workers in JR schemes when the underlying conditions are poor and, correspondingly, reduce the share of the workforce in JR schemes when business conditions improve. Such pro-cyclical behaviour strongly biases the estimate of our variable of interest because the unobservable business conditions would be part of the residual and negatively correlated with the JR scheme take-up variable (for Germany, see Aiyar and Dao 2021).

TABLE 4 *Continued from the previous page*

Explanatory variables	*P*
Anderson canon correlation test of under identification	0.000
Sargan Hansen test of over identification	0.682

NOTES Calculations based on Eurostat (https://ec.europa.eu/eurostat) and Oxford COVID-19 Government Response Tracker (GitHub 2022). The dependent variable is employment in persons per employment in hours, normalised so that the average in 2019 is 1. Explanatory variables are: support_con(–1) – economic support policy index multiplied by a dummy for construction, lag1; support_vul(–1) – economic support policy index multiplied by a dummy for vulnerable, lag1; support_nvul (–1) – economic support policy index multiplied by a dummy for non-vulnerable, lag1; support_uti (–1) – economic support policy index multiplied by a dummy for utilities, lag1; support_pub (–1) – economic support policy index multiplied by a dummy for public sector, lag1; takeup_ws – take-ups multiplied by a dummy for a WS scheme; takeup_stw3 – take-ups multiplied by a dummy for an updated STW scheme (increased access and coverage; increased generosity; increased access for workers in non-standard jobs); takeup_stw2 – take-ups multiplied by a dummy for an updated STW scheme (increased access and coverage; increased access for workers in non-standard jobs); takeup_stw1 – take-ups multiplied by a dummy for an updated STW scheme (increased access and coverage; increased generosity); takeup_stwn – take-ups multiplied by a dummy for a new STW scheme; dum_stwo – a dummy for a pre-COVID STW scheme. Sargan-Hansen over identification test (significance); Anderson test of under identification (significance). ***, **, * significant, respectively at 0.01, 0.05 and 0.1.

demic and not the state of the labour market and the economy, but may well impact the level of the government's economic support measures and JR schemes.

Table 4 presents estimates of the model in its starting specification (5) for euro area countries. The Sargan-Hansen and Anderson tests confirm that the instruments' quality is acceptable. The coefficients of JR scheme take-up types are significant and have the expected sign, while among the sectoral economic support variables only the support for vulnerable sectors is significant. Others have the expected sign but are not significantly different from the corresponding effect of manufacturing, which represents the basis of the sectoral economic support variables comparison and which in itself is non-significant. Given that all time dummies in the COVID-19 period are non-significant and are not significantly different from the time dummies in the pre-COVID-19 period,[8] there are no other decisive factors mitigating employment losses during the lockdown episode.

Table 5 displays estimates of the model in its basic specification. It

[8] Corresponding estimates are available from the author upon request.

TABLE 5 Basic Model Estimates

Explanatory variables	Coefficient	*t*-stat	*P*
support(−1)	0.00013	1.01	0.315
support_con(−1)	0.00000	0.00	0.998
support_vul(−1)	0.00049	3.19***	0.001
support_nvul(−1)	0.00000	−0.01	0.994
support_uti(−1)	−0.00021	−1.18	0.238
support_pub(−1)	−0.00015	−0.86	0.392
takeup_ws	0.60253	8.31***	0.000
takeup_stw3	2.10297	11.86***	0.000
takeup_stw2	1.01807	11.81***	0.000
takeup_stw1	1.42968	13.56***	0.000
takeup_stwn	0.65103	6.45***	0.000
dum_stwo	0.08637	7.75***	0.000
Cons	−0.05647	−7.60***	0.000
Anderson canon correlation test of under identification			0.000
Sargan Hansen test of overidentification			0.605

NOTES N = 5130. The dependent variable is employment in persons per employment in hours, normalised so that the average in 2019 is 1. Explanatory variables are: support (−1) – economic support policy index, lag1; support_con(−1) – economic support policy index multiplied by a dummy for construction, lag1; support_vul(−1) – economic support policy index multiplied by a dummy for vulnerable, lag1; support_nvul (−1) – economic support policy index multiplied by a dummy for non-vulnerable, lag1; support_uti (−1) – economic support policy index multiplied by a dummy for utilities, lag1; support_pub (−1) – economic support policy index multiplied by a dummy for public sector, lag1; takeup_ws – take-ups multiplied by a dummy for a WS scheme; takeup_stw3 – take-ups multiplied by a dummy for an updated STW scheme (increased access and coverage; increased generosity; increased access for workers in non-standard jobs); takeup_stw2 – take-ups multiplied by a dummy for an updated scheme STW (increased access and coverage; increased access for workers in non-standard jobs); takeup_stw1 – take-ups multiplied by a dummy for an updated STW scheme (increased access and coverage; increased generosity); takeup_stwn – take-ups multiplied by a dummy for a new STW scheme; dum_stwo a dummy for a pre COVID STW scheme. Sargan-Hansen over identification test (significance); Anderson test of under identification (significance); ***, **, * significant, respectively at 0.01, 0.05 and 0.1.

differs from the model's starting specification in the absence of time dummies. The model is estimated with instrumentalised fixed effects. In estimating the basic model, the same instruments are used as for estimating the starting model.

The coefficients of the JR scheme take-up rates are highly significant and have the expected sign. A positive impact was especially strong in pre-existing STW schemes with increased access and cov-

TABLE 6 Effects of Employment Preservation Policy

Period	Actual values	All model measures	Macroec. measures
Q1 2020	0.027	0.036	0.000
Q2 2020	0.110	0.123	0.002
Q3 2020	0.020	0.028	0.015
Q4 2020	0.035	0.033	0.014
Q1 2021	0.034	0.042	0.015
Q2 2021	0.022	0.024	0.017
Average	0.041	0.048	0.011

NOTES Employment preservation; basic model simulation of employment preservation effects; actual values; total simulated effects; simulation of the effects of only the macroeconomic support measures.

erage, increased generosity, and increased access for workers holding non-standard jobs.

The effects of the macroeconomic economic support by way of mitigated sectoral employment loss are positive for manufacturing, construction, vulnerable and non-vulnerable services, but only significant for the group of vulnerable sectors.

To reveal the structure of policy contributions to the retained employment levels, table 6 presents actual values of employment in person per working hours, model-simulated common effects of the JR schemes and the macroeconomic support measures, as well as the contribution of only the macroeconomic support measures. Average values for all sectors and countries are given.

Employment preservation effects were quite volatile in the first three waves of the epidemic. They reached their peak in Q2 2020 when slightly more than 10% of the employed were not working. The biggest contribution to such employment preservation effects was made by the taking up of JR schemes. Still, the contribution made by the macroeconomic measures to curbing employment losses was also not negligible. It was small only in the first two quarters of the COVID-19 pandemic. After that, the contribution was quite sizeable; in the whole period of the first three epidemic waves, it accounted for around one-quarter (0.011/0.048 = 0.23) of the total mitigation effects.

Overall, it may be concluded that in line with hypotheses 1 and 2 changes in the employment preservation ratio over time can be to a larger degree explained by changes in JR scheme take-up rates and by changes in other government support measures.

TABLE 7 Macroeconomic Support Effects on Employment Preservation – Sectoral Differences

Sector	support_con	support_vul	support_nvul	support_uti	support_pub
support_man	0.005	0.488***	−0.0001	−0.208	−0.151
support_con		0.483***	−0.005	−0.213	−0.156
support_vul			−0.488***	−0.696***	−0.639***
support_nvul				−0.208*	−0.151
support_uti					0.057

NOTES Differences in macroeconomic support effects on employment preservation; sectoral differences (column sector less row sector item) are multiplied by 1,000; macroeconomic support effects on employment preservation in: manufacturing (support_man), construction (support_con), vulnerable service sectors (support_vul), nonvulnerable service sectors (support_nvul), utilities (support_uti), and public sector (support_pub); ***, **, * significant at 0.01, 0.05, and 0.1, respectively.

The estimated effects of macroeconomic support on sectoral employment preservation presented in table 5 also enable a comparison of those effects between sectors. Corresponding differences in sectoral employment preservation effects are given in table 7. Macroeconomic support is shown to have mitigated employment loss by far the most in the group of vulnerable service sectors. The employment-preservation impact of economic support measures for the vulnerable service sectors is several times (significant at $p = 0.00$) larger than in the other sectors. However, as shown in table 7, the effects of those sectors (with one exception) did not significantly exceed the effects in any other sector; only the effects in non-vulnerable service sectors differ from the effects in utilities by the lowest margin of significance ($p = 0.10$).

We may conclude that the evidence presented in table 8 confirms that the impact of economic support measures on employment preservation varies across sectors, especially between vulnerable sectors and others.

Estimates of the basic model (in table 5) also indicate that the effectiveness of different types of JR scheme take-ups varies considerably. To enable a more detailed comparison, table 8 presents differences in the effects on employment preservation of the analysed types of JR scheme take-ups.

The evidence presented in table 8 shows that the most successful countries have been those with a previous STW scheme which they extended most extensively by applying all three key changes to it (the most extensively updated STW schemes – denoted by takeup_stw3):

- simplifying access and extending coverage;

TABLE 8 Employment Preservation Effects – Differences between JR Schemes Take-Ups

	takeup_stw234	takeup_stw24	takeup_stw23	takeup_stwn	dum_stwo
takeup_ws	1.500***	0.416***	0.827***	0.048	−0.516***
takeup_stw3	−1.085***	−0.673***	−1.452***	−2.017***	
takeup_stw2		0.412***	−0.367**	−0.932***	
takeup_stw1			−0.779***	−1.343***	
takeup_stwn					−0.565

NOTES Differences in employment preservation effects for types of JR scheme take-ups; effect of JR scheme take-ups in column less the effect of a JR scheme in row item; analysed types of JR schemes: takeup_ws – take-ups multiplied by a dummy for WS scheme; takeup_stw3 – take-ups multiplied by a dummy for an updated existing STW scheme (increased access and coverage; increased generosity; increased access for workers in non-standard jobs); takeup_stw2 – take-ups multiplied by a dummy for an updated existing STW scheme (increased access and coverage; increased access for workers in non-standard jobs); takeup_stw1 – take-ups multiplied by a dummy for an updated existing STW scheme (increased access and coverage; increased generosity); takeup_stwn – take-ups multiplied by a dummy for a new STW scheme; dum_stwo a dummy for a pre-COVID STW scheme; ***, **, * significant, respectively at 0.01, 0.05 and 0.1.

- extending coverage to non-permanent workers; and
- making their benefits more generous.

The take-ups of this JR scheme had the strongest impact on employment preservation, outperforming other types of JR schemes in the COVID-19 pandemic by 25%–70%. The lowest effect on employment preservation was seen for take-ups of the JR scheme WS, which supported employment by subsidising all employees in the firm (denoted by takeup_ws). For every 1% of take-ups, this type of JR scheme reduced employment losses almost four times less effectively than the most successful STW scheme.

One may conclude that the empirical evidence given in table 9 validates the last (3rd) research hypothesis, namely, that among the different JR schemes in the COVID-19 pandemic the most effective at preserving employment levels were take-ups of already existing STW schemes that had been most extensively updated.

ROBUSTNESS TEST

To check the robustness of the estimated basic model with regard to its estimates, consistency and lessons, the model is also estimated in the robust specification (6). The model is estimated in a simplified version without an explicit sectoral dimension. Again, we employed an instrumental version of the fixed effects regression (instrumental estimator

TABLE 9 Robust Model Estimates

Explanatory variables	Coefficient	*t*-stat	*P*
support(−1)	0.00019***	3.280	0.001
takeup_ws	0.60253***	8.22	0.000
takeup_stw3	2.10297***	11.75	0.000
takeup_stw2	1.01807***	11.70	0.000
takeup_stw1	1.42968***	13.43	0.000
takeup_stwn	0.65103***	6.38	0.000
dum_stwo	0.08637***	7.67	0.000
Cons	−0.05650***	−7.54	0.000
Anderson canon correlation test of under identification			0.000
Sargan-Hansen test of over identification			0.609

NOTES The dependent variable is employment in persons per employment in hours, normalised so that the average in 2019 is 1. Explanatory variables are: support (−1) – economic support policy index, lag1; takeup_ws – take-ups multiplied by a dummy for a WS scheme; takeup_stw3 – take-ups multiplied by a dummy for an updated STW scheme (increased access and coverage; increased generosity; increased access for workers in non-standard jobs); takeup_stw2 – take-ups multiplied by a dummy for an updated STW scheme (increased access and coverage; increased access for workers in non-standard jobs); takeup_stw1 – take-ups multiplied by a dummy for an updated STW scheme (increased access and coverage; increased generosity); takeup_stwn – take-ups multiplied by a dummy for a new STW scheme; dum_stwo a dummy for a pre-COVID STW scheme. Sargan-Hansen over identification test (significance); Anderson test of under identification (significance); ***, **, * significant, respectively at 0.01, 0.05 and 0.1.

GMM). Instruments used in estimating the robust model are again constructed according to the same principles as for the previous model variants. The estimated model is presented in table 9.

The macroeconomic effects on employment preservation are highly significant and larger than the simple average of the corresponding sectoral effects in the basic model. Namely, the simple average of the sectoral effects in the basic model (see table 5) was 0.00016 (p = 0.06) versus 0.00019 (p = 0.00) in the robust version of the model.

This fact further confirms the sectoral differences in the economic support measures effects and, in particular, the size and importance of the vulnerable service sectors support for the success in limiting the loss of jobs during the COVID-19 pandemic, as already seen in table 7.

CONCLUSION

The COVID-19 pandemic has had an unprecedented impact on the labour market across world economies. The key instruments for mitigating the effects of the lockdowns on employment and social hardship that different countries introduced or extended in response to the crisis include different job retention (JR) schemes. JR schemes were implemented in all euro area countries, although different countries introduced or extended a range of JR schemes. Using data for euro area countries, this paper has analysed the effects of various JR scheme take-ups on employment preservation during the COVID pandemic. To assess the impacts of different JR schemes, we used the OECD classification whereby the countries use five types of JR schemes (OECD 2020a).

Our paper supports literature findings (Hijzen and Venn 2011; Boeri and Bruecker 2011; Hijzen and Martin 2013; OECD 2020a; 2020b; 2020c; 2021) that JR schemes have been the most important instrument for reducing the loss of employment following the impacts of the nonpharmaceutical interventions during the COVID-19 crisis. Such schemes were able to relatively successfully limit excessive layoffs in the situation of a temporary reduction in business activity. Our results also show that countries (France, Germany, Spain, Finland) which extended a previous STW scheme by increasing its access, coverage and generosity, and also integrated workers holding non-standard jobs (denoted by takeup_stw3) into the scheme had the most successful JR scheme take-ups.

Our study reveals that JR schemes contributed less than the overall employment preservation achieved during different epidemic waves, and that other macroeconomic measures (non-JR schemes) contributed around one-quarter to the employment preserved. Corresponding differences in sectoral employment preservation effects show that macroeconomic support mitigated the loss of jobs by far the most in the group of vulnerable services sectors, where the corresponding nonpharmaceutical intervention (NPI) losses were the highest, and which was the crucial driver of the high indirect net effects in other sectoral groups (Bole, Prašnikar, and Rop 2021). Better targeting by using STW for non-standard jobs (i.e. self-employed workers and those in temporary or part-time dependent employment) and providing more generous benefits have no doubt helped to improve the situation (OECD 2020b). Still, since employers have little or zero incentive to use STW for non-standard jobs when they know that these workers can be fired at little or no cost, and governments are reluctant to subsidise these jobs due to the moral hazard problem (Boeri and Bruecker 2011), other macroeconomic measures (non-JR schemes) might also do a good job at preserving jobs, in particular, in these sectors of the economy.

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