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Productivity-enhancing reallocation during the Covid-19 pandemic*

Tibor Lalinsky†, Jaanika Meriküll‡, Paloma Lopez-Garcia§

Abstract

This paper studies how the Covid-19 pandemic and the extensive job retention support that accompanied it affected productivity in Europe. The focus is on the reallocation channel and productivity-enhancing reallocation of jobs, following Foster et al., 2016. An extensive micro-distributed analysis of firm-level data for 11 euro area countries is used. The unique firm-level datasets are constructed by merging balance-sheet and income-statement data with policy support data. The paper exploits variation in employment responsiveness to productivity over time, particularly examining the relationship between changes in employment responsiveness and the job retention support in 2020 and studying how well the support was targeted by firm productivity. Acknowledging limitations of a small set of countries covered and occasionally large confidence bounds around estimates, the findings suggest that (1) productivity-enhancing reallocation was weaker in the pandemic than in the Great Recession; (2) The countries that were more generous with job retention support and countries where more support was allocated to low-productivity firms showed weaker productivity-enhancing reallocation in 2020.

Keywords: Productivity-enhancing reallocation, Covid-19, adjustment of firms, job retention support, cross-country analysis

JEL codes: D22, H25, J38, L29

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Non-technical summary

The Covid-19 pandemic prompted widespread lockdown measures and subsequent disruptions in supply chains, resulting in significant declines in firm sales. Despite endeavours to mitigate revenue shortfalls through cost adjustments, a discernible decrease in value added was evident across various sectors during the initial year of the pandemic. With adjustments in employment comparatively minor in relation to those made in value added, a decline in labour productivity ensued.

Our study builds upon prior research concerning the impact of crises on productivity growth and labour reallocation, contributing to the comparative analysis of Covid-19's effects on productivity. We offer empirical insights into several pivotal inquiries. What constituted the primary conduit for the productivity downturn during the Covid-19 pandemic? Were heightened levels of labour reallocation observed amidst the economic downturn of the pandemic? Did such reallocation yield productivity gains, such that more proficient enterprises experienced greater employment expansion? Did the trajectory of productivity and reallocation amid the pandemic diverge from patterns observed during other crises? Moreover, did the extensive policy interventions aimed at supporting firms during the pandemic adversely affect productivity and productivity-enhancing reallocation?

We present empirical findings for 11 euro area countries: Croatia, Estonia, Finland, France, Italy, Latvia, the Netherlands, Portugal, Slovakia, Slovenia, and Spain. Our analysis draws upon firm-level data sourced from balance sheets and income statements, supplemented by information pertaining to the distribution of pandemic-related job retention support at the firm level.

The methodology underpinning our data preparation and analysis aligns with the established CompNet framework. Employing a micro-distributed approach, we deploy a standardised code disseminated to data providers, who execute it independently on their respective national firm-level datasets. This approach ensures broad coverage and facilitates cross-country comparability of the underlying data while safeguarding its confidentiality.

Our study demonstrates the significant impact of the Covid-19 pandemic on productivity dynamics in the euro area, primarily manifesting through adverse effects at the within-firm level. However, the between-firm dimension is also noteworthy, contributing positively to overall productivity growth.

Our comparative examination shows that higher-productivity firms generally exhib-

ited greater employment expansion or lesser employment contractions during the pandemic than their less productive counterparts. Across most euro area countries, we ascertain that productivity-enhancing labour reallocation accelerated amidst economic contraction, indicative of the activation of mechanisms such as creative destruction or cleansing during recessionary phases. However, a longitudinal perspective reveals that productivity-enhancing reallocation, on average, exhibited somewhat subdued trends during the Covid-19 pandemic compared to the Great Recession.

To assess how productivity declines and the unprecedented scale of government support influenced subdued reallocation during the pandemic, we leverage granular data on employment support and conduct a thorough investigation into its distribution among firms.

Our findings indicate that most subsidies were directed towards productive firms, which were more likely to receive support across most countries. Nonetheless, the quantum of support relative to revenue diminishes with increasing firm productivity.

Despite variations in the design and implementation of job retention schemes and employment subsidies across countries, our analysis suggests that productivity-enhancing reallocation was less pronounced in 2020 in nations where support participation was more widespread or skewed towards low-productivity firms.

1. Introduction

The Covid-19 pandemic caused deep disruption to global economic activity and affected resource allocation and productivity. The response to the pandemic was massive policy support from governments. Fiscal support was given to firms in order to limit bankruptcies, capital disruption and job losses. The rapid policy support provided to firms prevented a wave of bankruptcies and it supported the rapid economic recovery of the euro area economy following the pandemic-induced crisis. However, it is not straightforward to assess the scale of its effect on productivity across individual economies and firms. This paper adds to the debate by providing comparable firm-level evidence for a number of euro area countries.

In this paper, we ask what the impact of the pandemic was on labour reallocation and thereby on productivity. We first provide comparative evidence about implications of job reallocation on productivity, the productivity-enhancing reallocation, for 11 euro area countries: Croatia, Estonia, Finland, France, Italy, Latvia, the Netherlands, Portugal, Slovakia, Slovenia and Spain. We compare productivity-enhancing reallocation during the pandemic with that observed during the Great Recession. We then ask whether job retention support affected productivity-enhancing reallocation during the pandemic. To that end, we use cross-country variation in the intensity of job retention support. Finally, and to complement the analysis of the link between policy support and productivity-enhancing reallocation, we merge wage support with productivity at the firm level in the few countries with available data and study whether participation in the support and the intensity of it depended on firm productivity.

Our analysis adds to the comparative studies on Covid-19 and productivity. It builds on the early work by di Mauro and Syverson, 2020 highlighting the main channels through which the crisis might affect productivity growth. Following Schumpeter, 1939, the recessions accelerate the process of labour reallocation from low-productivity firms to high-productivity ones through creative destruction, and activate the cleansing effect of recessions predicted by Caballero and Hammour, 1994. The substantial policy measures that were taken to mitigate the shock of Covid-19 might have reduced productivity-enhancing reallocation. One of the first estimates published by Andrews, Charlton, and Moore, 2021 suggests that job reallocation remained connected to firm productivity during the pandemic, so high-productivity firms were more likely to expand and low-productivity firms were more likely to contract. However, they also suggest in their three-country comparative study that productivity-enhancing reallocation was suppressed in New Zealand and not in Australia or the UK because the job retention support was much more widespread there. We follow this line of research and

contribute by studying productivity-enhancing reallocation and job retention support in a much larger set of 11 European countries.

We apply the approach of Foster et al., 2016 by estimating productivity-enhancing reallocation as the sensitivity of a firm's employment growth to its lagged relative productivity. The relative productivity is taken as firms' productivity relative to average productivity in the industry, hence the effect of relative productivity on employment growth shows how the between-firm reallocation contributes to aggregate productivity. The approach is a regression-based alternative to various decomposition methods that disentangle the contribution of within-firm productivity growth and between-firm reallocation of resources to aggregate productivity, see the methodological discussion in Dosi et al., 2015. The between-firm term is showing how effectively the resources move from low- to high-productivity firms, being a proxy for Schumpeterian creative destruction or cleansing process. There are other ways how to estimate the contribution of reallocation to aggregate productivity, most notably the evolutionary accounting approach by Dosi et al., 2015 where the firm sales growth is explained by relative productivity growth, and marginal product approach by Hsieh and Klenow, 2009 where within a detailed industry variation in firms' marginal products are compared to hypothetical counterfactual of no variation in marginal products.

We take the approach of Foster et al., 2016 in this paper as it allows direct comparison of our results with many empirical papers on productivity-enhancing reallocation. These papers focus on the productivity-enhancing reallocation during the Great Recession in the euro area countries[1], but the evidence is inconclusive as some studies find the recession to have been cleansing, while others do not. The evidence from the US found by Foster et al., 2016 is that while the Great Recession was cleansing, the cleansing effect was weaker than that in earlier recessions.

Much less is known about productivity-enhancing reallocation during the Covid-19 pandemic, though Andrews, Charlton, and Moore, 2021, Andrews, Hambur, and Bahar, 2021, Kozeniauskas et al., 2022 and Meriküll and Paulus, 2024 provide the first evidence about it. The results are again inconclusive, but the findings suggest that the extensive policy support may have played a part in muting productivity-enhancing reallocation by supporting low productivity firms that otherwise would have exited. In general, there is evidence that growth in jobs has become less responsive to productivity in recent decades, showing that productivity-enhancing reallocation is contributing less to aggregate productivity (Decker et al., 2020, Andrews and Hansell, 2021). These findings point to the importance of studies that use a longer timespan and underline

[1] See Carreira and Teixeira, 2016, Bartelsman et al., 2019, Dias and Marques, 2021, Mina and Santoleri, 2021, Domini and Moschella, 2022, Meriküll and Paulus, 2024 and Garcia-Louzao and Tarasonis, 2023.

the shortcomings of drawing inferences from a single crisis episode.

A related line of literature studies whether it was high-productivity or low-productivity firms that were most likely to take up support, and derives conclusions from this about how support affected productivity. There is evidence that the support during the pandemic was concentrated among low-productivity firms, and this may have muted productivity-enhancing reallocation (Kozeniauskas et al., 2022, Harasztosi et al., 2022). However, there is also evidence that whether firms received support was not linked to their productivity (Meriküll and Paulus, 2023) or that the relationship with firm productivity was positive or negative dependent on the country (Bighelli et al., 2023). Altomonte et al., 2021 find that the support was allocated in line with firm productivity in Italy and Germany, but it was productivity-neutral in France.

Fernández-Cerezo et al., 2022 show that the Covid-19 shock had a stronger impact on small, young and less productive firms, and that those firms resorted relatively more to all the available support schemes, including furlough. Traditionally low-productivity industries such as hotels and restaurants were affected most by the Covid-19 containment measures, so controlling for industry or for eligibility for support is crucial if the relationship between firm productivity and take up of the support is to be understood. As shown by Fernández-Cerezo et al., 2022, the link between firm productivity and the severity of the Covid-19 shock weakens substantially once the industry that firms work in has been controlled for. Similarly, Meriküll and Paulus, 2023 demonstrate that the link between firm productivity and participation in support disappears after eligibility for the support is controlled for. We contribute to this literature by providing comparative evidence for this link in a sample of six euro area countries for which we are able to merge data on the support with balance-sheet data.

Our data preparation and analysis benefit from the established CompNet infrastructure[2]. We distribute a common code that is independently executed by data providers on their national firm-level datasets. This method is often called a micro-distributed exercise and ensures that there is high coverage and cross-country comparability, while preserving confidentiality (Bartelsman et al., 2004). Like Demmou et al., 2021, Lalinsky and Pál, 2022 or Bighelli et al., 2023, we use micro data originating from balance sheets and income statements to compute developments in productivity during the pandemic. The administrative data used in this paper have a high degree of coverage and span several decades for the majority of our sample countries, allowing us to compare the two crisis episodes of the Great Recession and the Covid-19 pandemic.

We show that the Covid-19 pandemic affected developments in productivity in the euro

[2]The Competitiveness Research Network https://www.comp-net.org/.

area significantly, mostly through the within-firm margin, though the between-firm margin is also important and is larger than shown by industry-level estimates. We find that productive firms experienced larger employment gains or smaller employment losses on average during the recent economic cycle. However, productivity-enhancing reallocation was somewhat weaker on average during the Covid-19 pandemic than during the Great Recession. The relationship between the intensity of the job retention support and the change in productivity-enhancing reallocation is negative at the country level in 2020, suggesting that reallocation contributed less to productivity in countries that gave more widespread support for jobs.

Firms from the lowest productivity decile were the least likely to participate in job retention support. After conditioning on participation, the relationship between firm productivity and relative support size is negative in all the sample countries. Combining the results for participation in support with the size of the support and productivity-enhancing reallocation suggests that the countries that supported relatively more low-productive firms recorded lower increases in productivity-enhancing reallocation during the pandemic. This means that the characteristics of the job retention support, and in particular its extent and effectiveness in targeting high-productivity firms, played a part in productivity-enhancing reallocation during the pandemic.

Our findings on the link between weaker productivity-enhancing reallocation in the pandemic and the potential role of job retention support are subject to many limitations. We can provide the long-run comparative evidence on reallocation and productivity for only eight sample countries and estimate the targeting of the support for only five countries. The estimates of the productivity-enhancing reallocation have occasionally large confidence bounds and changes in the reallocation pattern are rarely statistically significant. However, various identification strategies taken in this paper point to the direction that the contribution of between-firm reallocation on productivity was weaker during the pandemic than during the Great Recession and likely due to job retention support.

The paper proceeds as follows. In Section 2 we describe the aggregate and micro-aggregated developments in productivity in our sample countries. Section 3 presents the firm-level data and the methodology. Section 4.1 shows the results of productivity-enhancing reallocation, Section 4.2 connects the reallocation with pandemic job retention support and Section 4.3 provides details on the distribution of job retention support by firm productivity. Section 5 concludes.

2. Productivity developments during the Covid-19 pandemic

The Covid-19 pandemic affected developments in productivity in the euro area significantly. The euro area experienced a sharp decline in aggregate GDP per person employed, followed by a partial recovery in 2021; see Figure 1. The decline in labour productivity was more severe than that seen during the Great Recession. Developments in the euro area during the Covid-19 period also contrasted starkly with those in the United States, probably largely because the approaches to policy support for firms and households were different. Policy support in Europe focused on job retention schemes and on preserving job matches, while support in the US focused on unemployment insurance and preserving the incomes of those who were laid off (Giupponi et al., 2022). There is ongoing academic debate over the productivity and welfare effects of the different approaches taken by policymakers in the US and Europe. Job retention schemes are costly for productivity if they go mostly to low-productivity firms and mute reallocation from low-productivity firms to high-productivity ones, while they are an effective tool for guarding against excess layoffs during temporary shocks (Giupponi et al., 2022).

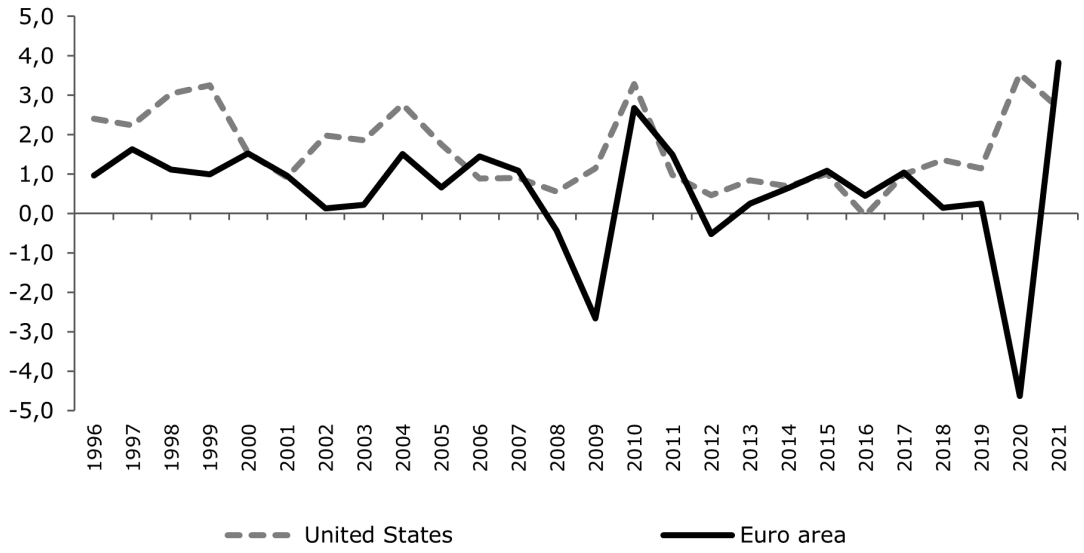

Figure 1: Labour productivity dynamics in the euro area and the US, year-on-year changes 1996-2021
Note: Labour productivity is measured as GDP per person employed.
Source: OECD.

Despite the extensive policy support given out to sustain employment during the Covid-19 pandemic in the euro area, firms recorded a decline in the number of employees; see Figure A1. Firms reduced employment in response to the Covid-19 economic shock across the countries analysed, and they switched from job creation in 2019 to job de-

struction in 2020. Our baseline analysis for the pandemic period focuses on surviving firms. We cannot study firm exits in this paper because of difficulties in identifying firm entries and exits properly in 2020. There is evidence that firm entry and exit had only a very small effect on productivity during the Covid-19 pandemic (Bloom et al., 2020) and that business exits remained at a lower level than usual (Wang et al., 2020, Crane et al., 2022, Cros et al., 2021 and Lalinsky et al., 2024).

The decline in value added was accompanied by a decline in the number of people employed, but the adjustments in employment were often smaller, with a negative impact on labour productivity. All of our sample countries witnessed negative growth in real value added in the first year of the pandemic, and the micro-aggregated growth in the labour productivity of the surviving firms varied between -11.8% in Portugal and 1.5% in Finland. Productivity growth remained positive in only two sample countries, in which the reduction in employment was larger than the drop in value added. The majority of our sample countries experienced a decline in productivity in 2020, which is in line with the average decline of 4% in productivity in the euro area in 2020. The decline in measured labour productivity resulted to some extent from labour hoarding, which was induced by policy support and the expectation that the crisis would be short-lived (di Mauro and Syverson, 2020).

The decomposition of productivity growth shows a negative within-firm margin and a positive between-firm reallocation margin; see Figure 2. We follow Baily et al., 1992 and decompose overall productivity growth into within-firm growth and the reallocation between firms[3]. The between-firm labour reallocation channel lifted aggregate productivity in the euro area by 1-3 percentage points in 2020. The contribution made to productivity growth by reallocation during the pandemic is remarkable, and was larger than that made during the Great Recession in most of the euro area countries. More detailed analysis confirms that only three countries recorded a stronger between-firm margin during the Great Recession than during the pandemic (Figure A2 in Appendix). The caveat in comparing these two recession episodes is the large heterogeneity in the shape of the recession during the Great Recession. While the pandemic was a relatively homogenous V-shape recession and hit all our sample countries the hardest in 2020, the Great Recession had its trough in 2009 for all of our sample countries, but there was a large variation in the shape of the recession. It was a V-shaped fast decline and fast recovery recession for Estonia, France, Latvia and Slovakia and a slow recovery recession for the rest of the countries, some of which double-dipped into the sovereign debt

[3]We omit the adjustment margins from entering and exiting firms and decompose the change in aggregate labour productivity ΔlnP_t for the set of surviving firms, S, as follows: $\Delta lnP_t = \sum_{i \in S} \theta_{it-1} \Delta lnp_{it} + \sum_{i \in S} (\theta_{it} - \theta_{it-1}) lnp_{it}$, where i denotes firm, t year, p_{it} firm i productivity and θ_{it} firm i employment share in total employment.

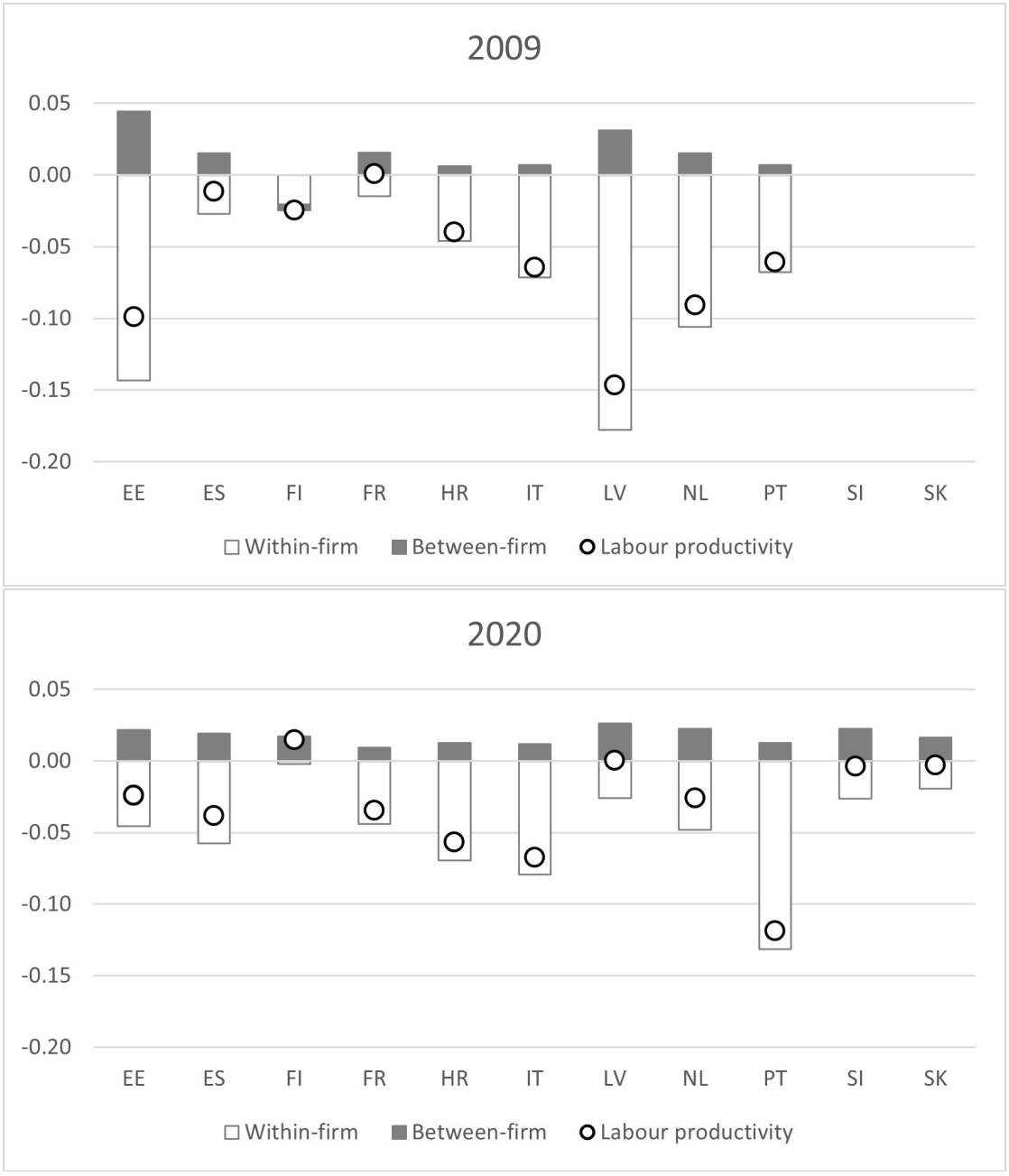

Figure 2: Margins of labour productivity growth in 2009 and 2020, balanced panels of firms

Notes: Micro-aggregated growth in real value added per employee from a balanced panel of firms in 2005-2010 and in 2015-2020.

Source: Authors' calculations from administrative data.

crisis.

Although the within-firm component predominantly drives the developments in the productivity of continuing firms, the contribution of between-firm reallocation is relatively larger than what is found for aggregate between-sector reallocation during the pandemic (see e.g. Lopez-Garcia and Szörfi, 2021). Bloom et al., 2020 estimate that only half or two thirds of the contribution of between-firm reallocation to productivity came from inter-industry reallocation, so that intra-industry reallocation also played a substantial role. Further analysis is needed to understand the role of within-sector reallocation and the extent of productivity-enhancing reallocation, and we conduct this analysis in the forthcoming sections.

3. Data and methodology

We use firm-level administrative data on firm performance, and for some countries we also have firm-level information on the subsidies received by each firm. The data originate from national administrative sources and are representative of all non-financial firms; see Tables A1 and A2. The universe of firms is covered for the majority of sample countries, while for larger countries also firm surveys have been used. The firm surveys are usually representative to the whole population, while larger firms are over-represented in samples for France, Italy and Netherlands. All the databases are workhorse tools for firm-level analysis at national central banks (CompNet, 2018). The data cover the two recessions in the Great Recession and the Covid-19 pandemic in ten of the eleven sample countries. The data are harmonised using the CompNet approach (CompNet, 2021) and are combined with firm-level data on pandemic subsidies.

We follow Foster et al., 2016 to study productivity-enhancing reallocation between firms. This approach regresses the employment growth at a firm, $g_{i,t}$, on the firm's relative productivity a year earlier, $Relprod_{i,t-1}$:

$$g_{i,t} = \alpha + \beta Relprod_{i,t-1} + \gamma Cycle_{r,t} + \delta(Relprod_{i,t-1} \times Cycle_{r,t}) + \theta Z'_{i,t-1} + \tau_t + \epsilon_{i,t}, \quad (1)$$

where $g_{i,t}$ is the mid-point average growth of the number of employees in firm i in year t, and $Relprod_{i,t-1}$ is the relative productivity of firm i in year $t-1$. Relative productivity is measured as the deviation of the firm's log labour productivity from the median value for its NACE 2-digit industry. Labour productivity is measured as value added divided by the number of employees, where GDP deflators are applied at the level of NACE 2-digit industries to give real values. The median of relative productivity

is zero by construction, but the mean is not; see Table 1. The business cycle, $Cycle_{r,t}$, is measured as growth in the unemployment rate in the NUTS2 level region[4], r. We control for additional firm-level characteristics in year $t-1$, which are captured by $Z'_{i,t-1}$ and include the log of firm employment and the NACE 2-digit industry. Time fixed effects are also controlled for by τ_t, while $\epsilon_{i,t}$ is an error term with conventional properties.

Table 1: Descriptive statistics over the sample period

Country (ISO code)	Employment growth		Relative productivity		Unemployment growth		Number of obs.
	Mean	St.dev.	Mean	St.dev.	Mean	St.dev.	
Croatia (HR)	0.020	0.302	0.020	0.302	-0.017	0.006	1,058,779
Estonia (EE)	0.005	0.285	-0.043	0.968	0.001	0.000	503,416
Finland (FI)	0.024	0.459	0.039	0.755	-0.001	0.000	2,294,214
France (FR)	0.016	0.209	-0.040	0.698	-0.004	0.001	3,744,600
Italy (IT)	0.012	0.251	-0.100	0.874	-0.100	0.874	9,523,530
Latvia (LV)	-0.009	0.390	-0.108	1.135	-0.004	0.000	798,124
Netherlands (NL)	0.015	0.270	-0.028	0.728	-0.006	0.003	2,803,212
Portugal (PT)	0.018	0.285	-0.088	0.977	-0.012	0.000	3,512,165
Slovenia (SI)	0.050	0.402	-0.003	0.705	-0.008	0.001	479,731
Slovakia (SK)	-0.006	0.223	-0.063	1.273	-0.009	0.004	489,677
Spain (ES)	0.018	0.364	-0.040	0.750	-0.013	0.000	8,501,020

Notes: Employment growth is the mid-point average growth rate of the number of employees; relative productivity is derived as the log difference between a firm's value added per employee and its industry median; and unemployment growth is the regional growth in the unemployment rate. The number of observations corresponds to those firm-year observations where there is non-missing information on employment over the sample period. The timespan covered is shown in Table A1.
Source: Authors' calculations from administrative data.

This approach allows us to investigate whether more productive firms tend to have higher employment growth than less productive firms, meaning that β is positive, and whether this relationship strengthens during economic downturns, meaning that δ is positive. We expect to observe productivity-enhancing reallocation towards more productive firms, and we expect it to happen faster during economic downturns as predicted by the hypothesis of creative destruction or cleansing. The coefficient γ is expected to be negative, showing that growth in employment is lower when unemployment is growing or during an economic downturn. The descriptive statistics of the variables used in the estimates of productivity-enhancing reallocation are shown in Table 1 and the size of sample firms in Table A2.

We estimate two alternative specifications to study the robustness of our results. The first robustness specification uses year dummies as a proxy for the business cycle instead of growth in the regional unemployment rate, by replacing $Cycle_{r,t}$ with time dummies τ_t in the interaction term of the baseline specification:

[4]The NUTS is the nomenclature of territorial units for statistics, the EU's hierarchical regional classification, and NUTS level 2 defines "basic regions for the application of regional policies"; see https://ec.europa.eu/eurostat/web/nuts/background. There is no regional variation in some countries - Estonia and Latvia - at this level of disaggregation.

$$g_{i,t} = \alpha + \beta Relprod_{i,t-1} + \tau_t + \delta(Relprod_{i,t-1} \times \tau_t) + \theta Z'_{i,t-1} + \epsilon_{i,t}, \quad (2)$$

The advantage of this specification is that it describes productivity-enhancing reallocation year by year and lets us study whether the sensitivity of reallocation to the business cycle has changed over time. Equations 1 and 2 are estimated by pooled OLS, following Foster et al., 2016. A fixed effects estimator is also used as a robustness test in order to control for firm-specific, time-invariant effects, and in this case α_i is estimated instead of α in equations 1 and 2.

For the second robustness specification, we run another set of regressions where separate regressions are estimated for each sample year t instead of the panel setting:

$$g_{i,t} = \alpha + \beta Relprod_{i,t-1} + \theta Z'_{i,t-1} + \epsilon_{i,t}, \quad (3)$$

This approach differs from those taken by equations 1 and 2 as it uses a cross-section of firms. This specification puts the focus on the relationship between firm productivity and employment growth in a given year and so provides an alternative to the estimates from equation 2. As a robustness test, we also derive the firms' relative productivity using a revenue-based TFP instead of labour productivity for this specification. The TFP is estimated as a residual from the Cobb-Douglas production function. All the estimates are weighted by firm size, where the weights are calculated as the average employment at the firm over the whole timespan.

We also have data on government support that cover the job retention support paid during the Covid-19 pandemic in Croatia, Estonia, Latvia, Portugal, Slovakia and Spain. The size of the support given and the share of firms supported, differ across countries, as does the type of support; see Table A3. The share of firms that the support reached ranged between 29% in Slovakia and 59% in Croatia; the share of workers on support ranged from 6% in Latvia to 40% in Croatia. The largest relative job retention subsidies were recorded in Croatia at 5% of the revenue of the firms; which corresponds to 2.1% of GDP in 2020. We focus on the first year of the pandemic and study the allocation of job retention support dependent on the characteristics of the firm receiving it in the year before the pandemic.

To study the distribution of the support by firm characteristics, we start by defining productivity clusters based on firm performance in the year before the pandemic, and then compute the share of subsidies allocated to each cluster in 2020. We continue by estimating logit regressions to assess the relationships between firm characteristics and

the support received. We regress the dependent variable, which is a binary dummy variable set to 1 for a firm that received support and 0 otherwise, $Participation_{it}$, on firm relative productivity, the log of firm employment and the NACE 2-digit industry in a similar vein to the specifications of productivity-enhancing reallocation:

$$p(Participation_{i,t}) = \frac{1}{1 + e^{-(\alpha + \beta Relprod_{i,t-1} + \theta Z'_{i,t-1} + \epsilon_{i,t})}}, \tag{4}$$

where t refers to the year 2020 and the probability of a firm receiving job retention support in 2020 depends on the characteristics of that firm in 2019.

Finally, we estimate OLS regressions to analyse how the amount of support given at the firm level depends on the same set of characteristics of firms. The dynamics of the specification are similar to those of participation, and we investigate how the pre-pandemic characteristics in 2019 affect the amount of support given in 2020, $Support_{it}$:

$$Support_{i,t} = \alpha + \beta Relprod_{i,t-1} + \theta Z'_{i,t-1} + \epsilon_{i,t}, \tag{5}$$

where $Support_{it}$ is measured as the share of support in revenue in 2020.

4. RESULTS

4.1 PRODUCTIVITY-ENHANCING REALLOCATION

The results from our baseline analysis for productivity-enhancing reallocation using the specification in equation 1 are presented in Table 2. These results confirm that high-productivity firms had higher employment growth on average than low-productivity firms from 2015 to 2020, and the reallocation remained productivity-enhancing. There are, however, noticeable differences between countries, as employment growth is more sensitive to firm productivity in Slovenia and Spain, but less sensitive to it in France and Italy[5]. This suggests that the between-firm reallocation channel contributes more to aggregate productivity in Slovenia and Spain and less in France and Italy[6]. Alternative estimates for the pandemic period employing a fixed-effects model (Table 3) confirm our baseline OLS estimates and suggest that there is a statistically significant cleansing

[5]There is no reason to believe that these cross-country differences in responsiveness are driven by differences in sample structure, within the samples where large firms are over-represented, France and Italy stand out by low responsiveness and the Netherlands by high responsiveness.

[6]How much reallocation contributes to aggregate productivity depends on the frequency or size of shocks and on the sensitivity of firm employment growth to shocks; see Decker et al., 2020. The sensitivity of firm employment growth to shocks is denoted as responsiveness and this is the channel that we study in this paper. The shocks to firms are presumably similar in our sample of euro area countries and the slowdown in job reallocation and productivity is related to lower responsiveness and not to change in economic shocks, as shown by Decker et al., 2020 with US data.

effect in a larger number of countries.

Supplementary estimates from an unbalanced panel of firms for 2015-2020 (Table A4) show a similar degree of productivity-enhancing reallocation. A comparison between the balanced and unbalanced panel results also suggests that the firm extensive margin made a relatively small and heterogeneous contribution to labour productivity growth during the pandemic. Further robustness estimates that use the full sample of firms across all the available years in the unbalanced panel (Table A5) and a comparison of those estimates with the unbalanced panel estimates for 2015-2020 (Table A4) indicate that productivity-enhancing reallocation was weaker and intensification was less frequent during the economic downturn in the pandemic than in the long run across the overall country-specific time spans.

How much productivity-enhancing reallocation contributes to aggregate productivity can also be estimated by deriving the weighted average productivity of firms in alternative employment growth scenarios, following Foster et al., 2016, Decker et al., 2020 and Andrews and Hansell, 2021. For the counterfactual scenario, the coefficients β and δ are set equal to zero in equation 1 so that firm growth is set not to depend on productivity. This investigates whether the weighted average productivity produced by the employment predicted by such a restricted model would be substantially lower than that from the model with the estimated β and δ. We derive predicted firm employment from the full model and from the counterfactual model without the coefficients β and δ. The contribution made by productivity-enhancing reallocation to aggregate productivity can be derived as $\Delta P_t = \sum_{i=1}^{N} \frac{\hat{l}_{i,t}}{\hat{L}_t} \times p_{i,t-1} - \sum_{i=1}^{N} \frac{\hat{l}^c_{i,t}}{\hat{L}^c_t} \times p_{i,t-1}$, where $\hat{l}_{i,t}$ and $\hat{L}_t$ are the employment predicted for firm i and total employment from the full model and $\hat{l}^c_{i,t}$ and $\hat{L}^c_t$ are from the restricted model without reallocation towards more productive firms. Firm productivity $p_{i,t-1}$ is taken from the previous year, so this decomposition ignores the contribution of within firm productivity between years t and $t-1$, and as productivity is measured by taking the logarithm of labour productivity in our conditional estimates, the ΔP_t shows the difference in aggregate productivity between the two scenarios in log points. Figure A3 presents these contributions for each country and each sample year.

The results are similar to those in Table 2, and show that productivity-enhancing reallocation contributes least to aggregate productivity in France and Italy, as productivity is 0.7 log point higher each year in France because of reallocation towards more productive firms, and 1.9 log points higher in Italy. The reallocation to productivity contributes more in other countries and is highest in 2015 to 2020 in Latvia, where it contributes 5.2 log points. There is also evidence that the contribution of reallocation to productivity

has declined over the decades, as the cross-country average contribution was 3.4 log points before 2011 and 2.5 log points after 2011. The decline is most noticeable in the Netherlands, Estonia and Spain, and the trend is also negative in other countries.

Evidence of reallocation making an increasing contribution to productivity is only found in Finland and Latvia. Given that the yearly aggregate growth in productivity was 0.8% before 2011 and 0.4% in 2011-2020 in the euro area, see Figure 1, the decline in reallocation is in line with the decline in aggregate productivity growth. Back-of-the-envelope calculations show that the slow-down in reallocation is in the magnitude of half of the decline in aggregate productivity growth. Aggregate growth in labour productivity halved between these periods and the contribution of productivity-enhancing reallocation to aggregate productivity declined by a quarter in our sample of euro area countries. These findings overlap with the evidence from the US and Australia (Decker et al., 2020, Andrews and Hansell, 2021), where the decline in productivity-enhancing reallocation also contributed negatively to aggregate productivity growth.

Table 2: Productivity-enhancing reallocation, OLS model estimates for the balanced panel, 2015-2020

	EE	ES	FI	FR	HR	IT	LV	NL	PT	SI	SK
$Relprod_{i,t-1}$	0.039***	0.062***	0.054***	0.012***	0.044***	0.031***	0.050***	0.050***	0.039***	0.072***	0.038***
	(0.002)	(0.006)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.010)	(0.006)	(0.006)	(0.002)
$Cycle_{r,t}$	-2.71***	-3.90***	0.08	-1.79*	-0.24	0.08	-4.06***	0.79	-4.84***	0.76	-0.18
	(0.176)	(0.192)	(0.382)	(1.059)	(0.186)	(0.168)	(0.296)	(1.070)	(0.303)	(1.118)	(0.341)
$Relprod_{i,t-1} \times Cycle_{r,t}$	0.292	0.772**	1.019***	-0.420	0.143	-0.268	0.565*	1.729*	0.346	2.377***	0.527**
	(0.200)	(0.309)	(0.324)	(0.506)	(0.120)	(0.239)	(0.330)	(0.970)	(0.407)	(0.600)	(0.237)
Firm size	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	87,252	843,984	265,014	538,308	182,826	1,314,083	127,584	436,933	661,692	121,534	202,770
R^2	0.064	0.096	0.060	0.038	0.062	0.048	0.062	0.057	0.044	0.087	0.085

Notes: OLS estimates with firm-level employment growth as the dependent variable, and relative within-sector value added labour productivity and the regional unemployment-based cycle as the explanatory variables. Firm size, sector and year fixed effects are included, but not presented. Firm size is the logarithm of firm employment at t_1 and sector is NACE 2-digit industry dummies. Estimates are weighted by the firm's average employment over the whole sample period between 2015 and 2020. Sandwich robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Source: Authors' calculations from administrative data.

Table 3: Productivity-enhancing reallocation, fixed-effects model estimates for the balanced panel, 2015-2020

	EE	ES	FI	FR	HR	IT	LV	NL	PT	SI	SK
$Relprod_{i,t-1}$	0.105***	0.120***	0.063***	0.023***	0.083***	0.056***	0.053***	0.098***	0.120***	0.104***	0.072***
	(0.009)	(0.010)	(0.006)	(0.003)	(0.007)	(0.003)	(0.007)	(0.015)	(0.009)	(0.010)	(0.010)
$Cycle_{r,t}$	-1.81***	-1.63***	0.05	-1.29*	-0.47***	0.18	-2.98***	0.48	-0.69*	0.19	-1.17***
	(0.169)	(0.204)	(0.315)	(0.733)	(0.129)	(0.151)	(0.304)	(0.441)	(0.366)	(0.991)	(0.415)
$Relprod_{i,t-1} \times Cycle_{r,t}$	0.697***	0.979***	1.057***	-0.643	0.532***	-0.230	1.213***	2.401***	0.541	3.887***	1.596***
	(0.178)	(0.370)	(0.294)	(0.502)	(0.121)	(0.207)	(0.342)	(0.489)	(0.337)	(0.694)	(0.186)
Firm size	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	87252	843984	265014	538308	182826	1314083	127584	436933	661692	121534	202770
R^2	0.269	0.310	0.258	0.245	0.269	0.216	0.260	0.272	0.297	0.250	0.229

Notes: Fixed-effects model estimates, see notes for Table 2 for further details. Source: Authors' calculations from administrative data.

Next, we examine the cyclicality of productivity-enhancing reallocation, taking the increase in productivity-enhancing reallocation during the recessions as evidence of creative destruction or the cleansing effect. The sensitivity of employment growth to productivity in firms increases during recessions in half of our sample countries, but not in the other half from 2015-2020; see the positive and statistically significant interaction term in Tables 2 and 3. This is in line with the related literature, in which there is no consensus about the presence of the cleansing effect during recessions.

A broader look at the evolution of productivity-enhancing reallocation shows that it was somewhat weaker on average during the Covid-19 pandemic than it was during the Great Recession, see Table 4. The table summarizes results for alternative specifications in equation 2 where the interaction term between firm productivity and the year fixed effects were used as a cycle proxy and equation 3 that provided estimates year-by-year. The full set of years for these estimates are presented in Figures A4, A5 and A6. This approach allows us to describe the changes in the strength of productivity-enhancing reallocation in the individual years and compare the situation in 2020 with that in 2009. As discussed above, while the timing and shape of the recession were very similar during the pandemic in our sample countries, this was not the case during the Great Recession. The economy started to decline already in 2008 in some of the sample countries and the shape of the recession differed. Given that the trough of the recession was in 2009 for all the sample countries, we focus on this year to see whether the Great Recession increased productivity-enhancing reallocation.

The results for the countries that have sufficiently long data show productivity-enhancing reallocation to be weaker in 2020 than it was in the past for some sample countries. The sensitivity to productivity went up to a statistically significant degree during the Great Recession in three of the nine sample countries in the panel estimates, which were Estonia, Italy and Latvia. There are also signs of increased sensitivity to productivity during the Great Recession in Spain and France, though the change in those countries is statistically insignificant. The Slovenian results also suggest that the Great Recession may have made job growth more responsive to productivity, but any conclusions about this need some more data on the years before the recession.

The results of the Covid-19 pandemic show that productivity-enhancing reallocation increased in 2020, which was the first and most severe year of the pandemic. The change in sensitivity is statistically significant in Finland, the Netherlands and Slovakia, while there was also an increase in sensitivity in Spain and Slovenia, but it was statistically insignificant. The sensitivity of employment growth to productivity did not change much in 2020 in six of the eleven sample countries or even declined from what it was

before the pandemic.

Table 4: Productivity-enhancing reallocation, Great Recession versus Covid-19 pandemic, summary of panel and year-by-year estimates

Country (ISO code)	Full panel estimates		Year-by-year estimates			
	Great Rec.	Covid-19	Great Recession		Covid-19	
	Labour prod.	Labour prod.	Labour prod.	TFP	Labour prod.	TFP
Croatia (HR)		(↓)			(↓)	(↓)
Estonia (EE)	↑		↑	(↑)		
Finland (FI)		↑			(↑)	(↓)
France (FR)	(↑)		(↑)	↑		(↓)
Italy (IT)	↑					
Latvia (LV)	↑	(↓)	(↑)	↑	↓	(↓)
Netherlands (NL)		↑	NA	NA	NA	NA
Portugal (PT)			(↑)	(↑)		
Slovenia (SI)	NA	(↑)	NA	NA		(↓)
Slovakia (SK)	NA	↑	NA	NA		
Spain (ES)	(↑)	(↑)	↑		↑	(↑)

Notes: The table summarizes the estimates of equation 2 (Full panel estimates) and equation 3 (Year-by-year estimates). The detail results are shown in Figures A4, Figures A5 and A6. ↑ shows a statistically significant increase and ↓ a statistically significant decrease in productivity-enhancing reallocation during the recession, the arrows in parenthesis show increases and decreases that are statistically insignificant, the empty cell shows no change in productivity-enhancing reallocation, and NA indicates not available estimates.
Source: Authors' calculations from administrative data.

The year-by-year estimates from equation 3 confirm these findings, as the productivity-enhancing reallocation strengthened around the Great Recession in most of the sample countries, but not during the first year of the pandemic. We also test the sensitivity of our results to the productivity measure using alternative specifications: one with labour productivity and another with total factor productivity (TFP). These estimates have two messages. First, the estimates with labour productivity or TFP provide similar results about the change in productivity-enhancing reallocation; occasionally, one of the productivity measures shows statistically significant results, and the other does not, but usually, there are no conflicting findings between the productivity measures. Second, similarly to the estimates with the panel data and year dummies as business cycle proxy, there is evidence that productivity-enhancing reallocation increased in the Great Recession in more countries than in the Covid-19 crisis. There are four out of eight countries where reallocation towards more productive firms increased statistically significantly in the Great Recession, either by labour productivity or TFP measure. While there is only one country out of ten where the productivity-enhancing reallocation increased during the Covid-19 crisis[7].

The cross-country heterogeneity may arise from the scale of the pandemic policy support and how efficiently it was allocated, and also from differences in the country-specific characteristics of the cycle[8].

[7]Unfortunately, we do not have these rolling window estimates available for the Netherlands, where there was also signs of increasing reallocation during the Covid-19 crisis.

[8]The job retention support schemes were used in many sample countries already during the Great

4.2 Employment subsidies and productivity-enhancing reallocation

The key question is whether productivity-enhancing reallocation was muted for some countries because of the extensive policy support during the pandemic. It remains unclear whether the productivity-enhancing reallocation was muted more because the pandemic had an unusually strong effect on productive firms, or because policy support sustained relatively more employment in firms with low productivity. One way to address the causality problem and to draw some inferences about how the extent of the policy support affected productivity-enhancing reallocation is to look at the cross-country variation in the participation rates for the support and the change in productivity-enhancing reallocation during the pandemic. This follows the line of argument in Andrews, Charlton, and Moore, 2021, who use fewer countries than our baseline estimates. Figure 3 suggests that the countries that supported more workers had a smaller increase in productivity-enhancing reallocation in 2020. The change in the point estimates of responsiveness are shown on y-axis in Figure 3, the statistical significance of the change is shown in Figure A4.

The design of the job retention support may also explain why the reaction of reallocation was different in different countries. The design of the support scheme had different implications for how long job matches were preserved, as the main furlough schemes that were used in Finland and Spain allowed workers covered by the scheme to start looking for a job while still receiving the support, whereas the short-time work or wage subsidies used in other countries implied that workers getting the support could not be fired even several months after the support had ended, see Table A3. The cap on support may have had a role as well: Netherlands had a very high cap compensating full wages of workers with wages up to 5.8 times the minimum wage; the cap in France was also set very high, up to 4.5 times the minimum wage, while workers received 70% of their former gross wage. These high caps made the support relatively more attractive for high-wage / high-productivity firms and may have contributed to the preservation of jobs at high-productivity firms.

In Finland and Slovakia, where productivity-enhancing reallocation increased statistically significantly, the intensity of support was very low and only 8% of workers participated in it. Similarly, firms from Croatia, France and Portugal, which were the countries where the support was most widespread, did not experience any increase in

Recession, however, the scale of the support used at the time was substantially smaller. A quarter of workers received job retention support during the peak month of Covid-19 (Müller et al., 2022); while 3.2% of workers in Italy, 1.7% in Finland, 1% in Spain, 0.8% in Slovakia and France, 0.7% in Netherlands and 0.1% in Portugal received the support on average month of 2009 (Hijzen and Venn, 2011).

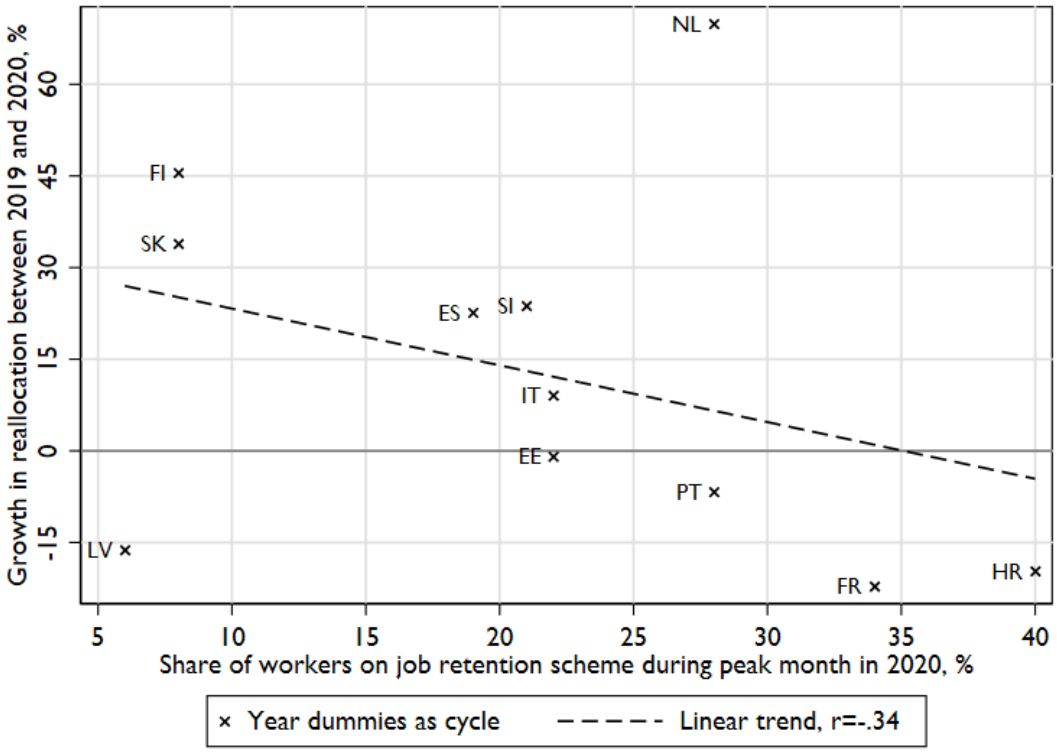

Figure 3: Share of workers getting support and change in productivity-enhancing reallocation

Notes: Change in productivity-enhancing reallocation between 2019 and 2020 origins from the estimates from equation 2, the full set of coefficients on productivity-enhancing reallocation are shown in Figure A4.
Sources: Authors' calculations from administrative data, job retention support data from Table A3.

productivity-enhancing reallocation in 2020. However, the intensity of support cannot explain the majority of the variation in cross-country differences in productivity-enhancing reallocation. The correlation between the two indicators for the intensity of the support and the increase in productivity-enhancing reallocation is -0.34. The most notable exceptions to this are Latvia, which had a lower sensitivity to productivity than predicted, and the Netherlands, where the sensitivity to productivity was higher than predicted[9]. One of the reasons why these two countries stand out as outliers in this relationship is the role of other measures taken to support firms during pandemic. While the job retention support was the main measure taken to support firms in the Netherlands; in Latvia it was firm liquidity aid and the job retention support played marginal role during the first wave of pandemic (see the share of workers on job retention scheme by Müller et al., 2022 vs the share of firms benefiting from policy support by Harasztosi et al., 2022).

In addition to the intensity of the support, accurate targeting of the support may also have played a role. We study the allocation of support by firm productivity in the following subsection, but we use a smaller set of countries for which the data are available.

[9]These two countries remain outliers in this relationship also when using spending on job retention as a share of GDP as a proxy for support; see Figure A7.

4.3 Take up of job retention support by firm productivity

This subsection studies whether the amount of job retention support and the participation in it depends on firm productivity. We proceed from a sample of six countries – Croatia, Estonia, Latvia, Portugal, Slovakia and Spain – for which we can link job retention support with balance-sheet data at the level of the firm. [10]

We find several common patterns in the distribution of the pandemic job retention support. The group of the most productive firms received a much larger aggregate value of support than the group of firms with the lowest productivity, as shown by the amount of support received by firm productivity quintiles in Table 5. Around one third of the amount paid in job retention support was allocated to productive firms, which are defined as firms in the highest quintile of the labour productivity distribution in 2019. Only a small share of the support went to low-productivity firms, which are defined as firms in the lowest quintile of the productivity distribution. The distribution of job retention support was proportional to the number of workers employed in Croatia and Slovakia, while the support received by low-productivity firms in Estonia, Latvia and Portugal was half their share in employment.

Table 5: Allocation of employment subsidies and employment by firm productivity quintiles

	Croatia	Estonia	Latvia	Portugal	Slovakia
		Share of allocated support in %, 2020			
Highest quintile	33.9	26.0	34.0	32.1	32.2
Lowest quintile	7.0	4.2	3.4	5.2	5.8
		Share of employed workers in %, 2019			
Highest quintile	30.3	28.8	39.1	30.7	27.8
Lowest quintile	7.9	8.0	6.6	10.8	5.4

Notes: Highest and lowest quintile firms are firms in the highest or lowest quintile of labour productivity distribution in 2019. Data on the size of the support are unavailable for Spain.
Source: Authors' calculations from administrative data.

The relationship between the support and productivity is non-linear and concave in all six countries, and the concavity is much more pronounced in Croatia, Slovakia and Portugal than it is in Estonia, Latvia and Spain; see Figure A8. The probability of a firm receiving the support is lowest in all the countries in the lowest productivity decile, which is the reference category. Firms from the highest productivity decile were similarly unlikely to receive support in Spain, while the relationship between productivity and support was still high in the top productivity decile in Estonia, Croatia, Portugal and Slovakia. There is a noticeable upward trend in the probability of receiving support as the productivity of firms rises in Croatia, Portugal and Slovakia. As suggested by Fernández-Cerezo et al., 2022 or Meriküll and Paulus, 2023, the pandemic affected

[10] The take up analysis for Spain is limited to the probability of being supported, as the firm-level information on the amount of support given is not available for that country.

more firms from low-productivity industries, so controlling for industry or for eligibility for support is essential.

We find that the country-specific patterns remain unaltered after the industry mix is controlled for and the same regressions are run for within-sector productivity deciles; see equation 4 and Table 6. Conditional on sector and firm size, the probability of receiving job retention support increased with firms' relative productivity in five out of six sample countries; the link between participation and productivity was negative only in Spain.[11]

The probability of a firm being supported is only one part of the story. To appreciate the overall effect of subsidies, it is important to analyse how the amount of support given is related to the productivity of firms. After conditioning on whether a firm received support, there is clearly a negative relationship between the amount of support received and the productivity of the firm; see equation 5 and Table 7. We find that more productive firms received relatively smaller subsidies. The size of the effect varies over countries, and the sensitivity is highest in Croatia, followed by Portugal, Latvia, Estonia and Slovakia. Relative productivity being 10 log points higher in 2019 is related to the share of the support in revenue in 2020 being 0.007 percentage points smaller in Croatia, and the elasticity is barely a tenth of that in Slovakia[12].

Table 6: Participation in job retention support by productivity, 2020

	Croatia	Estonia	Latvia	Portugal	Slovakia	Spain
Labour productivity	0.0113***	0.0017	0.0021*	0.0168***	0.0153***	-0.0085***
in 2019	(0.0020)	(0.0012)	(0.0012)	(0.0010)	(0.0021)	(0.0007)
Sector	Yes	Yes	Yes	Yes	Yes	Yes
Size class	Yes	Yes	Yes	Yes	Yes	Yes
Observations	71,344	36,036	55,538	227,502	84,652	400,153

Notes: Dependent variable is participation in support in 2020. The table shows the marginal effects of the logit regressions for all the firms in 2020. Continuous variables in logarithm are used. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.
Source: Authors' calculations from administrative data.

[11]The annual frequency of the balance-sheet data does not allow us to address the eligibility issue directly, because the eligibility for the Covid-19 employment support was assessed on monthly basis. The decisive eligibility criterion in all countries was a significant decline in monthly turnover (exceeding at least 20%). Our alternative estimates based on the equation 4 extended with the industry-level eligibility dummy variable controlling for the annual decline revenue suggest somewhat weaker, but positive and statistically significant relationship between the probability of receiving job retention support firms' relative productivity. Results are available upon request.

[12]It does not seem that this relationship is driven by the cap on support. While the support in Croatia was a lump-sum wage subsidy per worker capped at a low level so that it likely made a higher share of wage costs in low-wage / low-productivity firms; the design of the support was similar in Estonia, Latvia, Portugal and Slovakia, and the negative relationship captures rather targeting of the support and not its' design mechanism. See the overview of support schemes in Table A3.

Table 7: Amount of job retention support by productivity, 2020

	Croatia	Estonia	Latvia	Portugal	Slovakia
Labour productivity in 2019	-0.0744*** (0.0015)	-0.02382*** (0.01519)	-0.03704*** (0.02496)	-0.0631*** (0.0029)	-0.0078*** (0.0010)
Sector	Yes	Yes	Yes	Yes	Yes
Size class	Yes	Yes	Yes	Yes	Yes
Observations	44,523	9,249	6,678	59,869	23,986
R^2	0.103	0.037	0.042	0.089	0.076

Notes: Dependent variable is the share of support in revenue in 2020. The table shows the coefficients of the OLS regressions for firms receiving support with the share of subsidies on revenue as the dependent variable. Continuous variables in logarithm are used. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.
Source: Authors' calculations from administrative data.

Taken together, the results for the extensive and intensive margins of the support suggest that the relationship between firm productivity before the pandemic and job retention support during the pandemic may have been negative in Croatia, Estonia, Latvia and Portugal, where the elasticity in the intensive margin was substantial. The results for Slovakia are ambiguous because a positive relationship is shown by the extensive margin and a weak negative relationship by the intensive margin. We find for most of the sample countries that firms with low productivity were supported more, which is in line with Kozeniauskas et al., 2022 and Harasztosi et al., 2022.

These results complement our findings in Subsections 4.1 and 4.2 on productivity-enhancing reallocation and job retention support. The productivity-enhancing reallocation did not strengthen in Croatia, Estonia, Latvia or Portugal, but it did in Slovakia. These findings support the view that employment subsidies played a role in muting productivity-enhancing reallocation during the Covid-19 pandemic. The productivity of the firms that received the support is important, as well as the intensity of the support as discussed in Section 4.2. In those countries where the support was more generous for less productive firms, the cleansing mechanism was weaker and the reallocation of jobs towards high-productivity firms did not strengthen in 2020.

5. Conclusions

This paper uses firm-level data from the balance sheets and income statements and the firm-level information on the distribution of the pandemic job retention support to understand how the Covid-19 pandemic impacted productivity-enhancing reallocation and what was the role of job retention support in it. We show empirical evidence for 11 euro area countries.

Our comparative analysis shows that high-productivity firms experienced larger employment gains or smaller employment losses on average than low-productivity firms

over the recent economic cycle. In some countries we observe that productivity-enhancing labour reallocation accelerated during the period of contraction or that the creative destruction or cleansing mechanism was activated in recessions. A broader look at the evolution of productivity-enhancing reallocation suggests that it was, on average, somewhat weaker during the Covid-19 pandemic than it was during the Great Recession.

Although, the conditions for job retention support varied over countries, the rapid policy support prevented a wave of bankruptcies and it supported the rapid economic recovery of the euro area economy following the pandemic. However, we find that productivity-enhancing reallocation was weaker in 2020 in countries where the participation in support was more widespread or was concentrated towards low-productivity firms. Most subsidies were allocated to productive firms, and productive firms were more likely to be supported in most of the countries. Yet, the amount of support received relative to revenue decreases together with the productivity of firms. In countries where this effect dominated, and the subsidies covered a significantly larger share of the revenue of firms with low productivity, we observe that more subsidies were related to lower productivity-enhancing reallocation during the pandemic.

This study is limited to firm performance and support in 2020, to a small set of countries covered and to occasionally large confidence bounds around estimates. Future studies on linked employer-employee level data are encouraged to reveal the longer-term implications of the pandemic on productivity. The key questions are whether the job retention support became more concentrated to low-productivity firms over the duration of the support, as suggested by Andrews, Hambur, and Bahar, 2021; or who were the new employers of these workers who became unemployed during the pandemic. As the design of job retention support also varied substantially across countries, it calls for focused case studies that would zoom into the details of support and search for identification strategies that would allow more elegant identification than taken in our cross-country study.

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APPENDIX

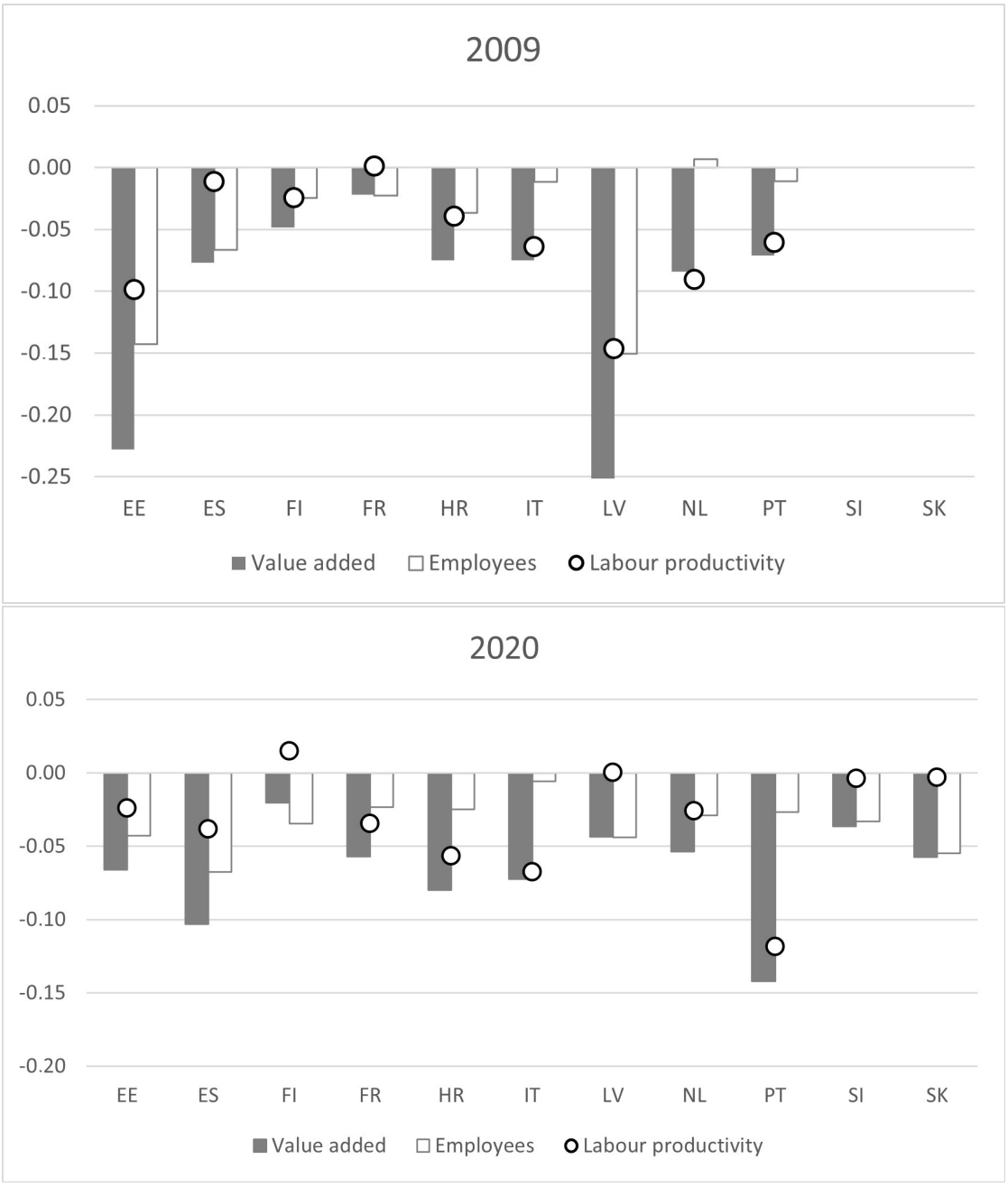

Figure A1: Annual labour productivity growth in 2020, balanced panel of firms
Notes: Micro-aggregated growth in real value added per employee from a balanced panel of firms in 2015-2020.
Source: Authors' calculations from administrative data.

Table A1: Sources of firm-level data

Country No of firms	Data source	Period
Croatia	Financial Agency (FINA), Croatian Employment Service (HZZ)	2002-2021
Estonia	Business Register, Tax and Customs Board	2004-2022
Finland	Statistics Finland	1999-2020
France	Fiben	2000-2020
Italy	Cerved Centrale dei Bilanci, Istituto Nazionale Previdenza Sociale (INPS)	2001-2020
Latvia	Central Statistical Bureau and State Revenue Service	2007-2021
Netherlands	Statistics Netherlands	2000-2021
Portugal	Central Balance Sheet Database	2006-2020
Slovenia	Slovenian Business Register (AJPES), Monetary financial institutions reporting (PORFI)	2008-2021
Slovakia	Statistics Slovakia and Bisnode, Transparency International Slovakia	2015-2022
Spain	Central Balance sheet database	1995-2020

Table A2: Firm size and coverage

Country	Employment, sample years		Employment, 2020	No of firms in 2020			Comment
	Mean	St.dev.	Eurostat mean	Sample	Eurostat	Share covered	
Croatia	11.0	92.6	5.0	63,557	180,537	0.352	Census
Estonia	6.7	39.4	4.7	31,842	85,842	0.373	Census
Finland	11.0	115.1	5.1	78,649	236,038	0.333	Census
France	43.1	670.1	4.0	159,573	3,084,048	0.052	Survey*
Italy	16.2	270.1	2.2	376,682	3,640,489	0.103	Survey*
Latvia	8.2	60.0	4.3	48,713	111,153	0.438	Census
Netherlands	20.6	328.6	2.9	109,494	1,362,947	0.080	Survey*
Portugal	7.9	93.3	3.0	204,671	916,292	0.223	Survey*
Slovenia	11.7	91.1	3.8	32,762	150,261	0.218	Census
Slovakia	11.2	117.2	2.3	75,703	518,497	0.146	Census
Spain	13.3	246.3	3.5	326,196	2,683,786	0.122	Survey*

Notes: Number of firms in sample is reported as those with non-missing information on growth of employment and value added in 2020.
France: Covers almost all firms that employ more than 500 employees, 20% of firms with 20-500 employees and 10% of firms with less than 20 employees (Sauvé and Ortega, 2002).
Italy: Sample of firms with 20 or more employees and construction firms with 10 or more employees (see https://www.bancaditalia.it/pubblicazioni/indagine-imprese/index.html).
Netherlands: Survey for large non-financial firms and tax register for small non-financial firms (CompNet, 2018).
Portugal: Coverage of sample is 98% of enterprises (CompNet, 2018).
Spain: Covers 22% corporations at the beginning of sample, while large firms are slightly over-represented (Sauvé and Ortega, 2002).
Sources: Authors' calculations from administrative data; Eurostat table SBS_NA_SCA_R2.

Table A3: Job retention scheme characteristics, 2020

Country	Type of support	Who received	Share of workers, %	Share in GDP, %	Cap on support	Pre-existing scheme
Croatia	Wage subsidy	Employer	40	2.1	Lump-sum 1.24×MW	No
Estonia	Short-time work	Worker	22	1.0	1.71×MW	No
Finland	Furlough	Worker	8	0.3	No cap	Yes
France	Short-time work	Employer	34	1.0	4.50×MW	Yes
Italy	Short-time work	Employer	22	1.6	1130eur	No
Latvia	Short-time work	Worker	6	0.2	1.63×MW	No
Netherlands	Wage subsidy	Employer	28	1.9	5.77×MW	Yes
Portugal	Short-time work	Employer	28	0.5	3.00×MW	Yes
Slovenia	Short-time work	Employer	21	0.9	1.86×MW	No
Slovakia	Short-time work	Employer	8	0.3	1.90×MW	Yes
Spain	Furlough	Worker	19	1.8	0.99×MW	Yes

Notes: The characteristics of the support refer to the peak month of the pandemic in 2020, for most of the countries it was April. We do not cover support schemes introduced later, e.g. short-time work scheme introduced in June in Croatia.
There are three main types of job retention schemes used during the pandemic (Drahokoupil and Müller, 2021 and Müller et al., 2022):
(1) Short-time work – some work-time is reduced and compensated to employers by the support; employers share some costs; workers share some costs by getting lower wage for hours not worked; workers cannot take up other employment.
(2) Furlough – workers laid off temporarily, but can return to their job; employers pay some part of benefit; benefit paid directly to workers; workers integrated into unemployment assistance system and can start a new job.
(3) Wage subsidy – employers in financial difficulty receive support per employee, regardless of whether the working hours of workers have been reduced.
The source for share of workers in the scheme is Müller et al., 2022 for all the countries, except the Netherlands where the source is Scarpetta et al., 2020. Müller et al., 2022 report the share of workers in support at quarterly frequency for the Netherlands and for the sake of comparability, we have switched to Scarpetta et al., 2020 for this country, because they report workers supported at the end of May in 2020.
MW – denotes minimum wage. Italy does not have national minimum wage. If the cap at support depends on the number of children in the family, the cap for worker without children is used.
Sources: https://www.etui.org/publications/job-retention-schemes-europe; Hijzen and Venn, 2011; Scarpetta et al., 2020; Drahokoupil and Müller, 2021; Müller et al., 2022; national minimum wage by Eurostat table EARN_MW_CUR

Table A4: Productivity-enhancing reallocation, OLS model estimates for the unbalanced panel, 2015-2020

	EE	ES	FI	FR	HR	IT	LV	NL	PT	SI	SK
$Relprod_{i,t-1}$	0.040***	0.068***	0.066***	0.011***	0.041***	0.031***	0.060***	0.044***	0.037***	0.072***	0.038***
	(0.002)	(0.003)	(0.003)	(0.001)	(0.003)	(0.002)	(0.002)	(0.006)	(0.004)	(0.005)	(0.002)
$Cycle_{r,t}$	-2.37***	-3.68***	0.46	-1.76**	-0.16	0.05	-2.88***	0.37	-4.26***	1.61	-0.50
	(0.156)	(0.151)	(0.366)	(0.843)	(0.221)	(0.119)	(0.231)	(0.800)	(0.269)	(1.119)	(0.336)
$Relprod_{i,t-1} \times Cycle_{r,t}$	0.106	0.705***	1.032***	-0.730**	-0.026	-0.192	0.012	1.967***	0.116	1.652***	0.534***
	(0.174)	(0.191)	(0.277)	(0.307)	(0.170)	(0.195)	(0.225)	(0.553)	(0.270)	(0.479)	(0.163)
Firm size	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	176999	1975088	494989	952743	390483	2715075	288144	848286	1152955	216034	363200
R^2	0.048	0.071	0.047	0.036	0.038	0.034	0.041	0.046	0.032	0.067	0.063

Notes: OLS estimates with firm-level employment growth as the dependent variable, and relative within-sector value-added labour productivity and regional unemployment-based cycle as the explanatory variables. Firm size, sector and year fixed effects are included, but not presented. Firm size is the logarithm of firm employment at t_1 and sector is NACE 2-digit industry dummies. Estimates are weighted by the firm's average employment over the whole sample period between 2015 and 2020. Sandwich robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Source: Authors' calculations from administrative data.

Table A5: Productivity-enhancing reallocation, OLS model estimates for unbalanced panel, full sample

	EE	ES	FI	FR	HR	IT	LV	NL	PT	SI	SK
$Relprod_{i,t-1}$	0.055***	0.073***	0.064***	0.014***	0.047***	0.033***	0.052***	0.090***	0.038***	0.062***	0.038***
	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.003)	(0.001)	(0.003)	(0.002)
$Cycle_{r,t}$	-3.25***	-5.33***	-0.352	-0.535	0.115	-0.23***	-3.90***	0.664	-5.81***	1.918**	-0.500
	(0.163)	(0.347)	(0.242)	(0.439)	(0.165)	(0.059)	(0.427)	(0.579)	(0.319)	(0.911)	(0.336)
$Relprod_{i,t-1} \times Cycle_{r,t}$	0.388***	0.567***	0.709***	0.063	-0.063	0.310***	0.081*	1.428***	0.054	0.190	0.534***
	(0.093)	(0.053)	(0.224)	(0.154)	(0.102)	(0.071)	(0.048)	(0.375)	(0.096)	(0.243)	(0.163)
Firm size	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	403037	5643238	1775272	2657697	875859	7057488	523915	2125747	2621787	367410	363200
R^2	0.079	0.059	0.051	0.030	0.046	0.035	0.058	0.071	0.031	0.059	0.063

Notes: OLS estimates with a full panel, see notes for Table A4 for further details. Source: Authors' calculations from administrative data.

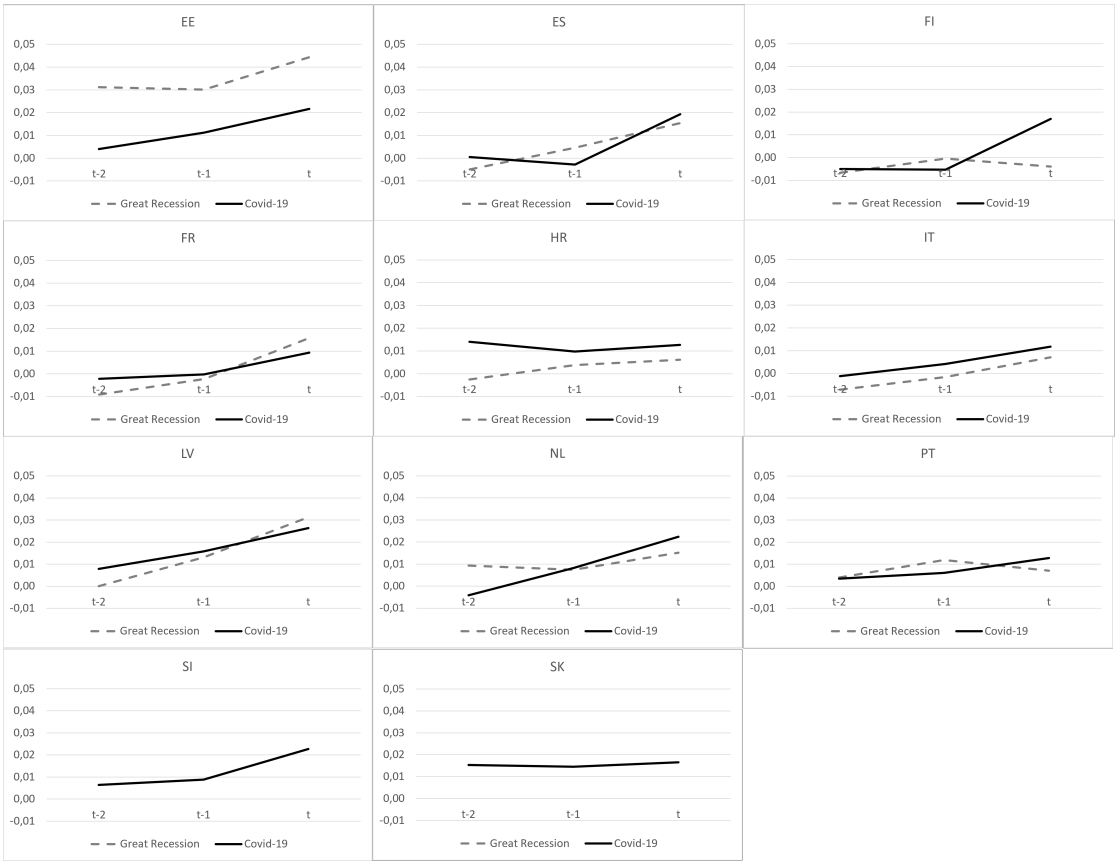

Figure A2: Between-firm reallocation, the Great Recession and the Covid-19 pandemic

Notes: The figure plots between-firm productivity growth margins during the Great Recession and the Covid-19 pandemic. Time t equals 2009 for the Great Recession and 2020 for the Covid-19 pandemic.

Source: Authors' calculations from firm-level data.

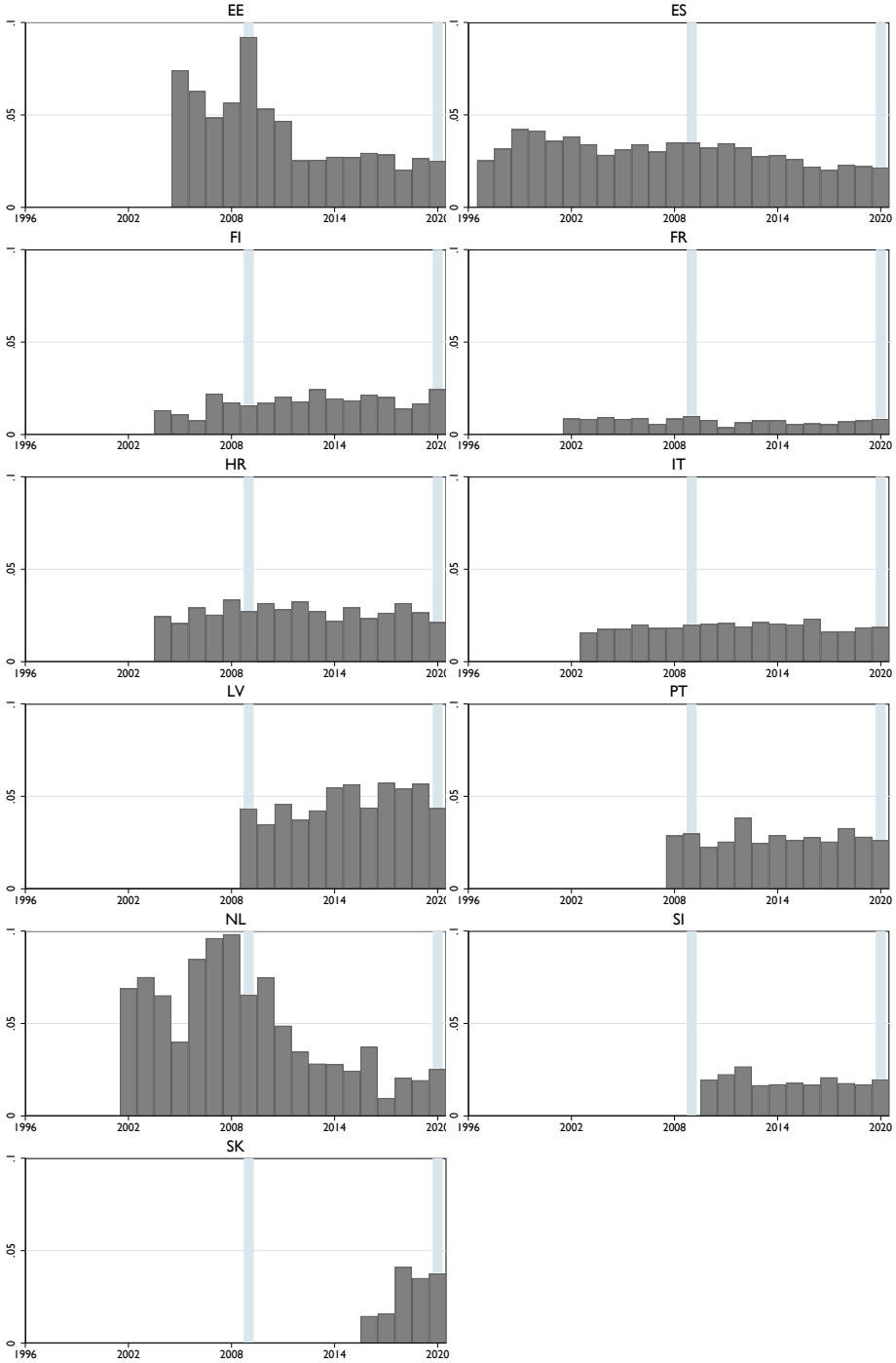

Figure A3: Contribution of productivity-enhancing reallocation to aggregate productivity by sample years, full sample

Notes: Each bar shows how large the contribution of productivity-enhancing reallocation to aggregate productivity is, compared to the counterfactual where employment growth at a firm would not depend on that firm's productivity. The contribution is found as the difference between the employment-weighted productivity from equation 1 and the employment-weighted productivity from the same equation, but with the coefficients β and δ set equal to zero.

Source: Authors' calculations from firm-level data.

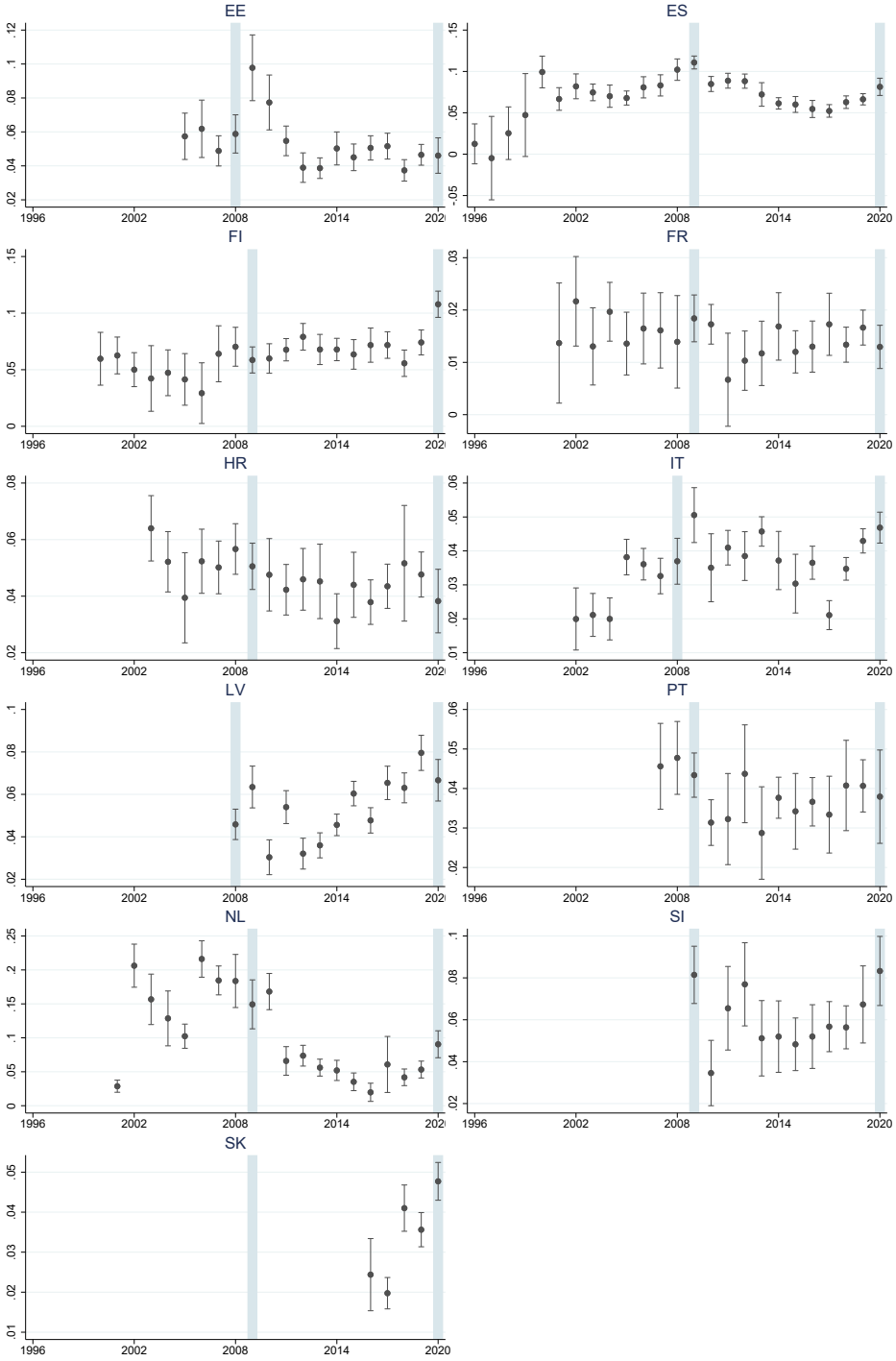

Figure A4: Productivity-enhancing reallocation by sample years, marginal effects from the full sample

Notes: The figure plots the marginal effects of an increase of one unit in relative productivity in each sample year using equation 2 and their 90% confidence bounds. The economic cycle is proxied by year dummies instead of regional unemployment for this specification and each marginal effect shows the sensitivity of employment growth at the firm to its lagged productivity in a particular year.
Source: Authors' calculations from firm-level data.

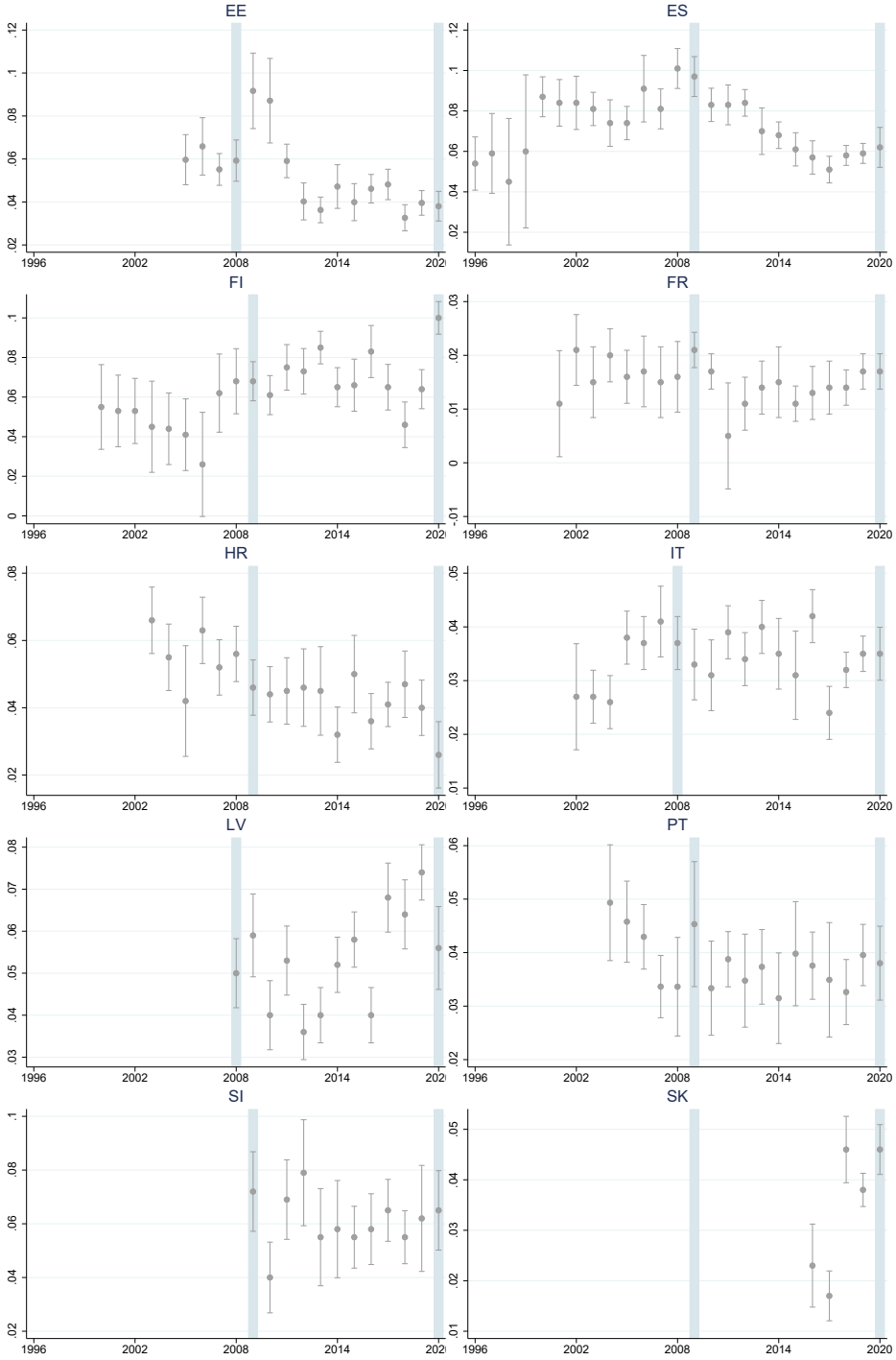

Figure A5: Productivity-enhancing reallocation by sample years, coefficients from year-by-year estimates

Notes: The figure plots the coefficients of relative productivity from separate estimations for each sample year using equation 3 and their 90% confidence bounds. Each coefficient shows the sensitivity of employment growth at the firm to its lagged productivity in a particular year. The results for the Netherlands are not shown for these estimates because of the limited coverage of the sample years.

Source: Authors' calculations from firm-level data.

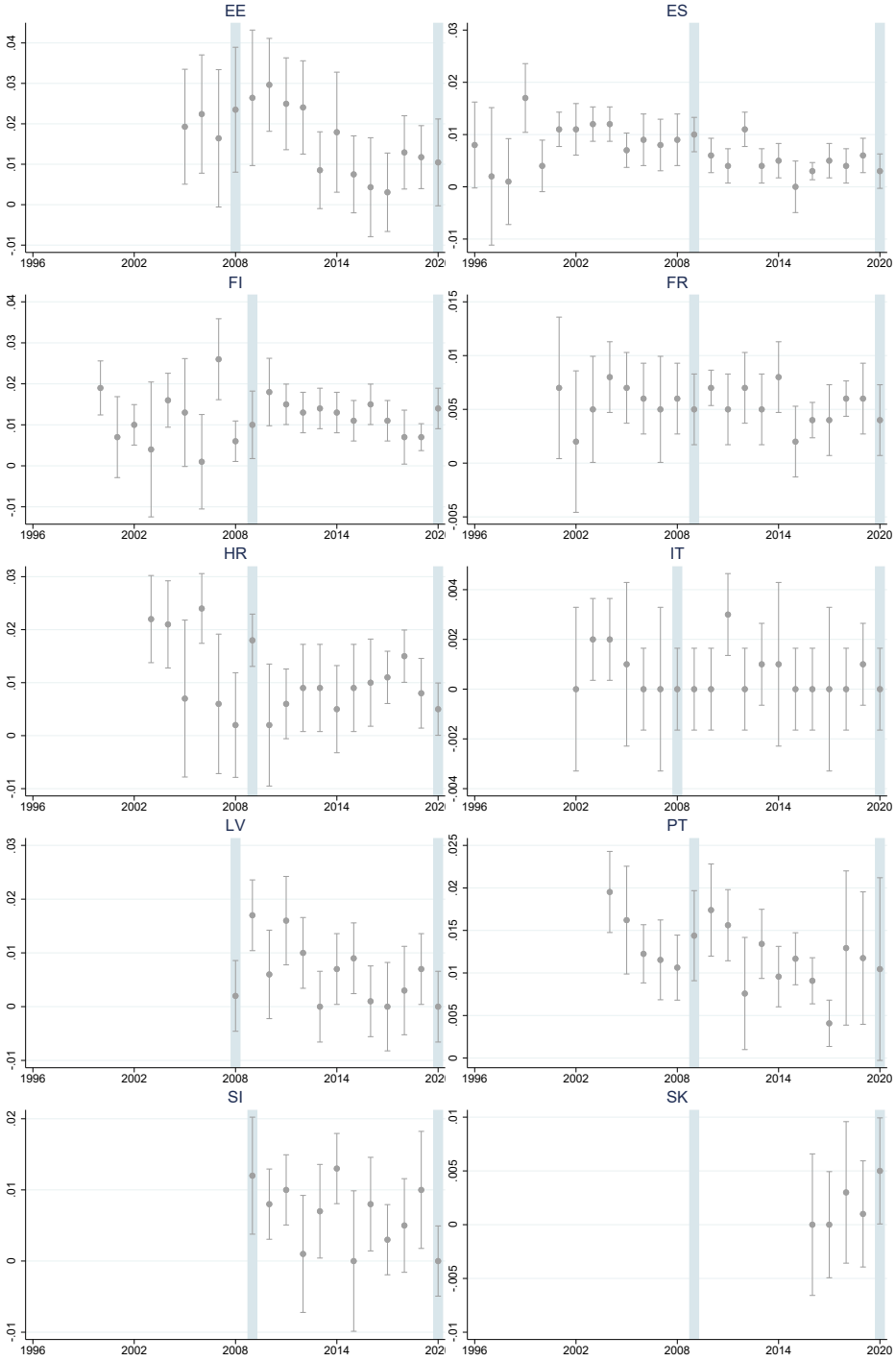

Figure A6: Total factor productivity-enhancing reallocation by sample years, coefficients from year-by-year estimates

Notes: The figure plots the coefficients of relative total factor productivity from separate estimations for each sample year using equation 3 and their 90% confidence bounds. Each coefficient shows the sensitivity of employment growth at the firm to its lagged productivity in a particular year. The results for the Netherlands are not shown for these estimates because of the limited coverage of the sample years.
Source: Authors' calculations from firm-level data.

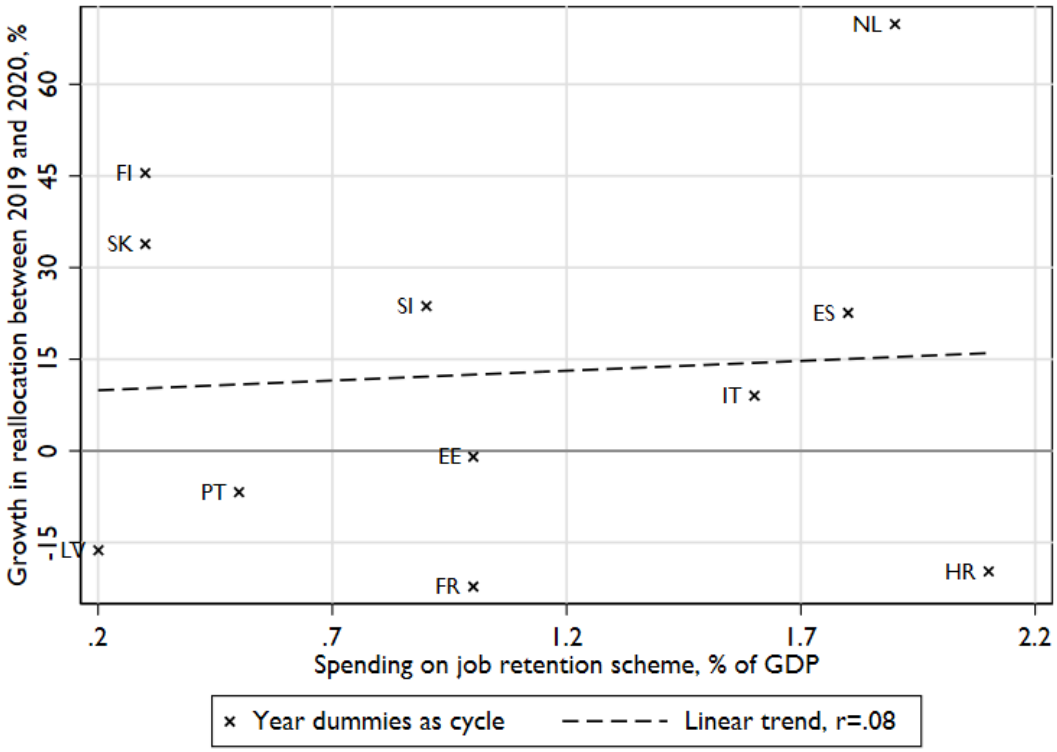

Figure A7: The costs of job retention support as a share of GDP and the change in productivity-enhancing reallocation

Notes: Change in productivity-enhancing reallocation between 2019 and 2020 origins from the estimates from equation 2.

Sources: Authors' calculations from administrative data, job retention support data from Table A3.

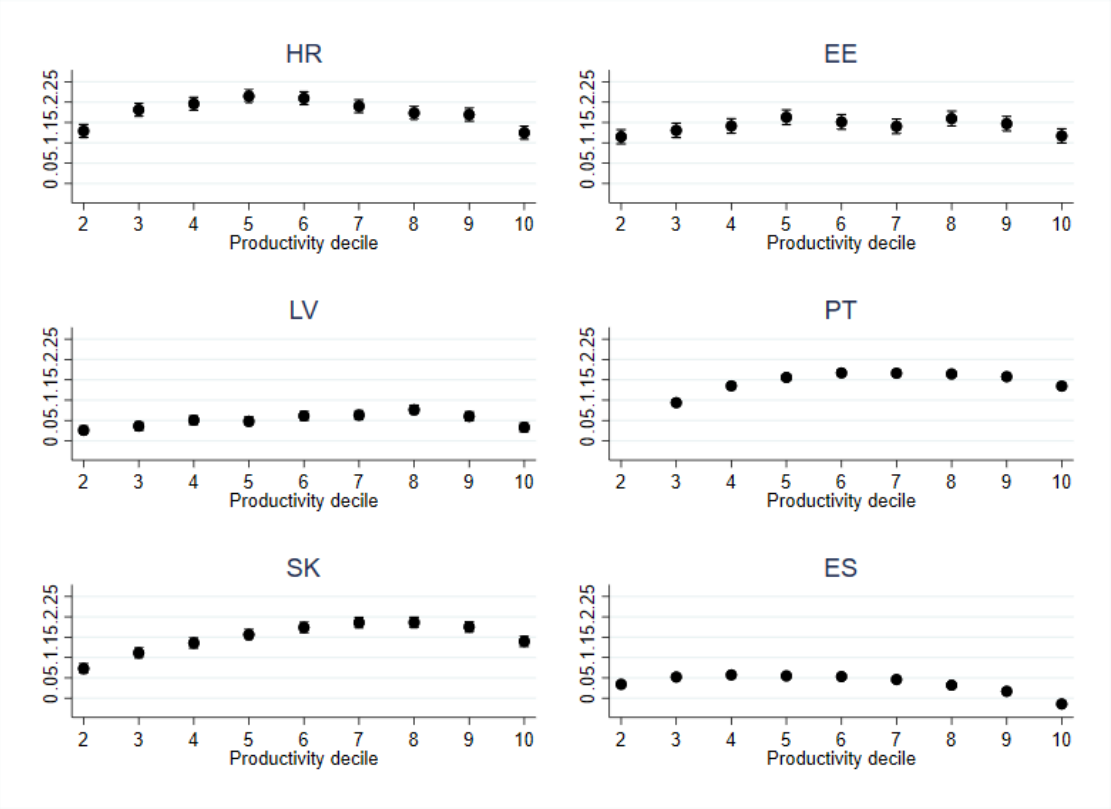

Figure A8: Probability of a firm receiving employment support by productivity deciles, 2020

Note: Firms are assigned to deciles of productivity by the country-level distribution of labour productivity in 2019.

Source: Authors' calculations from firm-level data.