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Covid-19 pandemic, state aid and firm productivity*

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Abstract

We study the consequences of the COVID-19 pandemic on productivity by matching firm performance outcomes with corresponding firm-level information on government support. Our cross-country evidence for five EU countries shows that the pandemic led to a significant short-term decline in productivity predominantly driven by the within-firm growth component. A thorough comparative analysis of the distribution of employment and overall direct subsidies, considering separately also relative firm-level support and the probability of being supported, reveals several common characteristics. In general, the pandemic support was distributed rather efficiently, i.e. towards "deserving" firms and only marginally towards "zombie" and non-viable firms. However, government subsidies appear to have had a limited effect on aggregate productivity developments.

Keywords: Covid-19, productivity, firm-level data, government support, employment subsidies, cross-country analysis

JEL: D22, H25, J38, L29

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1 Introduction

The Coronavirus pandemic and related containment measures have led to the deepest disruption in the global economic activity since the Second World War. The pandemic has evoked massive government support interventions, unprecedented in scope and scale. Although fiscal support to firms was well justified in order to limit bankruptcies, capital disruption and job losses, its longer-term effect on aggregate productivity is unclear. This paper adds to the debate by providing comparable firm-level evidence for five EU countries along three dimensions. First, we cluster firms according to their pre-pandemic performance to evaluate the allocation of government subsidies to each cluster. We find that the pandemic state aid was distributed rather efficiently, as it supported mainly "deserving" firms and only marginally "zombie" and non-viable firms. Second, we document a large short-term decline in productivity due to the pandemic. Third, we quantify the impact of subsidies on productivity and find that it has only partially offset the large negative shock to productivity.

While being huge by now, the literature on the economic impact of the pandemic is still hampered by the fact that firm-level balance sheet data are available with a significant time lag and the Covid-19 support and related data originate from different sources. In addition, a cross-country analysis faces an additional challenge that the micro-level data are typically not harmonized across countries making cross country comparisons difficult. We contribute to the literature by (i) combining firm-level data on public Covid-19 support with firm-level data measuring firm performance and (ii) providing cross-country evidence for five EU countries (Croatia, Finland, Netherlands, Slovakia and Slovenia) by implementing a micro-distributed approach to the analysis. Our data preparation and analysis benefit from the established CompNet (The Competitiveness Research Network) infrastructure. A common code distributed and independently executed by data providers on their respective national firm level information ensures high coverage, cross-country comparability and access to sensitive information without breaching confidentiality rules.

The subsidies we consider refer predominantly to the first and the most damaging wave of the Covid-19 pandemic. Although, our calculations are based on subsidies provided over the entire year 2020, more granular data shows that subsidies assigned for the period between March and June 2020 represent between 45% to 70% of overall resources allocated in 2020. For Croatia, Slovakia and Slovenia we consider solely employment (wage) subsidies, i.e. support received by a firm related to employment contracts kept by the firm even if the work had been suspended. For Finland and Netherlands, a broader set of subsidies is included.

Our analysis brings more empirical evidence to the literature on Covid-19 and productivity. It builds on the early considerations by di Mauro and Syverson (2020) which highlight the main channels through which the crisis may affect productivity growth. The Covid-19 shock affects production inputs and consequently overall productivity. With respect to labour inputs, we might expect significant impacts on human capital. School closures, despite the huge progress made in distance learning, and increased difficulties in integrating young people into the labour market, may have long-term negative effect on human capital (Martin et al., 2021). In addition to distance learning, we observe a historic increase in teleworking, that may also have consequences for productivity (considered e.g. by Bartik et al., 2020). The pandemic-related uncertainty and lack of financial resources influences capital inputs and investments. As suggested by Calligaris et al. (2021), lower investments may result in a long-term reduction in productivity.

Following Schumpeter (1939) we may assume that the pandemic recession accelerates the process of labour reallocation from low to high productivity firms. However, substantial policy measures implemented in order mitigate adverse effects on businesses prioritised job preservation that could potentially reduce or destroy productivity-enhancing reallocation. One of the first estimates published by Andrews et al. (2021a) suggest that job reallocation remained connected to firm productivity, i.e. high productivity firms were more likely to expand and low productivity firms were more likely to contract. The pandemic coincided with a temporary strengthening of the reallocation-productivity link in Australia – but a weakening in New Zealand – which appears related to the design of job retention schemes.

The Covid-19 pandemic brings two additional phenomena related to the extensive government support. First, as reported by Wang et al. (2020) for the United States, or Müller (2021) for Germany, during the crisis, when one would expect more firm defaults, countries are experiencing lower numbers of bankruptcies compared to the pre-pandemic period. Second, despite fears and policy suggestions (e.g. Laeven et al., 2021), we do not observe an immediate increase in Zombie firms.

Like Benassy-Quere et al. (2021), Demmou et al. (2021), or Lalinsky and Pal (2021), we benefit from micro data originating from balance sheet and income statements to compute productivity decompositions and projections; in addition, we also use administrative records on government subsidies. Our productivity decomposition builds on Bloom et al. (2020), who distinguish between within and between firm productivity growth and using UK data show that the pandemic has had a negative impact on productivity growth driven mainly by the within firm margin.

The paper proceeds as follows. Section 2 describes the data and the methodology. In Section 3 we briefly characterize the Covid-19 support measures in EU countries and in the sample countries in particular. Section 4 analyses the allocative efficiency of the support measures. In section 5 we study the consequences of the support measures for productivity. Section 6 concludes.

2 Data and methodology

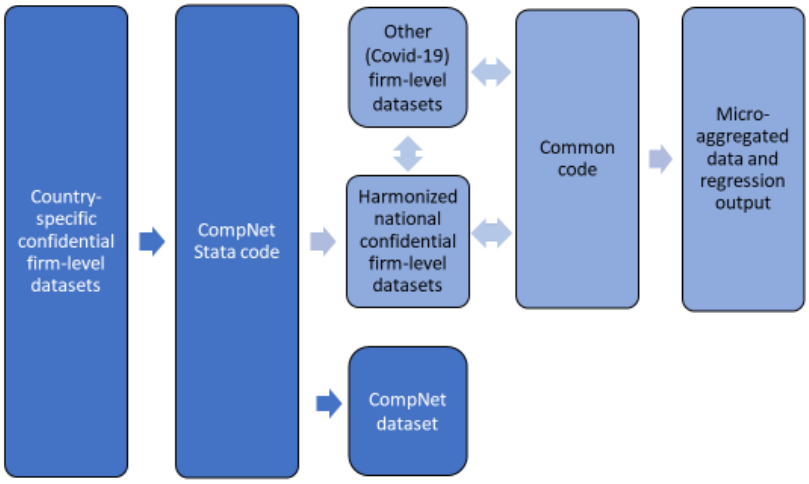
Firm level data is of key importance in studying the Covid-19 crisis, as the pandemic has hit companies unevenly across, but even within, sectors. Macro or industry level data thus provides an incomplete picture of the heterogenous effects of the crisis across firms. We combine firm-level administrative data on firm-performance in 2019 with firm-level information on subsidies received by each firm during 2020. For each firm we observe characteristics such as revenues, value-added and input costs as well as other financial variables from balance sheet and income statements together with employment data. The data originate from national sources and represent fairly exhaustive samples of all non-financial firms.[1] They are harmonised using the CompNet approach (CompNet, 2020).[2]

Confidentiality of the firm-level information rules out combining the raw data across countries. Therefore, we follow the CompNet approach and use its infrastructure developed for updating its micro-aggregated dataset. This allows us to utilize firm-level data from many countries and at the same time comply with micro-level data confidentiality restrictions. Although we benefit from the established CompNet infrastructure, we do not use the CompNet Dataset. Instead, we take advantage of the original national, but properly harmonized, confidential firm-level datasets, that are produced as a by-product of the CompNet procedure, and which remain in the data providers' possession. These data are combined with firm-level data on pandemic subsidies. We extend the standard CompNet Stata code and distribute it to the national data providers, who run it on their microdata. We apply this task specific code and obtain the needed harmonized aggregate data and regression outputs related to Covid-19 support and productivity.

The government support data refers to Covid-19 related employment subsidies allocated to firms in 2020 in Croatia, Slovakia and Slovenia. In the case of Netherlands, we investigate both employment subsidies and overall direct subsidies. The analysis of Covid-19 support in Finland builds on overall direct Covid-19 subsidies to firms in 2020.[3]

[1] See also Table A1.1 in Appendix 1 for the description of variables.
[2] We rely on the CompNet routine that was developed for the construction of the CompNet database.
[3] The overall support information for Netherlands covers employment subsidies, reimbursement of selected fixed costs, but also tax deferrals and loans that will have to be paid back. The overall support information for Finland covers funding for business development in disruptive circumstances, fixed-term support for (inflexible) business costs, temporary support and remuneration for catering

Figure 2.1.1. Modified CompNet approach.



The size of support and share of supported firms, as well as the type of support, differ across countries. The support reached between 29% (Finland and Slovakia) and 59% (Croatia) of firms. The largest relative size of employment subsidies was recorded in Croatia (5% of firm revenue) and the largest relative size of overall support was observed in the Netherlands (11% of firm revenue).[4]

In order to understand the distribution of the Covid-19 related support, we start with employing logit models to assess the conditional relationships between firm characteristics and corresponding support. We continue with conditional OLS analysis to find out to what extent the size of the support at the firm level depends on the firm's characteristics. We conclude the analysis of the support distribution with the assessment of the overall amount of the support allocated to selected firm clusters based on the performance of firms before the pandemic. This allows us not only to (i) quantify the share of subsidies allocated to "deserving" firms, but also to (ii) assess the impact of the Covid-19 pandemic on aggregate productivity, its distribution and growth margins.

The details of the econometric approaches and productivity decomposition used in the paper are described in the associated sections. Whereas the analysis of subsidy allocation connects pre-pandemic firm characteristics with pandemic subsidies, the analysis of productivity effects relies on projected firm developments in value added and employment during the pandemic.

companies. Finland compensated workers for reduced working hours in the form of a furlough scheme. However, this compensation was paid directly to workers, and not via firms. As a result, the scope of the Dutch overall direct support is not directly comparable with Finnish overall direct support.

[4] Further information on pandemic subsidies is available in section 2. COVID-19 support in EU countries.

Table 2.1.1: Summary statistics (mean value by country)

Variables	Croatia	Finland	Netherlands	Slovakia	Slovenia
Revenue (Thousand EUR)	1400	2542	8469	2765	2863
Employees	10.7	13.1	33.8	11.2	14.0
Supported firms (Share of total)	0.59	0.29	0.50	0.29	0.46
Size of support (Share on revenue)	0.05	0.07	0.11	0.02	0.03
Observations	85424	113454	120211	93520	36339

Note: Relative support for supported firms only. Based on employment support (Croatia, Slovakia and Slovenia) and overall direct support (Finland and Netherlands). Employment support in the Netherlands reached 40% of firms (i.e. coefficient is 0.4) and its size was 0.5.

The firm-level pandemic $Productivity_{ist}$ is calculated using pandemic value added and the number of employees

$$Productivity_{\mathrm{ist}} = \frac{(Sales_{ist} - Costs_{ist})}{Employees_{\mathrm{ist}}} \tag{1}$$

where value added is defined as the difference between $Sales_{ist}$ and $Costs_{ist}$, i stands for individual firm, s for industry and t for pandemic period of year 2020.[5]

The pandemic firm-level $Sales_{ist}$ are derived from the pre-pandemic firm $Sales_{ist-1}$ and an annual index of sectoral turnover I_{st} recorded during the pandemic following the relationship

$$Sales_{ist} = I_{st} \,.\, Sales_{ist-1} \tag{2}$$

Assuming the following relationship between total firm sales $Sales_{ist}$ and material costs $Costs_{ist}$

$$\Delta Costs_{ist} = \alpha_s \,.\, \Delta Sales_{ist} \text{ with } 0 < \alpha_s < 1 \tag{3}$$

we quantify pandemic-time changes in costs associated with pandemic changes in sales. Sectoral material cost elasticities α_s originate from Maurin and Pal (2021).[6] Firm-level pandemic costs are calculated as

$$Costs_{ist} = Costs_{ist-1} + \Delta Costs_{ist} \tag{4}$$

Analogously to material costs, the pandemic-time change in firm-level number of employees follows

$$\Delta Employees_{ist} = \beta_s \,.\, \Delta Sales_{ist} \text{ with } 0 < \beta_s < 1 \tag{5}$$

where β_s stands for sectoral labour cost elasticities from Maurin and Pal (2021). Firm-level pandemic

[5] The definition of the variables follows the CompNet (2021) methodology. Sales correspond to gross output. Costs correspond to intermediate input variable and Employees correspond to the employment variable used for the construction of the CompNet Dataset.

[6] By employing the ORBIS- Bureau Van Dijk dataset of non-financial corporations they estimate the sectoral short-term elasticities of costs to sales using data from 17 EU countries (almost 13 million firms from all available sectors) over the years 2014-2017. Cost elasticities used in our paper are listed in Appendix 1.

employment is then calculated as

$$Employees_{ist} = Employees_{ist-1} + \Delta Employees_{ist} \ . \tag{6}$$

3 Covid-19 support in EU countries

EU countries have differed significantly in how the pandemic has hit the economies and in the respective policy responses. The cross-country heterogeneity in the spread of the virus including contagion, hospitalization and death rates has been large. The transmission of the pandemic situation to the economy has also differed widely across countries, depending on e.g. the relative size of the service sectors (in particular the industries with personal contacts such as the accommodation and food services industries).[7] Policy measures have naturally played an important role for the economic consequences of the pandemic, but also self-imposed voluntary social distancing on the behalf of consumers has been important. Moreover, policy responses have varied both in size and type, depending on the above factors, but also importantly depending on the institutional features of the respective economies. The choice of Covid-19 support measures relied in many countries on pre-existing institutions, such as pre-pandemic distribution channels of public subsidies to firms or labour market adjustment channels, such as short time working schemes. Furthermore, the existing automatic stabilizers in the economy have influenced the need and choices of Covid-19 policy measures. Therefore, the Covid-19 support measures are not directly comparable.

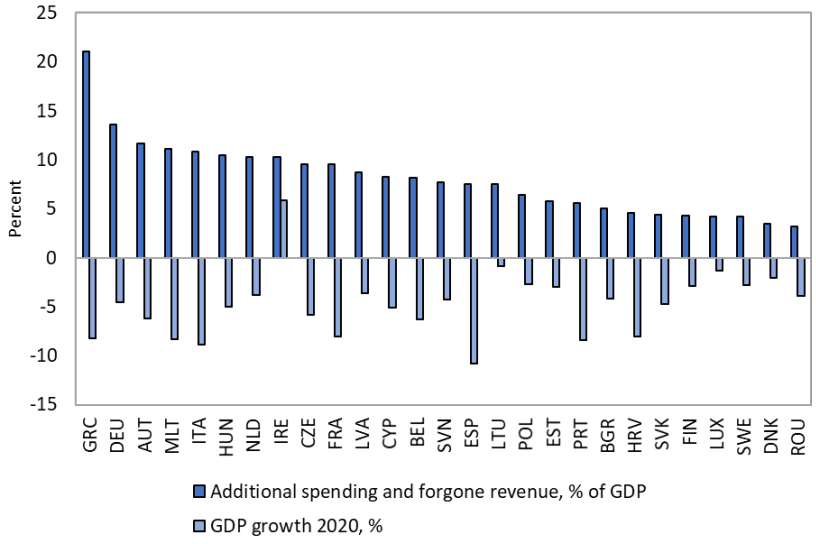
The discretionary fiscal responses in EU countries range from under 5 percent to roughly 20 percent of annual GDP (Figure 3.1). The large differences reflect the severity of the Covid-19 shock to the economies, but only partly. In addition, they reflect the above discussed features of the economies, in particular the country-specific size of the service sector, labour market institutions and automatic stabilizers, as well as economic policy decisions.[8]

According to EU Independent Fiscal Institutions (2021), public spending accounts for much larger share of the adopted fiscal measures (6.9% of GDP) than foregone revenues and liquidity measures (defaults of loans and guarantees) all together (1.4% of GDP) on average. In terms of beneficiaries, non-financial corporations benefited the most, receiving 3.4% of GDP in a form of subsidies and grants. Households represented the second group of direct beneficiaries, receiving about 2% of GDP. The rest of the support targeted non-profit institutions serving households or several categories of other beneficiaries at once.

[7] For example, in Finland the profitability of the corporate sector as a whole improved in 2020, although e.g. the accommodation and food services industries were severely hit by the crisis.

[8] Although, we cannot include large EU countries (like Germany, France, or Italy) in our analysis due to data unavailability, our sample of five countries very well matches the true heterogeneity of the EU member states in terms of the size of the pandemic shock to GDP and fiscal response, but also in terms of the structure of the economies or the level of development.

Figure 3.1: GDP growth in 2020 and discretionary fiscal response to the Covid-19 crisis in EU-economies.



Sources: IMF WEO Database and IMF Database of Country Fiscal Measures in Response to the COVID-19 Pandemic.
Note: Estimates as of June 5, 2021. Numbers are based on July 2021 World Economic Outlook Update.

3.1 Role of employment subsidies

Governments implemented broad packages of fiscal measures to help businesses to weather the pandemic-time economic decline. The list of policy responses typically ranges from tax or social security contributions deferrals or exemptions, public guarantees and subsidized loans, to employment subsidies and direct grants. Despite certain cross-country differences, employment (wage) subsidies or short-time work schemes (part-time and full-time furlough) represent the most frequent and largest measures adopted in the EU countries. The policies alleviated firms' liquidity needs when firms faced a sudden contraction in their sales, while allowing them to resume activity more swiftly after the lockdown by preserving the employment relationships.

Fernández-Cerezo et al. (2021) using Spanish sample document that firms predominantly responded to the pandemic-time decline in sales by reducing their investments and by implementing working from home. Short-time working schemes (and employment support) were deemed as especially useful for medium-sized firms and firms facing significant (more than 15%) decline in sales. As mentioned by Anderton et al. (2020), job retention schemes reached unprecedented levels already in the first months after the onset of theCOVID-19 pandemic. In April 2020, when lockdown measures to contain the spread of COVID-19 were in place in most euro area countries, 15% of all employees in Germany, 34% in France, 30% in Italy and 21% in Spain were on short-time work.[9]

[9] In 2009 the average share of employees participating in short-time work schemes reached 3.2% in Germany, 0.8% in France, 3.3% in Italy and 1.0% in Spain.

An experience from the Great Recession suggested that short-time work – publicly subsidized rule-based working time reductions – represented a cost-efficient job saving measure (Balleer et al., 2016). One of the first justifications for the furloughs during the pandemic was brought by Bennedsen et al. (2020), who confirmed that firms' primary response to the crisis was to furlough a large share of their workforce and found a strong relationship between taking up labour cost support and reporting lower layoffs.

However, past experience suggests that public support in the form of job retention schemes may also potentially lead to undesired effects when subsidizing highly leveraged firms (Cahuc et al., 2018) or unviable jobs and reducing allocative efficiency (Cooper et al., 2017). Another feature of job retention schemes is that they channel the labour market adjustment to quantities (employment), reducing the effect of shocks on prices (wages). This implicitly amplifies downward wage rigidity, which is a well-documented feature in European labour markets (e.g. Babecký et al. 2010, Fabiani et al. 2010, Holden and Wulfsberg 2014).

Specific conditions, scale and duration of Covid-19 related employment subsidies have differed across countries. Although, they have typically included automatic rule-based and subsidized working time reductions or temporary layoffs, the rules have been frequently adjusted to reflect the severity of the economic consequences of the pandemic. The eligibility conditions have usually included thresholds for minimum firm-level drops in sales and maximum wage limits. The size of compensation a firm can receive generally has increased with the drop in sales.

In all countries of the sample a large range of fiscal measures were applied, including employment support subsidies, tax and social contribution exemptions, tax deferrals, government guarantees and loans from government institutions. Our analysis focuses on direct employment support measures (Croatia, Slovakia, Slovenia) and overall direct subsidies to firms (The Netherlands and Finland).

In Croatia, a first employment support scheme was introduced for companies with a decline in revenue exceeding 20% during the first lockdown (March-May 2020), amounting initially to the minimum wage and subsequently 4,000 HRK. Further employment support measures were introduced, including subsidies for micro-entrepreneurs with a decline in revenues exceeding 50% (2,000 HRK), subsidies for employers in most heavily affected economic activities with a decline in revenue of 60% or more (up to 4,000 HRK) and subsidies for shorter working times if the companies had a decline in revenue exceeding 20% (up to 2,000 HRK). In response to a partial lockdown in the end of 2020, more measures were introduced, including subsidies for companies with restricted activities proportional to the fall of revenues (up to 4000 HRK per employee), an increase of subsidies for shorter working times (up to

2800 HRK per employee) and an extension of wage subsidies to the additional economic activities and subsidies for fixed costs for companies with restricted activities proportional to the fall of revenues.

In Slovakia, a first employment protection scheme for employers was introduced for firms that halted operations on the order of the public health authority and a second scheme was introduced for companies that decided to interrupt operations to protect the health of their employees and clients, or due to decreased sales. In the first scheme employers could apply for financial support of up to 80 percent of the average wages of its employees (limited to EUR 1,100 per employee). In the latter scheme a subsidy up to 80% of average earnings (limited to 880 EUR per month per employee) could be received, under the condition that the employer could not assign work to the employee. Or employers could receive a flat-rate contribution (up to 540 EUR per month per employee) to cover part of the wage costs of all employees depending on the decrease in sales.

In Slovenia, a first employment support scheme was directed to firms using temporary layoffs and provided employers with a full or partial refund of paid wages to furloughed workers. The subsidy could cover of up to 100 % of the average (2019) wage of its employee (up to 1,754 EUR per employee). Mostly the share of wage compensation covered by the state was 80 %. This measure represented the majority of aid granted in the form of wage subsidies in 2020. A second measure – to reduce full-time work – enabled employers to temporarily order part-time work (i.e. short time work for a maximum of half-time work), and for the rest of the time the worker was furloughed. Employers received up to 448 EUR per month per employee, working 20-24 hours per week.

In addition to employment support analysis, data for the Netherlands and Finland allow us to investigate the distribution and effects of overall subsidies to companies. The list of considered subsidies by countries is summarized in Table 3.1.2.

In Finland there were four types of Covid-19 subsidies in 2020. Initially, due to existing subsidy administration, subsidies for funding for business development in disruptive circumstances were distributed by two agencies (Business Finland and the Centre for Economic Development, Transport and the Environment). Thereafter a compensation scheme for government-imposed restrictions to catering companies was introduced to cover (non-labour) inflexible running expenses. Finally, the Business Cost Support (including labour costs) was introduced, intended to subsidize fixed costs for companies whose turnover had fallen markedly due to the pandemic.[10]

[10] Although furloughs were an important adjustment channel during the pandemic, they are not included in the present study as the furlough compensation in Finland is not administered through firms and does therefore not feature in the dataset.

Table 3.1.1: Summary of main eligibility criteria and coverage of employment support

	Croatia	Netherlands	Slovakia	Slovenia
Eligibility threshold	At least 20% decline in sales (revenue)	At least 20% decline in sales (revenue)	At least 20% decline in sales (revenue)	At least 20% decline in sales (revenue)
Wage replacement rate	Not set	Up to 85%	Up to 80%	Up to 100% (on average 80%)
Wage cap	4000 HRK (approx. 532 EUR)	Not set	1100 EUR	1754 EUR (country average wage)

Note: The conditions are only indicative, they may differ depending on the specific type of support and the time of application.
Source: Eurofound and data providers' information.

Table 3.1.2: The list of subsidies included in the analysis

Croatia	Finland	Netherlands	Slovakia	Slovenia
Employment subsidies		Employment subsidies	Employment subsidies	Employment subsidies
	Direct costs subsidies	Fixed costs subsidies		
		Tax deferrals		
		Pandemic loans		

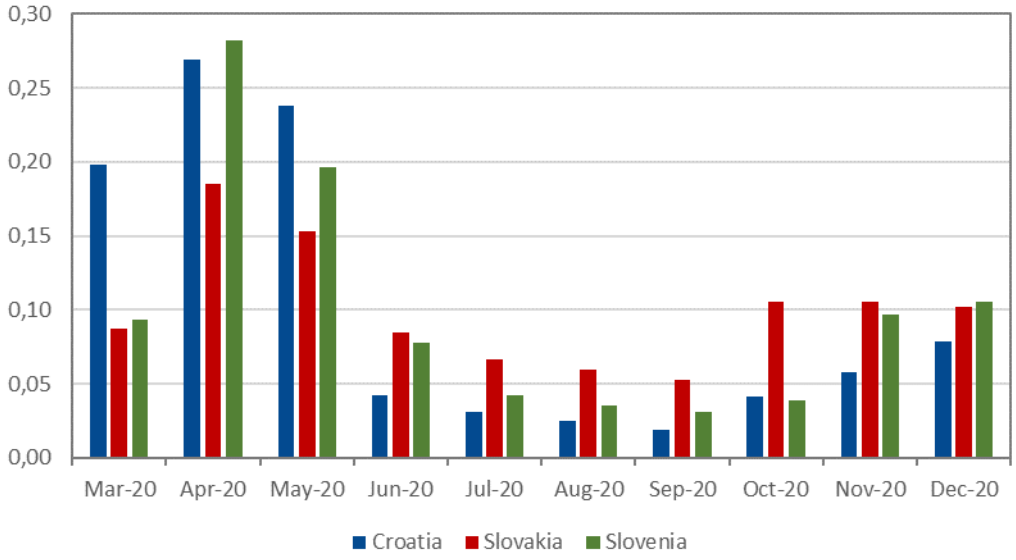
Source: Data providers' information.

In the Netherlands the government introduced a range of emergency financial schemes for employers and self-employed. The Temporary Emergency Bridging Measure for Sustained Employment (NOW) was directed to businesses with employees and self-employed, who expected to lose at least 20% turnover (at firm or subsidiary level) over the period they apply for as a result of the COVID-19 pandemic, to cover wage costs. Also, the Dutch government introduced the Reimbursement of Fixed Costs (TVL) programme to cover non-labour fixed costs for firms that suffered significant losses in turnover.

3.2 Evolution of allocated amounts

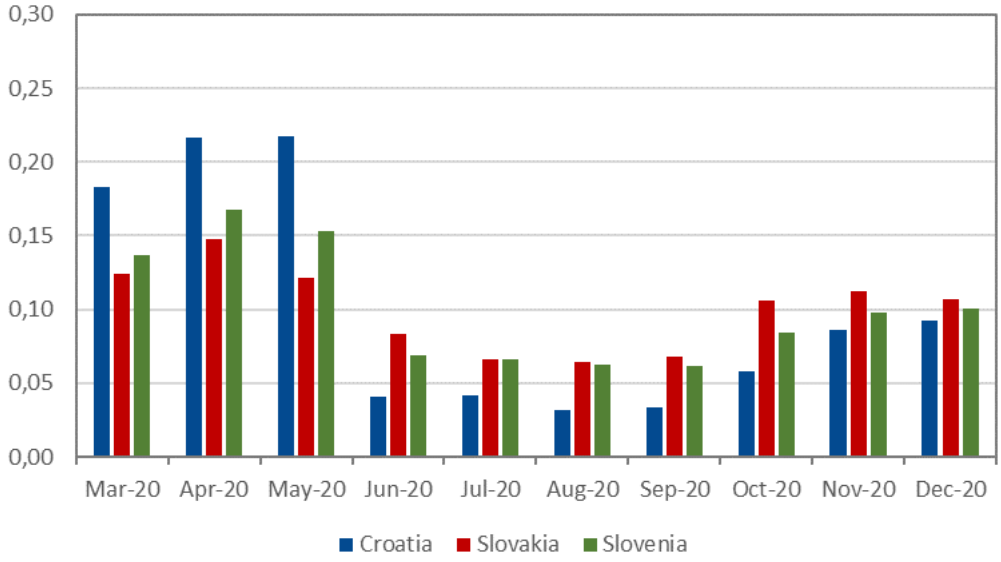
The distribution of Covid-19 support shows several interesting patterns. As confirmed by the detailed information on employment subsidies, the evolution of allocated subsidies is highly correlated across countries and it follows the economic impact of the pandemic. Most of the subsidies were paid to counteract the huge drop in sales recorded in April 2020. Within the first three months of the pandemic, between March and May 2020, 45% to 70% of all subsidies in 2020 were allocated to firms.

Figure 3.2.1: Share of allocated employment subsidies (% of year total)



Source: CompNet Data Providers.

Figure 3.2.2: Share of supported firms (% of year total)



Source: CompNet Data Providers.

The monthly development in the number of supported firms was somewhat smoother and even more correlated across countries. However, Croatia stood out again, as 60% of the overall number of subsidized firms were subsidized in the first three months of the pandemic.

4 Allocative efficiency of the support

In order to understand the distribution of the Covid-19 related support, we start with employing logit models to assess the conditional relationships between firm characteristics and corresponding support. We regress the dependent variable - binary dummy variable equal 1 for supported firm and 0 otherwise – on different explanatory variables of our interest and a set of covariates.

$$\Pr\left(Y_t = 1 | X_{t-n}\right) = \frac{1}{1+\exp(-X_{t-n}\beta)} \tag{7}$$

where $\Pr(Y_t=1|X_{t-n})$ denotes the probability of receiving support for a given firm in period *t* given X_{t-n}, where X_{t-n} is a row vector of explanatory variables and β is the corresponding column vector of regression coefficients.[11]

We continue with conditional OLS analysis to find out to what extent the size of the support at the firm level depends on the firm's characteristics and estimate equation (2) by OLS.

$$Y_t = \alpha + \beta X_{t-n} \tag{8}$$

where Y_t denotes the relative size of the firm-level subsidy with respect to revenue (or labour costs) and X_{t-n} is a row vector of explanatory variables (including sector and size controls) and β is the corresponding column vector of regression coefficients.

We conclude the subsidy allocation analysis with the assessment of the overall amount of the support allocated to selected firm clusters based on the performance of firms prior the pandemic. This exercise allows us to quantify the share of subsidies allocated to "deserving" firms, viable firms in temporary liquidity needs, and other relevant groups of firms.

Our findings are based on exhaustive detailed firm-level data on the pandemic support merged with firm-level balance sheet data. They do not necessarily confirm findings arising from studies relying on survey-based information on Covid-19 subsidies combined with firm-level balance sheet data. For example, Fernández-Cerezo et al. (2021) state that Covid-19 shock had stronger impact on small, young and less productive firms, which resorted relatively more to all available support schemes, including furlough in Spain. Harasztosi et al. (2021) employ results of a EU-wide EIB Investment Survey and document that firms with low pre-Covid-19 productivity are significantly more likely to be supported than firms with high productivity and being an exporter also matters, albeit to a lesser extent.

[11] The vector X_{t-n} contains main control variables (sector, size and region), various continuous explanatory variables (e.g. labour productivity, wage share or price-cost margin) and binary explanatory variables (e.g. for firm liquidity, ownership or financial distress). Continuous explanatory variables enter the model in logarithm. n takes value of 1, i.e. the probability of a firm receiving government support in year 2020 depends on the firm's characteristics from year 2019. See Appendix 1 for a description of explanatory variables.

4.1 Firm probability to receive the support

The probability of receiving Covid-19 support differs across firm characteristics. We focus on employment subsidies and overall direct subsidies. We start with the analysis of subsidy allocation by firm productivity and continue with other firm characteristics.

We find several common patterns. For example, larger or older firms and firms supplying accommodation and food services had higher chance to be supported. The probability of receiving support is higher also for domestic or growing firms. The support also seems to reach more frequently firms from less developed regions. The role of firm productivity shows a certain level of heterogeneity and non-linearity, but we may conclude that medium and less productive firms had higher chance to be subsidized. The effects of other firm characteristics are less conclusive and more country or support specific.

Allocation probability by productivity deciles

Pandemic subsidies reach mainly medium (and low) productive firms with relatively significant differences in allocation probabilities across countries. As shown in Table 4.1.1, for Croatia and Slovakia, we find that the chance of being supported increases with firm productivity. In Slovenia, Finland and Netherlands, we observe negative relationships between the probability to receive subsidy and firm productivity.

Our cross-country results do not confirm universal validity of previous evidence on higher probability of employment support allocated to high productive firms concluded by Andrews et al. (2021b). As shown in Figure 4.1.1, these relationships between the probability of receiving support and firm productivity is non-linear. The positive relationship increases up to the 5th or 7th deciles and then it declines in Croatia and Slovakia. In Slovenia and Finland, the overall negative relationship between productivity and probability of being supported is driven by the upper part of the productivity distribution, when only the firms belonging to the highest probability deciles have significantly lower chance to be supported. In the Netherlands, only firms in the 2nd and 3rd productivity deciles tend to be supported with higher probability and then the probability steeply declines.[12]

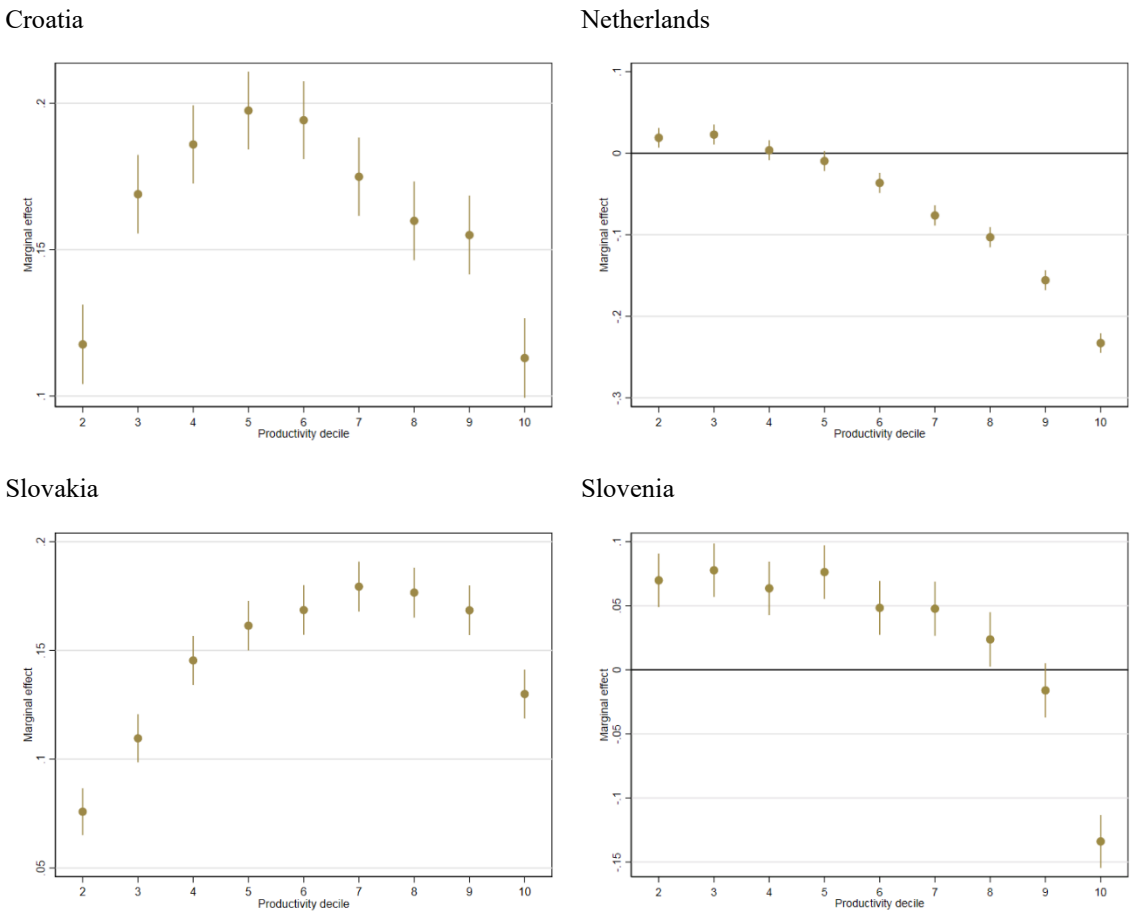
[12] For a robustness analysis we run the same regressions for within-sector productivity deciles, the results are presented in Appendix 2.

Table 4.1.1: Probability of receiving support – by productivity

	Wage subsidies				**Overall subsidies**	
Variables	Croatia	Netherlands	Slovakia	Slovenia	Finland	Netherlands
Labour productivity	**0.0202*** **	**-0.0690*** **	**0.0213*** **	**-0.0673*** **	**-0.0280*** **	**-0.0918*** **
	(0.0020)	**(0.0019)**	**(0.0013)**	**(0.0045)**	**(0.0020)**	**(0.0019)**
Control variables:						
Sector	Yes	Yes	Yes	Yes	Yes	Yes
Size class	Yes	Yes	Yes	Yes	Yes	Yes
Observations	71,180	99,925	76,005	30,701	90,855	99,925

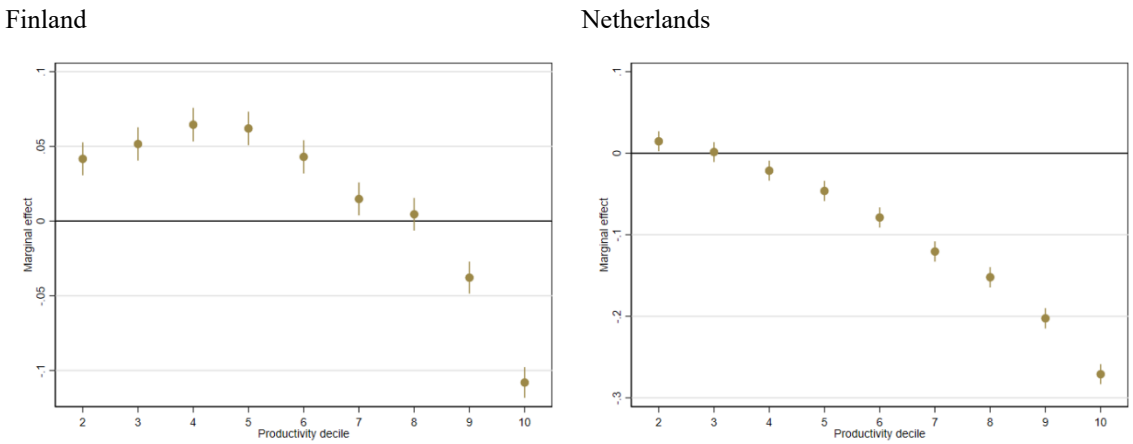
Note: The table shows average marginal effects from the logit regression for binary dummy representing receipt of COVID-19 government support in 2020. Lagged explanatory variables from year 2019. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Figure 4.1.1: Firm probability of receiving employment support – by productivity deciles



Note: Within country – firms assigned to deciles of the country-level distribution of labour productivity.
Source: Authors' calculations based on micro-data from Croatia, Finland, Netherlands, Slovakia and Slovenia.

Figure 4.1.2: Firm probability of receiving overall support – by productivity deciles



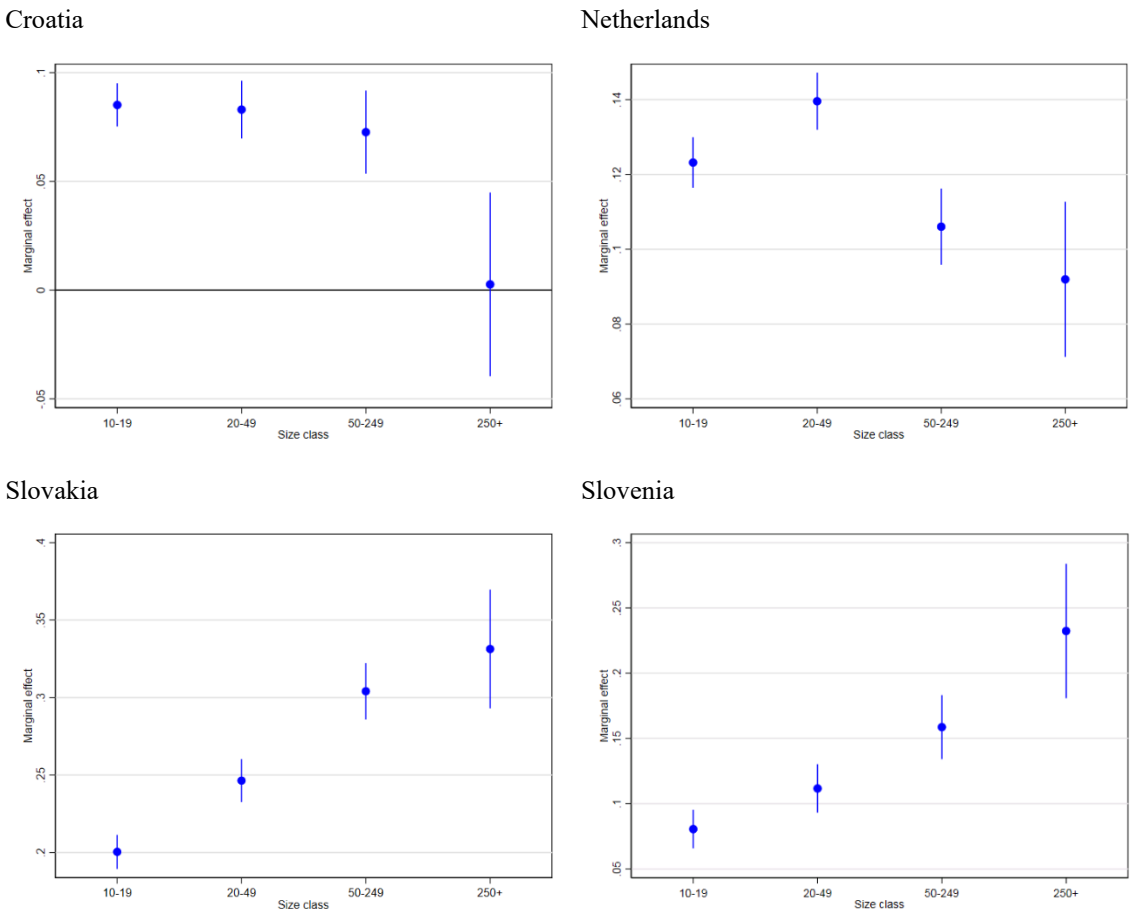
Note: Within country – firms assigned to deciles of the country-level distribution of labour productivity.
Source: Authors' calculations based on micro-data from Croatia, Finland, Netherlands, Slovakia and Slovenia.

Allocation probability by firm size, industry and location

The allocation of subsidies across firm size categories is more homogenous, we see that larger firms receive support with higher probability. In Slovakia or Slovenia – economies that tend to rely more on larger industrial firms' performance – the probability increases monotonically, and the largest employers have highest chance to be subsidised during the pandemic. In Croatia, Finland and Netherlands small and medium size firms tend to be supported more frequently than the micro or large firms.

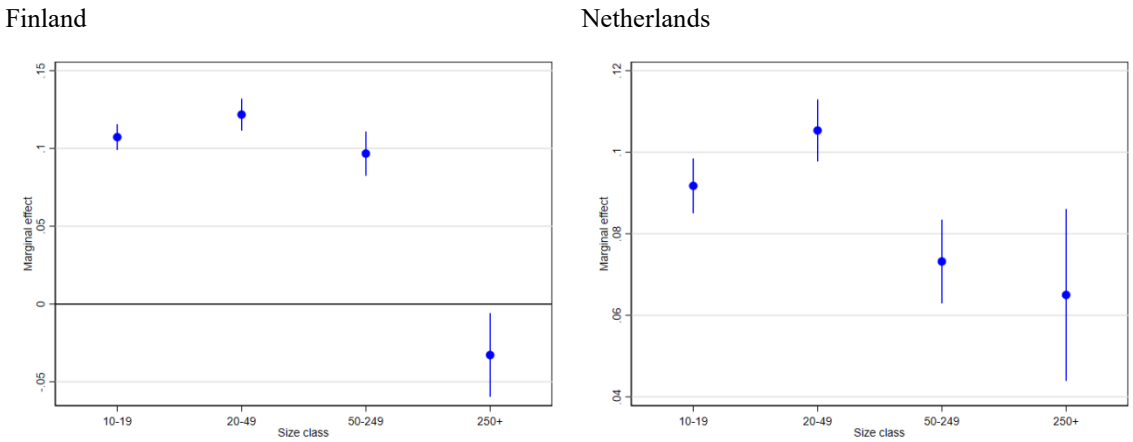
In line with the nature of the corona crisis that hit mostly in-person services, our analysis confirms that firms supplying accommodation and food services have the highest chance to be supported. This finding holds for all considered countries and both types of subsidies. Conditional on firm size and productivity, these firms have up to 0.44 percentage points higher probability to be supported than manufacturing firms.

Figure 4.1.3: Firm probability of receiving employment support – by firm size (employment)



Source: Authors' calculations based on micro-data from Croatia, Finland, Netherlands, Slovakia and Slovenia.

Figure 4.1.4: Firm probability of receiving overall support – by firm size (employment)



Source: Authors' calculations based on micro-data from Croatia, Finland, Netherlands, Slovakia and Slovenia.

Table 4.1.2: Probability of receiving support – by macro-sector

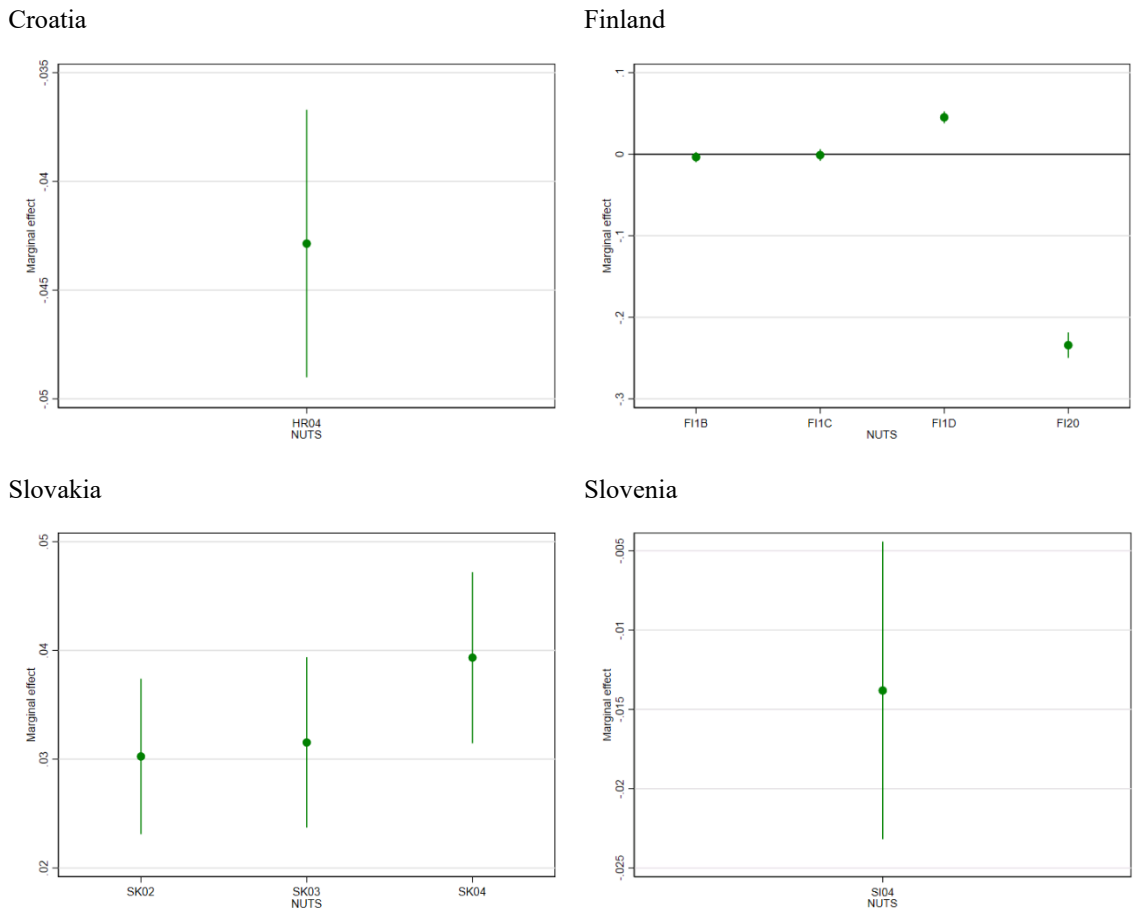
	Wage subsidies				**Overall subsidies**	
Variables	Croatia	Netherlands	Slovakia	Slovenia	Finland	Netherlands
Construction	-0.1249***	-0.2056***	-0.0724***	-0.1229***	-0.1807***	-0.1919***
	(0.0070)	(0.0063)	(0.0066)	(0.0102)	(0.0054)	(0.0065)
Wholesale and retail trade	-0.0138**	0.0020	0.0344***	0.0784***	-0.0115**	0.0262***
	(0.0061)	(0.0054)	(0.0057)	(0.0091)	(0.0058)	(0.0053)
Transportation and storage	-0.0733***	-0.0604***	-0.0179**	-0.0550***	-0.0309***	-0.0425***
	(0.0089)	(0.0082)	(0.0081)	(0.0122)	(0.0066)	(0.0083)
Accommodation and food service activities	**0.1447*** **	**0.2968*** **	**0.2647*** **	**0.3059*** **	**0.4362*** **	**0.3215*** **
	(0.0066)	**(0.0080)**	**(0.0092)**	**(0.0121)**	**(0.0081)**	**(0.0072)**
Information and communication	-0.2225***	-0.1176***	-0.1217***	-0.1322***	0.0338***	-0.0846***
	(0.0093)	(0.0070)	(0.0076)	(0.0134)	(0.0081)	(0.0071)
Real estate activities	-0.1246***	0.0476	-0.0885***	-0.0545***	-	0.0326
	(0.0134)	(0.2435)	(0.0085)	(0.0195)	-	(0.2406)
Professional, scientific and technical activities	-0.0865***	-0.1393***	-0.0613***	-0.0824***	-0.0551***	-0.1248***
	(0.0066)	(0.0057)	(0.0059)	(0.0096)	(0.0061)	(0.0057)
Administrative and support service activities	0.0322***	-0.0522***	-0.0367***	0.0866***	-0.0737***	-0.0117
	(0.0091)	(0.0072)	(0.0068)	(0.0164)	(0.0071)	(0.0073)
Control variables:						
Productivity	Yes	Yes	Yes	Yes	Yes	Yes
Size class	Yes	Yes	Yes	Yes	Yes	Yes
Observations	71,180	99,925	76,005	30,701	90,855	99,925

Note: The table shows average marginal effects from the logit regression for binary dummy representing receipt of COVID-19 government support in 2020. Lagged explanatory variables from year 2019. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

In order to account for firm location, we take into account firm's NUTS2 region. Our estimates suggest higher probability of being supported for firms located in less developed regions. As presented in Figure 4.1.5, firms from more developed regions of Western Slovenia or Continental Croatia have lower chance to receive employment subsidies. At the same time, firms from less developed regions in Slovakia are more frequently supported during the pandemic. However, this pattern can be clearly confirmed only for employment subsidies.[13]

[13] In Finland the overall direct subsidies are distributed more equally across NUTS2 regions. Although a more developed western region has a lower chance to receive subsidies than eastern and northern Finland, the estimates for the most developed Helsinki region and southern region are not statistically significant. The regional allocation of overall support in the Netherlands cannot be assessed, because we do not have information on the location of Dutch firms.

Figure 4.1.5: Firm probability of receiving support – by NUTS2 regions



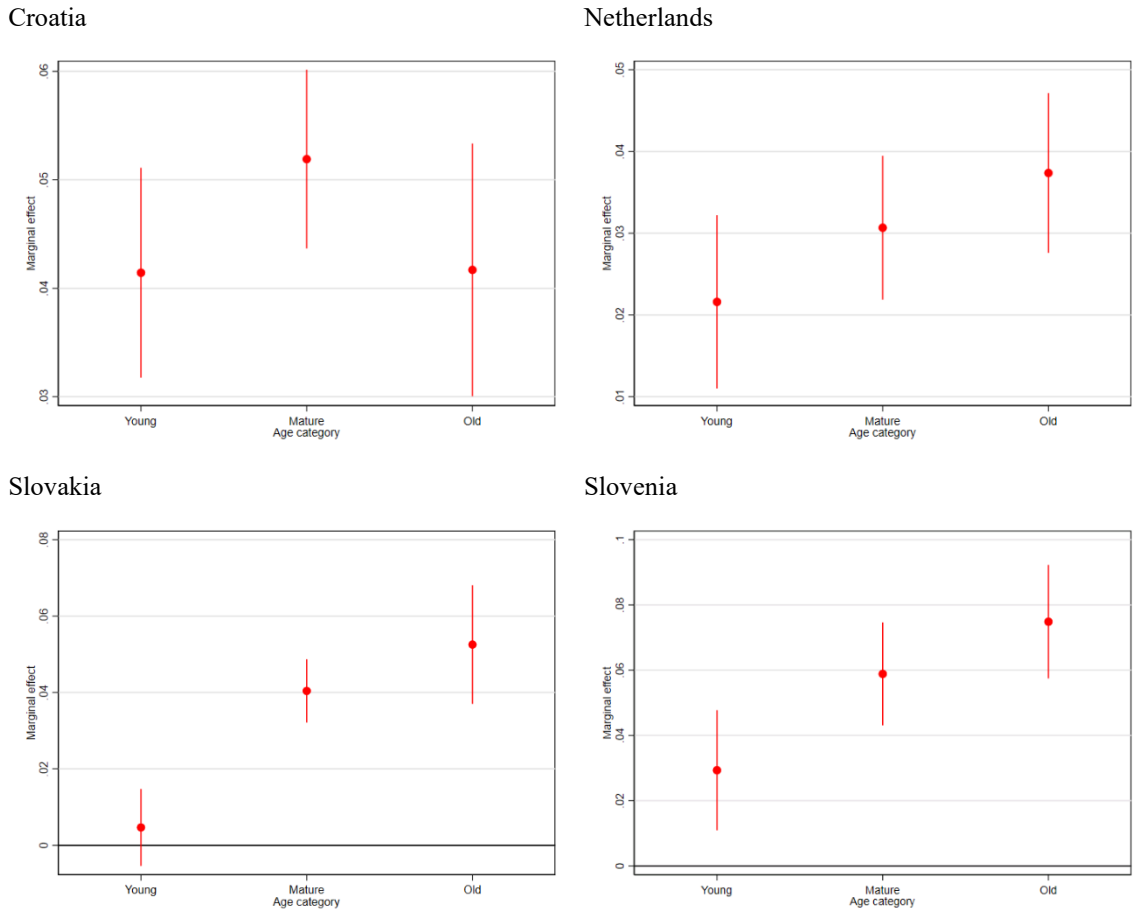
Note: Overall direct support for Finland and employment support for all other countries.
Source: Authors' calculations based on micro-data from Croatia, Finland, Slovakia and Slovenia.

Allocation probability by age, growth, ownership and labour intensity

Our conditional Logit regression results for all available countries show that probability of receiving employment support increases with firm age. Mature firms have between 0.03 to 0.06 percentage points higher probability to be supported and old firms have 0.04 to 0.08 percentage points higher probability to be supported compared to the very young (start-up) firms.[14] However, estimates for Netherlands suggest that the positive relationship does not hold for overall direct subsidies and an additional (other than employment related) support is directed more frequently to younger firms.[15] An alternative specification with age as a continuous variable confirms our baseline results.[16]

[14] Start-ups are firms younger than 3 years; young firms are firms in the age of at least 3 years, but younger than 5 years, mature firms are at least 5 years old, but younger than 25, and old firms are firms present for at least 25 years.
[15] As a result, old firms have about 0.02 percentage points lower chance to receive overall support.
[16] See Appendix 2 for more details.

Figure 4.1.6: Firm probability of receiving employment support – by firm age



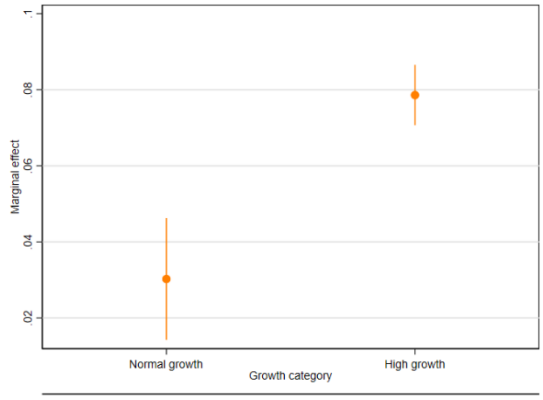
Source: Authors' calculations based on micro-data from Croatia, Netherlands, Slovakia and Slovenia. Firm age not available for Finnish firms.

To some extent similar findings hold for firm (employment) growth. Growing or highly growing firms have statistically significant and economically larger chance to receive subsidies. Importantly, although growing firms have between 0.018 and 0.079 percentage points higher probability to be subsidized, there is no common pattern regarding the difference between firms with standard and high growth.[17]

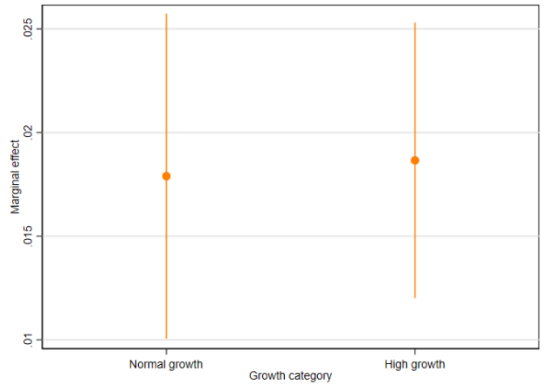
[17] Declining or stagnating firms are firms that recorded negative or no employment growth over the last three years. Growing firms are firms that increased their employment by less than 20% over the last three years. Highly growing firms recorded growth exceeding 20% over the last three years.

Figure 4.1.7: Firm probability of receiving employment support – by firm growth

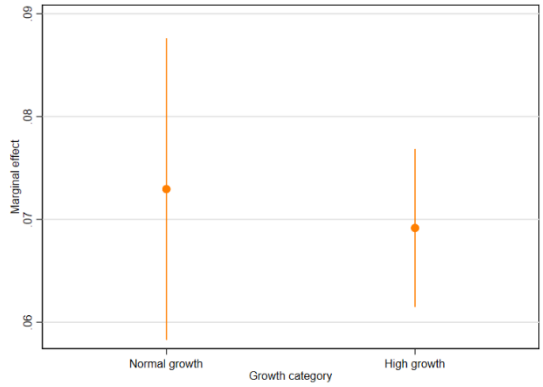
Croatia



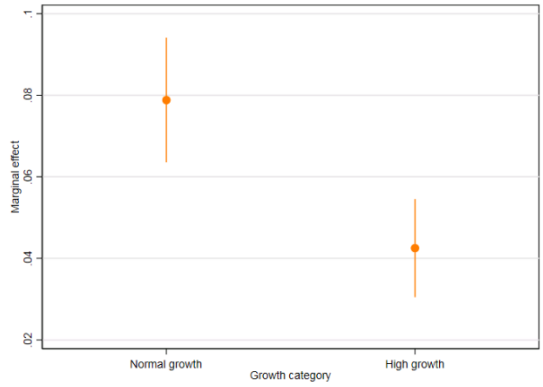
Netherlands



Slovakia



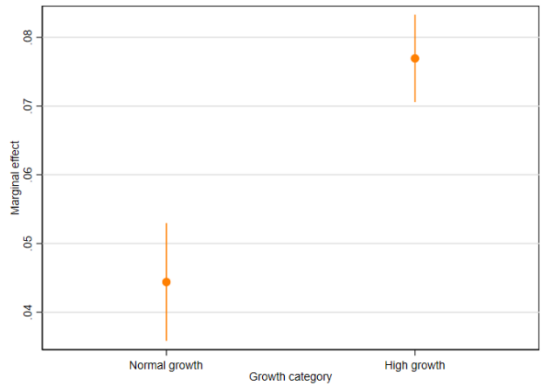
Slovenia



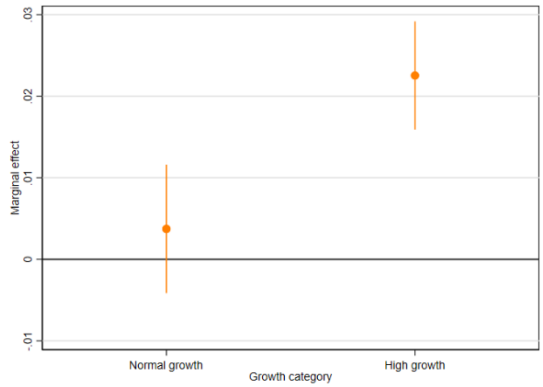
Source: Authors' calculations based on micro-data from Croatia, Netherlands, Slovakia and Slovenia.

Figure 4.1.8: Firm probability of receiving overall support – by firm growth

Finland



Netherlands



Source: Author's calculations based on micro-data from Finland, Netherlands.

Table 4.1.3: Probability of receiving support – by firm ownership

	Wage subsidies			**Overall subsidies**	
Variables	Croatia	Netherlands	Slovakia	Finland	Netherlands
Foreign ownership	**-0.0864*** **	**-0.0765*** **	**-0.0318*** **	**-0.3165*** **	**-0.1059*** **
	(0.0080)	**(0.0093)**	**(0.0058)**	**(0.0135)**	**(0.0091)**
Public ownership	**-0.3936*** **	**0.1589**	**0.0241** **	**-0.3515*** **	**0.2060**
	(0.0292)	**(0.1559)**	**(0.0100)**	**(0.0406)**	**(0.1647)**
Control variables:					
Productivity	Yes	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes	Yes
Size class	Yes	Yes	Yes	Yes	Yes
Observations	71,180	10,997	76,005	90,855	10,997

Note: The table shows average marginal effects from the logit regression for binary dummy representing receipt of COVID-19 government support in 2020. Lagged explanatory variables from year 2019. Ownership information not available for Slovenia. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 4.1.4: Probability of receiving support – by labour intensity

	Wage subsidies				**Overall subsidies**	
Variables	Croatia	Netherlands	Slovakia	Slovenia	Finland	Netherlands
Wage share	**0.0312*** **	**-0.0024**	**0.0612*** **	**-0.0174*** **	**0.0184*** **	**-0.0039* **
	(0.0028)	**(0.0023)**	**(0.0019)**	**(0.0044)**	**(0.0023)**	**(0.0023)**
Control variables:						
Productivity	Yes	Yes	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes	Yes	Yes
Size class	Yes	Yes	Yes	Yes	Yes	Yes
Observations	71,180	99,925	76,005	30,701	90,855	99,925

Note: The table shows average marginal effects from the logit regression for binary dummy representing receipt of COVID-19 government support in 2020. Lagged explanatory variables from year 2019. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

In terms of firm ownership, we find that foreign firms were between 0.03 to 0.32 percentage points less likely supported during the Covid-19 pandemic. However, the role of public ownership is not so clear. Our estimates suggest that publicly owned firms were slightly prioritized in Slovakia. At the same time, in Croatia and Finland they had much lower chance to be subsidized (compared to privately owned firms).

Higher labour intensity of a firm's output does not necessarily increase its probability to be supported. The effect of this factor differs across countries. Although, in Slovakia, Finland or Croatia firms with higher wage share have higher chance to receive subsidies, in Slovenia and Netherlands we find weaker, but negative relationship.

Allocation probability by firm market power and dominance

Our conditional logit regression estimates (controlling for firm size) suggest that that firms with lower market power or dominance were more successful in receiving government support. In all analysed countries (except Slovenia), we observe that probability of receiving pandemic support decreases with firm market power measured by markup or price-cost margin.[18]

Table 4.1.5: Probability of receiving support – by firm markup

	Wage subsidies				**Overall subsidies**	
Variables	Croatia	Netherlands	Slovakia	Slovenia	Finland	Netherlands
Markup	**-0.0129*** **	**-0.1397*** **	**-0.0072*** **	**0.0586*** **	**-0.0714*** **	**-0.2077*** **
	(0.0013)	**(0.0101)**	**(0.0011)**	**(0.0160)**	**(0.0067)**	**(0.0099)**
Control variables:						
Productivity	Yes	Yes	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes	Yes	Yes
Size class	Yes	Yes	Yes	Yes	Yes	Yes
Observations	68,435	99,896	74,592	29,516	88,318	99,896

Note: The table shows average marginal effects from the logit regression for binary dummy representing receipt of COVID-19 government support in 2020. Lagged explanatory variables from year 2019. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 4.1.6: Probability of receiving support – by firm concentration of revenue

	Wage subsidies				**Overall subsidies**	
Variables	Croatia	Netherlands	Slovakia	Slovenia	Finland	Netherlands
HHI (Revenue)	**-0.0056*** **	**-0.0253*** **	**-0.0178*** **	**0.0237*** **	**N/A**	**-0.0182*** **
	(0.0019)	**(0.0022)**	**(0.0016)**	**(0.0031)**		**(0.0023)**
Control variables:						
Productivity	Yes	Yes	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes	Yes	Yes
Size class	Yes	Yes	Yes	Yes	Yes	Yes
Observations	71,180	99,925	76,005	30,701	90,855	99,925

Note: The table shows average marginal effects from the logit regression for binary dummy representing receipt of COVID-19 government support in 2020. Lagged explanatory variables from year 2019. Standard errors in parentheses, ***p<0.01, ** p<0.05, *p<0.1

[18] The markup is based on firm intermediate and labour input decision, see CompNet (2021) for details. The price-cost margin is defined as a ratio (Revenue - Material costs - Labour costs - Capital costs)/Revenue. See Appendix 2 for the estimates of the price-cost margin.

Using the Herfindahl-Hirschman index for nominal turnover as a measure of firm dominance in the market leads to similar conclusions. In all countries (except Slovenia), we find that more dominant firms had a somewhat lower chance to be subsidised.

Allocation probability by firm financial distress

From the point of efficiency, it is important to know to what extent the support reached financially viable firms. We consider subsidy allocation with respect to firm's longer-term ability to create profit and its ability to cover interest costs.[19]

Although, the results presented in Table 4.1.7 does not confirm excessive targeting of loss-making firms, in Slovakia and Netherlands firms recording negative operating profit for three consecutive years had about 0.05 percentage points higher chance to be funded.

In the same vein, we may consider whether a firm creates enough profit to cover its financial obligations (interests) and to what extent the Covid-19 government support schemes created space for excessive financing of so called "zombie" firms. As suggested by the results presented in Table 4.1.8, "zombie" firms had a somewhat higher chance to be supported only in the Netherlands. In other countries (non-high growth) firms unable to cover their interest obligations for three consecutive years had lower or not statistically different probability to be supported during the pandemic (compared to the remaining firms).

Table 4.1.7: Probability of receiving support – by firm profitability

	Wage subsidies				**Overall subsidies**	
Variables	Croatia	Netherlands	Slovakia	Slovenia	Finland	Netherlands
Loss-making firm	**-0.0170**	**0.0120**	**0.0518*** **	**-0.0451** **	**-0.0554*** **	**0.0428*** **
	(0.0109)	**(0.0093)**	**(0.0082)**	**(0.0197)**	**(0.0091)**	**(0.0094)**
Control variables:						
Productivity	Yes	Yes	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes	Yes	Yes
Size class	Yes	Yes	Yes	Yes	Yes	Yes
Observations	31,400	44,881	46,008	14,724	44,221	44,881

Note: The table shows average marginal effects from the logit regression for binary dummy representing receipt of COVID-19 government support in 2020. Lagged explanatory variables from year 2019. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

[19] Here, we take into account firm's financial condition during the period of three years prior the Covid-19 pandemic. Alternatively, negative operating profit during the pandemic and shortly prior the pandemic may be considered as a sign of temporary liquidity need.

Table 4.1.8: Probability of receiving support – by firm ability to pay interests

	Wage subsidies				**Overall subsidies**	
Variables	Croatia	Netherlands	Slovakia	Slovenia	Finland	Netherlands
Zombie firm	**-0.0163**	**0.0194****	**-0.0096**	**-0.0365***	**-0.0903*****	**0.0541*****
	(0.0221)	**(0.0082)**	**(0.0121)**	**(0.0216)**	**(0.0128)**	**(0.0083)**
Control variables:						
Productivity	Yes	Yes	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes	Yes	Yes
Size class	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,544	44,572	19,378	9,090	15,029	44,572

Note: The table shows average marginal effects from the logit regression for binary dummy representing receipt of COVID-19 government support in 2020. Lagged explanatory variables from year 2019. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

4.2 Firm-level size of the support

The probability of a firm being supported tells only a part of the story. For the overall effect of subsidies, it is important to analyse the size of the support. We start with the analysis of subsidy distribution by firm productivity that represents main focus of our study. We continue with a cross-country comparison of relative size of government subsidies[20] by basic firm characteristics like firm size, age, industry, location or ownership. We also consider a range of additional firm characteristics shedding more light on the role of firm growth, market dominance, financial distress or zombification.

We find several common patterns. More productive or growing firms received lower relative subsidies. The support decreases also with firm size or firm age. In terms of other characteristics, we see that more labour-intensive firms or dominant firms received higher support and the same is true for dominant firms.

Role of firm productivity

Our conditional OLS estimates for supported firms show that the relative size of the support decreases with firm productivity. The effect is stronger for overall direct subsidies than for employment subsidies. The relationship between the firm size of the subsidies and firm productivity is more linear than the relationship between productivity and the probability of being supported. This holds especially for the employment subsidies (see Figure A2.2.1 and A2.2.2 in the Appendix for details).

[20] The relative size of the support represents the amount of a subsidy allocated to a firm with respect to its revenue or labour costs. The findings presented below hold for both definitions, unless otherwise stated.

Table 4.2.1: Relative size of support – by productivity

	Wage subsidies				Overall subsidies	
Variables	Croatia	Netherlands	Slovakia	Slovenia	Finland	Netherlands
Labour productivity	**-0.0744*** **	**-0.1297*** **	**-0.0078*** **	**-0.0283*** **	**-0.0239*** **	**-0.2546*** **
	(0.0015)	**(0.0023)**	**(0.0002)**	**(0.0007)**	**(0.0008)**	**(0.0060)**
Constant	-5.5331***	-5.5134***	0.0452***	0.1256***	0.1656***	-5.3014***
	(0.3031)	(0.3032)	(0.0010)	(0.0025)	(0.0033)	(0.6310)
Control variables:						
Sector	Yes	Yes	Yes	Yes	Yes	Yes
Size class	Yes	Yes	Yes	Yes	Yes	Yes
Observations	44,523	43,193	23,986	14,838	28,481	51,785
R-squared	0.1034	0.1101	0.0764	0.1660	0.1643	0.0492

Note: The table shows coefficients of OLS regressions for supported firms with the share of firm subsidies on labour costs as dependent variable. Continuous variables in logarithm. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

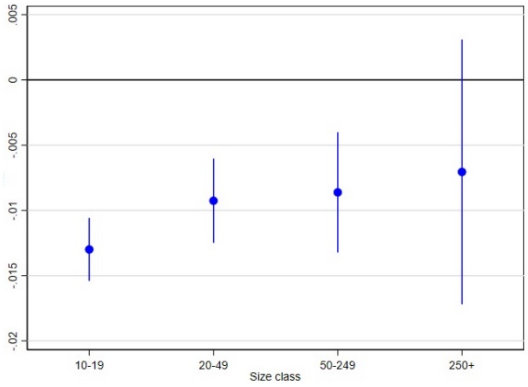
Role of firm size, industry and location

Micro or small firms tend to receive higher support than medium or large firms. This holds for the firm size defined based on number of employees or revenue. As shown in Figure 4.2.1 and Figure 4.2.2, we observe some differences across countries and the types of support. In the case of employment subsidies in Croatia or Netherlands, the support does not monotonically decrease with firm size dummies.

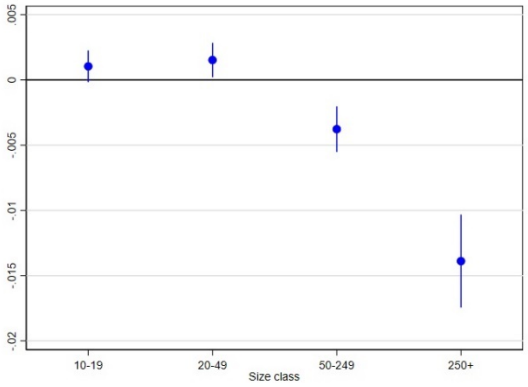
Our conditional estimates controlling for firm size, region and productivity confirm larger relative size of support allocated to firms supplying accommodation and food services in most of the countries. At the same time, the macro sectors receiving the highest relative support differ across countries and types of support. In Finland or Netherlands, highest relative subsidies were allocated to the Information and communication sector. In Croatia and Slovenia, the largest relative amount reached Real estate activities and in Slovakia it was Professional, scientific and technical activities.

Figure 4.2.1: Relative size of the employment support – by firm size (number of employees)

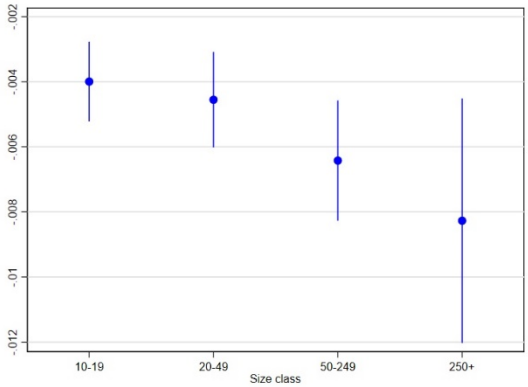
Croatia



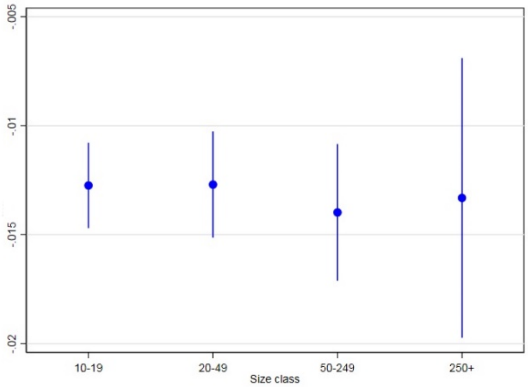
Netherlands



Slovakia



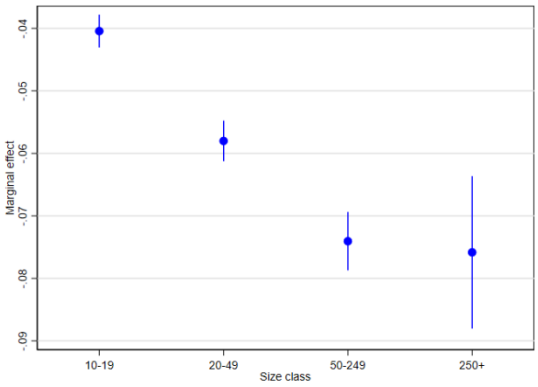
Slovenia



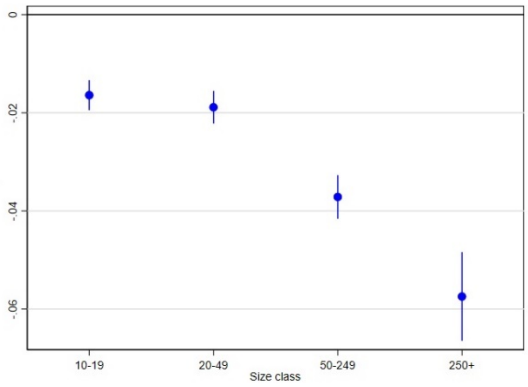
Note: Relative support with respect to revenue. Conditional OLS estimates for supported firms.
Source: Authors' calculations based on micro-data from Croatia, Finland, Netherlands, Slovakia and Slovenia.

Figure 4.2.2: Relative size of the overall direct support – by firm size (number of employees)

Finland



Netherlands



Note: Relative support with respect to revenue. Conditional OLS estimates for supported firms.
Source: Authors' calculations based on micro-data from Croatia, Finland, Netherlands, Slovakia and Slovenia.

Table 4.2.2: Relative size of support – by macro sectors

	Wage subsidies				**Overall subsidies**	
Variables	Croatia	Netherlands	Slovakia	Slovenia	Finland	Netherlands
Construction	0.0029*	-0.0085***	-0.0055***	-0.0027*	-0.0197***	-0.0127***
	(0.0017)	(0.0014)	(0.0010)	(0.0015)	(0.0023)	(0.0034)
Wholesale and retail trade	-0.0082***	-0.0191***	-0.0018**	-0.0028**	-0.0221***	-0.0359***
	(0.0015)	(0.0009)	(0.0008)	(0.0012)	(0.0020)	(0.0024)
Transportation and storage	0.0142***	-0.0002	-0.0054***	-0.0004	-0.0225***	0.0030
	(0.0022)	(0.0015)	(0.0012)	(0.0017)	(0.0023)	(0.0038)
Accommodation and food service activities	0.0117***	0.0264***	0.0040***	0.0042***	-0.0331***	0.0459***
	(0.0017)	(0.0013)	(0.0010)	(0.0015)	(0.0021)	(0.0033)
Information and communication	0.0000	0.0337***	0.0031**	0.0101***	0.0708***	0.0794***
	(0.0026)	(0.0014)	(0.0014)	(0.0021)	(0.0026)	(0.0034)
Real estate activities	0.0324***	-0.0160	0.0012	0.0360***		-0.0311
	(0.0035)	(0.0420)	(0.0015)	(0.0028)	N/A	(0.1138)
Professional, scientific and technical activities	0.0081***	0.0250***	0.0041***	0.0123***	0.0398***	0.0453***
	(0.0016)	(0.0011)	(0.0009)	(0.0014)	(0.0022)	(0.0027)
Administrative and support service activities	0.0195***	0.0245***	0.0029***	0.0032	0.0052*	0.0285***
	(0.0023)	(0.0013)	(0.0010)	(0.0020)	(0.0027)	(0.0032)
Constant	-5.5331***	-5.5134***	0.0440***	0.1248***	0.1605***	-5.3014***
	(0.3031)	(0.3032)	(0.0011)	(0.0025)	(0.0035)	(0.6310)
Control variables:						
Productivity	Yes	Yes	Yes	Yes	Yes	Yes
Size class	Yes	Yes	Yes	Yes	Yes	Yes
Region	Yes	No	Yes	Yes	Yes	No
Observations	44,523	43,193	23,986	14,838	28,469	51,785
R-squared	0.1034	0.1101	0.0768	0.1664	0.1673	0.0492

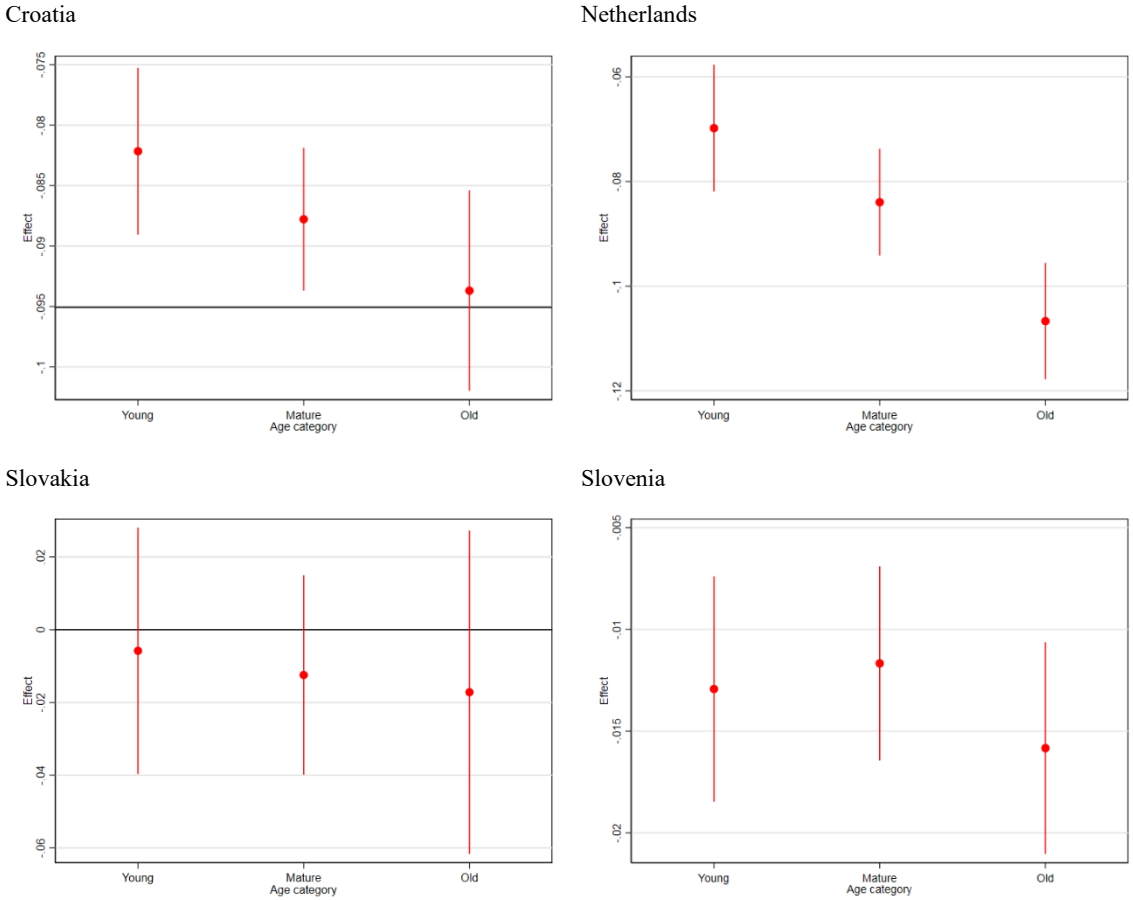
Note: The table shows coefficients of OLS regressions for supported firms with the share of firm subsidies on revenue as dependent variable. Manufacturing represents a base value for macro sectors. Firm location not available for the Netherlands. Continuous variables in logarithm. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

In order to account for firm location, we can take into account only firm's NUTS2 affiliation. However, the very broad NUTS2 classification does not bring any conclusive results. Our estimates suggest somewhat higher relative support for firms located in less developed regions in Slovakia. In Croatia and Finland there is not a statistical difference in the relative size of the support distributed to firms located in available NUTS2 regions. In Slovenia, firms from the more developed Western Slovenia received somewhat higher employment support (see Figure A2.2.3 in the Appendix).

Role of firm age, growth, ownership and labour intensity

The size of support decreases with firm age presented both in terms of age dummies and logarithm of age in years. This finding holds for employment subsidies, but also overall subsidies.[21] Figure 4.2.3 shows that mature and old firms receive up to 11% lower support (depending on the country).

Figure 4.2.3: Relative size of the employment support – by firm age



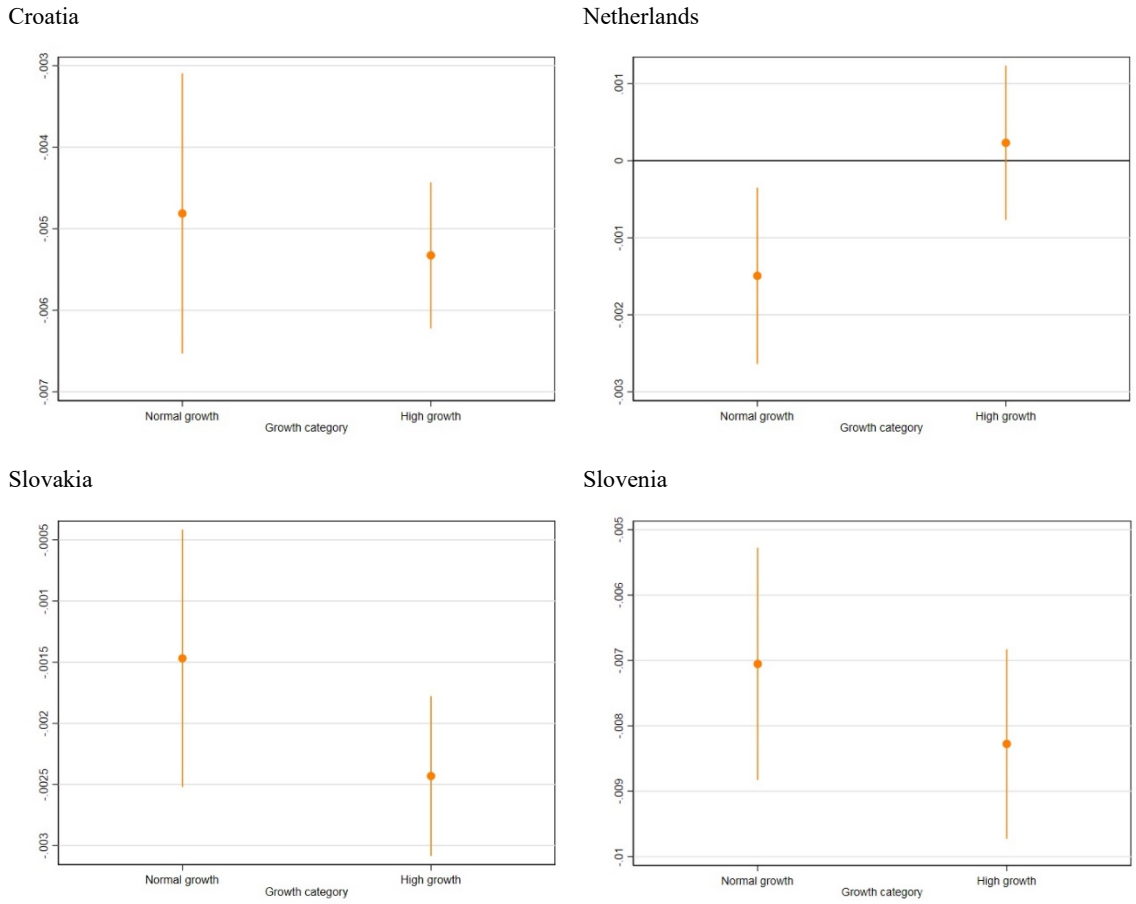
Note: Relative support with respect to labour costs. Conditional OLS estimates for supported firms.
Source: Authors' calculations based on micro-data from Croatia, Finland, Netherlands, Slovakia and Slovenia.

In terms of firm dynamics, we investigate the role of firm employment growth. We distinguish three categories of firms: a) declining or stagnating firms, b) growing firms and c) firms recording high growth.[22]

[21] In case of overall direct subsidies, we refer only to results for the Netherlands, because age of Finnish firms is unavailable. We do not show the visual representation of the effect for the Netherlands, as it well resembles the figure for the employment support (with somewhat higher magnitude of the effect).

[22] Declining or stagnating firms are firms that recorded negative or no employment growth over the last three years. Growing firms are firms that increased their employment by less than 20% over the last three years. Highly growing firms recorded growth exceeding 20% over the last three years.

Figure 4.2.4: Relative size of the employment support – by firm growth

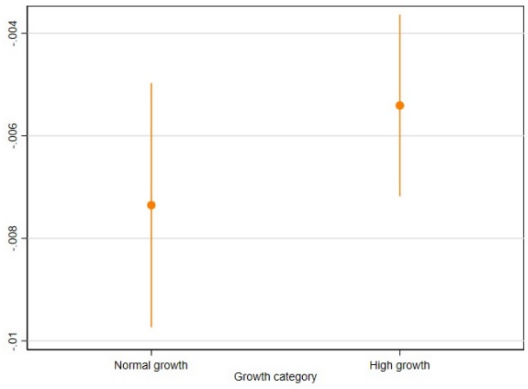


Note: Relative support with respect to revenue. Conditional OLS estimates for supported firms.
Source: Authors' calculations based on micro-data from Croatia, Finland, Netherlands, Slovakia and Slovenia.

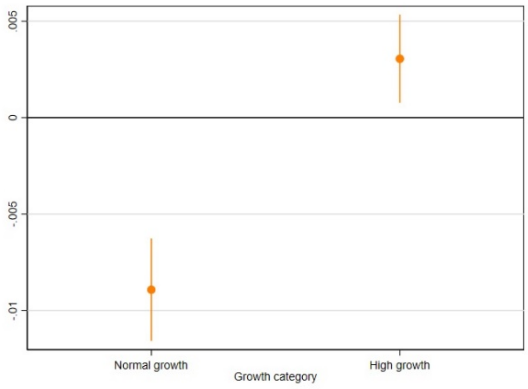
As presented in Figure 4.2.4 and 4.2.5, after controlling for firm size, sector and productivity, all growing firms received lower relative employment or overall support than the declining or stable firms, with exception of Netherlands, where we find a non-linear relationship – higher overall support for highly growing firms. At the same time, we see that the size of the effect is much smaller for employment support, when growing (and highly growing) firms receive only between 0.15% and 0,85% higher support than stagnating or declining firms.

Figure 4.2.5: Relative size of the overall direct support – by firm growth

Finland



Netherlands



Note: Relative support with respect to revenue. Conditional OLS estimates for supported firms.
Source: Authors' calculations based on micro-data from Croatia, Finland, Netherlands, Slovakia and Slovenia.

Public support schemes for firms frequently raise doubts about the fairness of the distribution of subsidies with respect to firm ownership. On the one hand, we do not find a statistically significant effect of public ownership on the relative size of the support in any of the analysed countries or types of support. On the other hand, in two out of three countries we confirm somewhat higher employment support for foreign owned firms. However, an opposite relationship holds for overall direct support in the Netherlands.

Table 4.2.2: Relative size of support – by firm ownership

	Wage subsidies			**Overall subsidies**	
Variables	Croatia	Netherlands	Slovakia	Finland	Netherlands
Foreign ownership	**0.0113*** **	**0.0034** **	**0.0004**	**-0.0055**	**-0.0144*** **
	(0.0021)	**(0.0016)**	**(0.0008)**	**(0.0062)**	**(0.0031)**
Public ownership	0.0104	0.0135	0.0004	-0.0015	0.0724
	(0.0101)	(0.0229)	(0.0015)	(0.0177)	(0.0440)
Constant	0.2009***	0.1442***	0.0437***	0.1655***	0.2609***
	(0.0021)	(0.0052)	(0.0061)	(0.0033)	(0.0100)
Control variables:					
Productivity	Yes	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes	Yes
Size class	Yes	Yes	Yes	Yes	Yes
Observations	44,523	5,386	23,986	28,481	6,016
R-squared	0.1860	0.2195	0.0764	0.1643	0.1770

Note: The table shows coefficients of OLS regressions for supported firms with the share of firm subsidies on revenue as dependent variable. Ownership information not available for Slovenia. Continuous variables in logarithm. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 4.2.2: Relative size of support – by firm wage share

	Wage subsidies				Overall subsidies	
Variables	Croatia	Netherlands	Slovakia	Slovenia	Finland	Netherlands
Wage share	**0.0144*** **	**0.0250*** **	**0.0081*** **	**0.0217*** **	**0.0101*** **	**0.0443*** **
	(0.0008)	**(0.0004)**	**(0.0003)**	**(0.0006)**	**(0.0009)**	**(0.0011)**
Constant	0.1972***	0.1570***	0.0510***	0.1170***	0.1729***	0.3336***
	(0.0021)	(0.0019)	(0.0010)	(0.0024)	(0.0034)	(0.0047)
Control variables:						
Productivity	Yes	Yes	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes	Yes	Yes
Size class	Yes	Yes	Yes	Yes	Yes	Yes
Observations	44,523	43,193	23,961	14,838	28,476	51,785
R-squared	0.1916	0.2649	0.0983	0.2318	0.1675	0.1486

Note: The table shows coefficients of OLS regressions for supported firms with the share of firm subsidies on revenue as dependent variable. Ownership information not available for Slovenia. Continuous variables in logarithm. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

In line with the nature of the employment support, one might expect that firms with higher labour intensity receive higher Covid-19 subsidies. Our estimates suggest that more labour-intensive firms receive not only higher employment subsidies, but also higher overall subsidies.

Role of firm market power and dominance

In order to account for firm market power and dominance, we consider price-cost margins or markups and HHI indices as explanatory variables. A shown in Table 4.2.4 firms with higher markups receive higher support.[23] Very similarly, also firms with higher price-cost margins receive higher subsidies.[24]

An alternative approach based on HHI index (with respect to revenue or employment) shows that more dominant firms are more successful at least in terms of the size of employment support. The results for available overall subsidies are inconclusive, as in Netherlands more dominant firms enjoy higher support, but in Finland dominant firms were supported with somewhat lower relative amount of direct subsidies.

[23] Markup is based on firm intermediate and labour input decision, see CompNet (2021) for details.
[24] Price-cost margin is defined as a ratio (Revenue - Material costs - Labour costs - Capital costs)/Revenue. See Table A2.2.3 for estimates.

Table 4.2.3: Relative size of support – by firm markup

	Wage subsidies				Overall subsidies	
Variables	Croatia	Netherlands	Slovakia	Slovenia	Finland	Netherlands
Markup	**0.0291*** **	**0.0966*** **	**0.0079** **	**0.0582*** **	**0.0106*** **	**0.3480*** **
	(0.0010)	**(0.0132)**	**(0.0032)**	**(0.0051)**	**(0.0030)**	**(0.0332)**
Constant	0.2286***	0.1625***	0.1910***	0.0767***	0.1066***	0.2935***
	(0.0040)	(0.0136)	(0.0175)	(0.0052)	(0.0033)	(0.0346)
Control variables:						
Productivity	Yes	Yes	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes	Yes	Yes
Size class	Yes	Yes	Yes	Yes	Yes	Yes
Observations	42,855	43,180	23,877	14,274	27,535	51,771
R-squared	0.0892	0.0699	0.0042	0.1576	0.1629	0.0304

Note: The table shows coefficients of OLS regressions for supported firms with the share of firm subsidies on labour costs as dependent variable. Continuous variables in logarithm. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 4.2.4. Relative size of support – by firm concentration of revenue

	Wage subsidies				Overall subsidies	
Variables	Croatia	Netherlands	Slovakia	Slovenia	Finland	Netherlands
HHI (revenue)	**0.0190*** **	**0.0028**	**0.0407*** **	**0.0070*** **	**-0.0111*** **	**0.0418*** **
	(0.0014)	**(0.0046)**	**(0.0025)**	**(0.0010)**	**(0.0010)**	**(0.0064)**
Constant	0.5285***	0.2187***	0.9012***	0.2653***	0.0868***	1.6106***
	(0.0086)	(0.0282)	(0.0147)	(0.0066)	(0.0055)	(0.0382)
Control variables:						
Productivity	Yes	Yes	Yes	Yes	Yes	Yes
Size class	Yes	Yes	Yes	Yes	Yes	Yes
Observations	44,523	23,961	43,193	14,838	28,481	51,785
R-squared	0.0835	0.0034	0.1029	0.1186	0.0728	0.0424

Note: The table shows coefficients of OLS regressions for supported firms with the share of firm subsidies on labour costs as dependent variable. Continuous variables in logarithm. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Role of firm financial distress

The pandemic government support schemes were not designed to explicitly favour profitable firms or discourage non-profitable ones and our estimates do not suggest a clear relationship between the relative size of support and firm's pre-pandemic profitability. Loss-making firms recorded a lower relative size of support than firms making profits prior to the pandemic only in Croatia and Netherlands.

Table 4.2.5: Relative size of support – by firm profitability

	Wage subsidies				**Overall subsidies**	
Variables	Croatia	Netherlands	Slovakia	Slovenia	Finland	Netherlands
Loss-making firm	**-0.0474*** **	**-0.0714*** **	**0.0013* **	**0.0095*** **	**0.0082** **	**-0.0989*** **
	(0.0031)	**(0.0046)**	**(0.0007)**	**(0.0012)**	**(0.0034)**	**(0.0119)**
Constant	0.4285***	0.7308***	0.0440***	0.1162***	0.1152***	1.4103***
	(0.0061)	(0.0118)	(0.0008)	(0.0027)	(0.0043)	(0.0306)
Control variables:						
Productivity	Yes	Yes	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes	Yes	Yes
Size class	Yes	Yes	Yes	Yes	Yes	Yes
Observations	44,523	43,193	14,492	14,838	12,693	51,785
R-squared	0.1005	0.1165	0.1713	0.1697	0.1414	0.0453

Note: The table shows coefficients of OLS regressions for supported firms with the share of firm subsidies on labour costs as dependent variable. Continuous variables in logarithm. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 4.2.6: Relative size of support – by firm ability to pay interests

	Wage subsidies				**Overall subsidies**	
Variables	Croatia	Netherlands	Slovakia	Slovenia	Finland	Netherlands
Zombie firm	**-0.0026**	**-0.0356*** **	**0.0032*** **	**0.0093*** **	**0.0053**	**0.0077**
	(0.0042)	**(0.0053)**	**(0.0006)**	**(0.0031)**	**(0.0034)**	**(0.0109)**
Constant	0.1655***	0.5251***	0.0338***	0.1138***	0.1101***	0.9132***
	(0.0051)	(0.0110)	(0.0008)	(0.0053)	(0.0057)	(0.0229)
Control variables:						
Productivity	Yes	Yes	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes	Yes	Yes
Size class	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,164	20,639	7,498	4,828	5,398	23,789
R-squared	0.1851	0.1558	0.1931	0.1279	0.1741	0.0900

Note: The table shows coefficients of OLS regressions for supported firms with the share of firm subsidies on labour costs as dependent variable. Continuous variables in logarithm. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Our conditional analysis of the firm-level size of support does not bring common unambiguous arguments to the discussion on the support of "zombie" firms. Dutch "zombie" firms receiving employment support with somewhat higher probability (Table 4.1.9) receive lower support in size (Table 4.2.6). Slovak and Slovenian "zombie" firms receive somewhat higher support compared to "non-zombie" firms. In Croatia and Finland, the size of subsidies allocated to "zombie" firms is not statistically different than the size of subsidies allocated to "non-zombie" firms.

4.3 Aggregate allocation by clusters

One of the main concerns related to the massive Covid-19 stimulus packages implemented around the world is whether the support was received by viable and productive firms in a temporary (financial) need, instead of insolvent unviable firms. In other words, to what extent are governments supporting firms that would (or should) quit the market even without the pandemic shock?

To form an aggregate picture, we define several clusters and assign firms to the clusters based on their performance in the years preceding the pandemic. We find that around one third of the wage subsidies in Croatia, Netherlands, Slovakia and Slovenia was allocated to productive firms, defined as firms that belonged to the highest quintile of the labour productivity distribution in 2019. However, only a very small share, less than 3%, went to young productive start-ups, defined as firms in the highest quintile of productivity distribution and active for less than three years.[25]

With respect to the long-term sustainability of the future economic growth, one might find it important to know to what extent the Covid-19 aid supports innovative or technologically advanced firms. Our calculations show that a relatively low share of subsides was distributed to high-tech or knowledge intensive firms. The majority of the subsidies (between 55% and 76% depending on the country) was allocated to low-tech or low knowledge intensive firms.[26]

A relatively frequently mentioned concern highlights possible excessive misallocation of the Covid-19 related support to financially distressed or zombie firms. We find that in all countries under review, only a small share of subsidies went to firms recording negative profits for three consecutive years and not high labour growth prior the pandemic (i.e. to zombie firms).

[25] This may not necessarily be a negative information. In their stage of the life cycle, start-ups may potentially rely less on sales and more on outside funding that was agreed upon already before the pandemic. As a result, they may be less in the need of Covid-19 subsidies.
[26] See Appendix 2 for the classification of the sectors.

Table 4.3.1: Allocation of subsidies to selected firm clusters

	Wage subsidies				Overall subsidies	
Cluster	Croatia	Netherlands	Slovakia	Slovenia	Finland	Netherlands
High productive	33.9	32.2	32.2	30.2	24.7	29.6
Low Productive	7.0	21.6	5.8	9.7	13.1	18.5
Young and high productive	2.8	1.4	1.1	1.3	N/A	2.0
Zombie	3.5	3.7	4.6	2.4	2.2	3.5
High-tech, knowledge intensive	15.6	41.1	32.7	22.6	30.8	38.4
Low-tech, not knowledge intensive	76.2	55.4	61.9	70.9	59.9	57.1
Growing	16.3	12.6	10.9	12.4	19.7	13.8
Declining	2.5	0.9	3.0	3.2	1.5	0.8

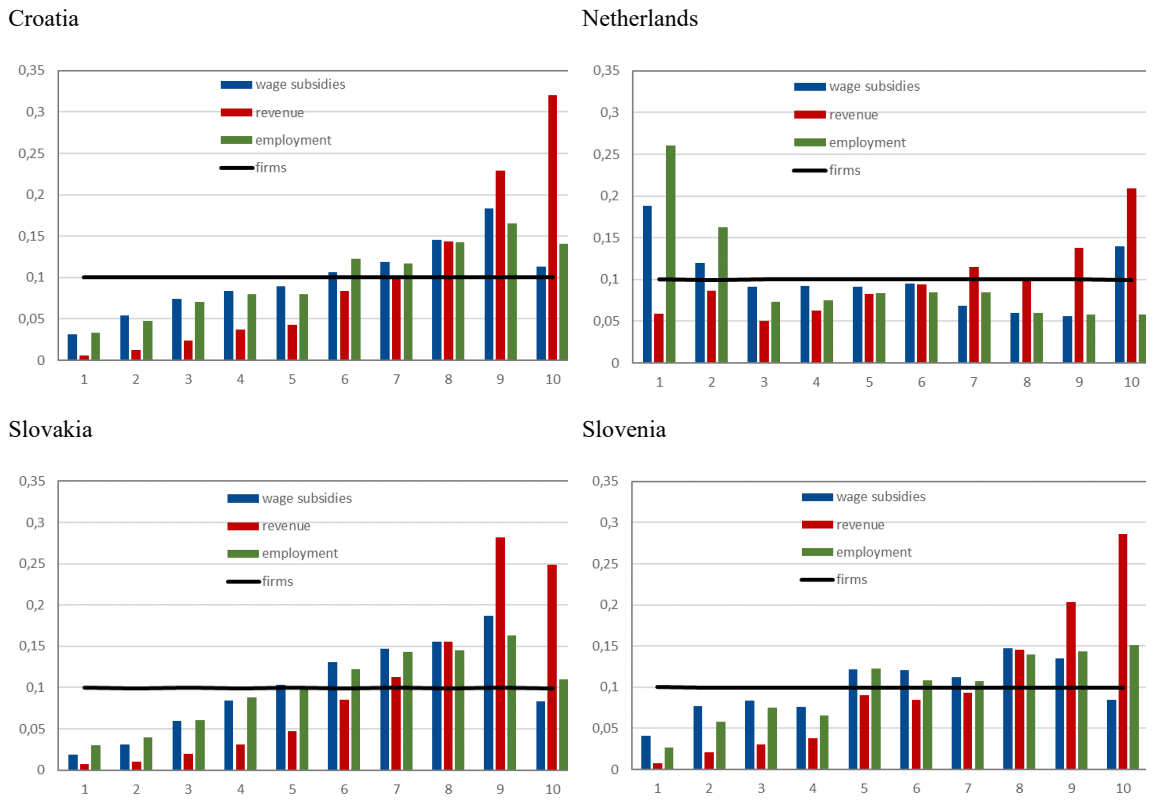
Note: High (low) productive firms are firms belonging to the highest (lowest) quintile of the labour productivity distribution. Young and high productive firms are firms from the highest quintile of productivity distribution and active for less than three years. Zombie firms are firms recording negative profits for three consecutive years and are not high labour growth prior the pandemic. High-tech (low-tech) firms are defined following the sectoral classification shown in Table A2.2.4 in the Appendix 2. Growing firms are defined as firms in the highest quartile of the rate of change of labour productivity distribution and in the highest quartile of the rate of change of size distribution. Declining firms are defined as firms in the lowest quartile of the rate of change of labour productivity distribution and in the lowest quartile of the rate of change of size distribution.
Source: Authors' calculations based on micro-data from Croatia, Finland, Netherlands, Slovakia and Slovenia.

Similarly, a relatively low rate of misallocation of the support to non-viable firms can be confirmed by the amount of subsidies allocated to growing or declining firms. As shown in Figure 4.3.1, the firms that in 2019 were among the firms which experienced the largest growth in labour productivity and largest growth in number of employees (first quartile of the two growth distributions) received between up to 20% of subsidies. In the contrary, firms from the lowest quartile of the two growth distributions, called declining firms, received a negligible share of the subsidies.[27]

A closer look at the overall allocation of employment subsidies across sectors and firm productivity deciles reveals other common, but also country specific findings. As shown in Figure 4.3.1, the allocation of employment subsidies across productivity deciles closely follows the contribution of the deciles to the aggregate employment in all countries.[28]

[27] By combining a pre-pandemic firm performance (based on 2019 and earlier data) with a pandemic support (allocated in 2020), the presented results may be subject to a composition effect. Especially, in the case of declining firms, when some of them could exit the market before receiving a subsidy. However, the size of the effect is very small. For example, in Slovakia only 0.04% of firms identified as declining in the pre-pandemic year 2019 exited the market in 2020.
[28] Correlation between the share of deciles on employment and employment subsidies ranges between 79%(NL) and 98% (SK).

Figure 4.3.1 Share of productivity deciles of overall wage subsidies, revenue, employment and firm population



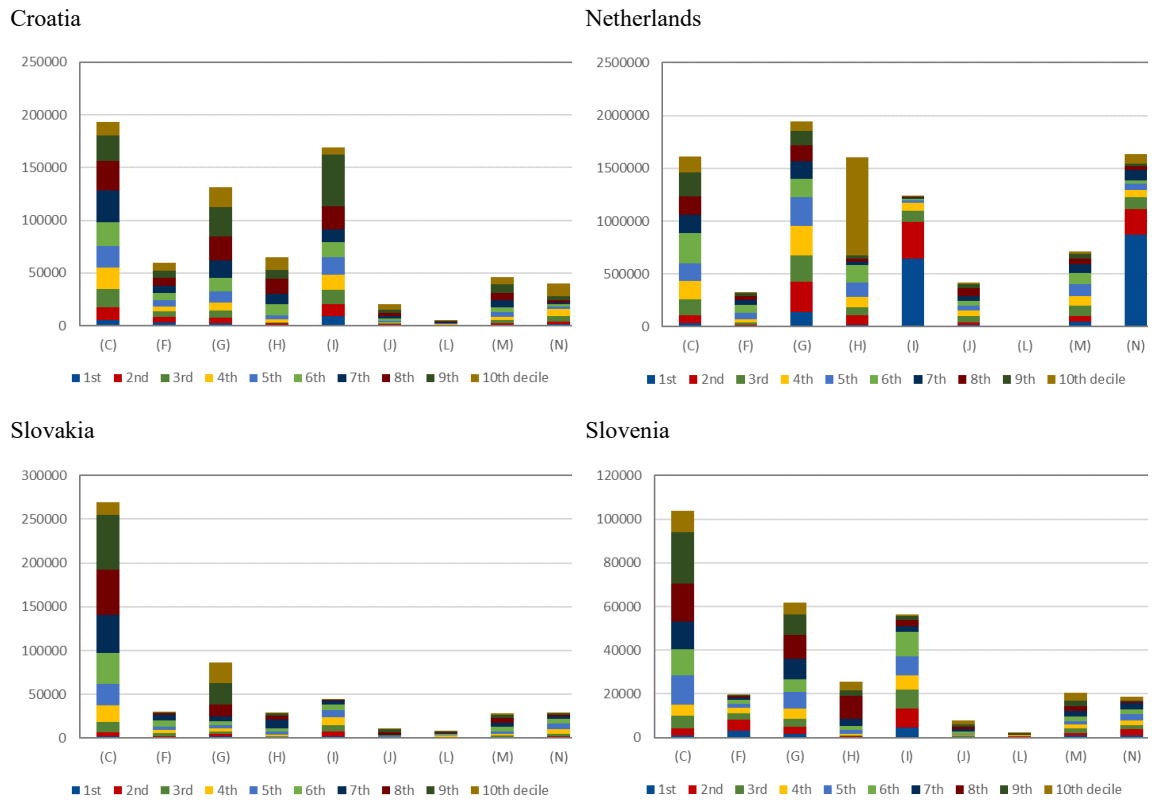
Source: Authors' calculations based on micro-data from Croatia, Netherlands, Slovakia and Slovenia.

At the same time, we find that in three out of four countries, firms from the upper parts of the (within-country) productivity distribution received shares of employment subsidies exceeding their shares of firm population, but frequently slightly exceeding also their (high) shares of employment. This does not hold for the Netherlands, where, on one hand, only the highest decile was "excessively" subsidized and, on the other hand, a large part of subsidies was allocated to the lowest productivity deciles, that (in contrast to other three countries) highly contribute to the overall employment.

Further decomposition shows that low productivity firms were less successful in receiving large amounts of employment subsidies across macro sectors in most of the countries. However, as documented in Figure 4.3.2, the allocation of subsidies to low productivity firms in the Netherlands is largely sector specific. Non-productive firms from administrative and support service activities, accommodation and food services and wholesale and retail trade were allocated relatively large part of the subsidies. To at least some extent this allocation is the result of the more uneven presence of low productive firms in these sectors (also compared to other countries considered in the analysis).[29]

[29] See Figure A2.3.1 in the Appendix, that shows the cross-country comparison of the presence of the low productivity firms in the macro sectors.

Figure 4.3.2 Overall allocation of wage subsidies by sectors and firm productivity



Note: Colours represent deciles of firm productivity. Vertical axis shows value of subsidies in thousands of euro. Horizontal axis represents macro sectors: (C) Manufacturing; (F) Construction; (G) Wholesale and retail trade; (H) Transportation and storage; (I) Accommodation and food service activities; (J) Information and communication; (L) Real estate activities; (M) Professional, scientific and technical activities; (N) Administrative and support service activities.
Source: Authors' calculations based on micro-data from Croatia, Netherlands, Slovakia and Slovenia.

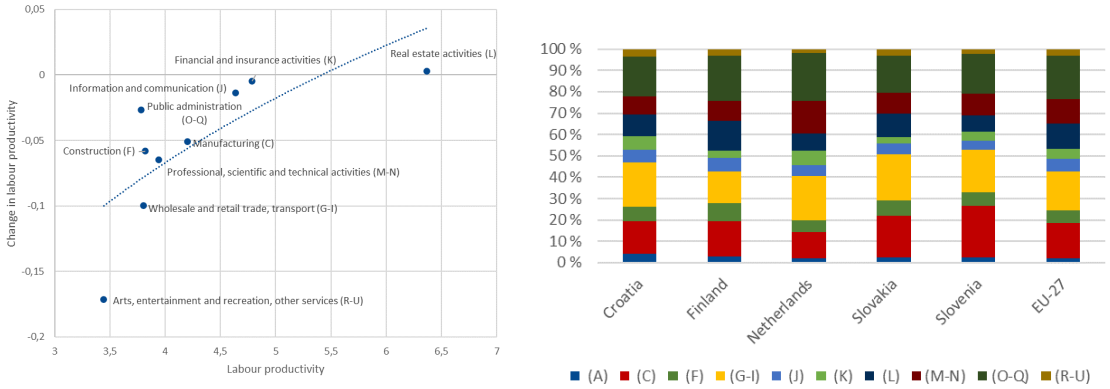
5 Consequences for productivity

Covid-19 related lockdowns and temporary supply chain disruptions resulted in significant annual declines in sales in most of the developed countries. As documented by Dhyne and Duprez (2021) the health crisis had a greater adverse impact on a larger percentage of firms than the 2008-2009 financial crisis. Although, firms tried to compensate the gaps in revenue by adjusting their costs, most of the industries experienced declines in value added. With generally lower elasticities of labour costs or employment than elasticities of material costs to sales, the majority of firms recorded lower labour productivity in 2020.

Based on Eurostat estimates, aggregate EU labour productivity declined by 4.6% in 2020.[30] All countries analysed in this study recorded smaller declines, only Croatia faced a somewhat steeper drop in overall labour productivity.[31]

[30] Labour productivity based on real gross value added and employment from nama_10_a10 downloaded on November 15, 2021.
[31] Finland (-0.8%), Slovakia (-2,5%), Netherlands (-3,3%), Slovenia (-3,7%) and Croatia (-7,0%).

Figure 5.1 EU labour productivity by sectoral breakdown



Note: The left-hand figure presents EU-27 labour productivity from 2019 in logarithm versus annual difference in labour productivity logarithms from year 2020. The right-hand figure presents sectoral EU-27 gross value- added shares in 2020. Sectors displayed: (A) Agriculture, forestry and fishing, (C) Manufacturing, (F) Construction, (G-I) Wholesale and retail trade, transport, accommodation and food service activities, (J) Information and communication, (K) Financial and insurance activities, (L) Real estate activities, (M-N) Professional, scientific and technical, activities; administrative and support service activities, (O-Q) Public administration, defence, education, human health and social work activities, (R-U) Arts, entertainment and recreation; other service activities.

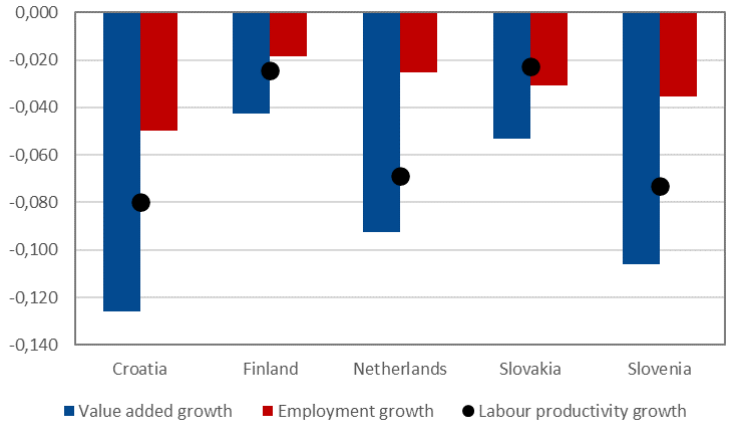
Source: Eurostat, authors' calculations.

The contraction of economic activity during the pandemic varies dramatically across sectors and the pattern of the sectoral impact is very different from normal recessions (EC 2021). It is well documented that sectors that require physical proximity, such as the cultural and creative industries, or accommodation and food services, have been the hardest hit by the crisis. While domestic containment measures and the voluntary behavioural response of individuals had a severe impact on e.g. recreational services, the mostly short-term retrenchment in manufacturing was largely driven by external factors.[32]

Available data on sectoral developments suggests that the most significant reduction in revenue, value added and consequently also in labour productivity took place in the sectors with initially low productivity levels. As documented in Figure 5.1, showing EU productivity by a main industry breakdown,[33] the steepest drop in labour productivity was recorded in the least productive sector of Arts, entertainment and recreation services.[34] At the same time, this sector creates only between 2% to 4% gross value added depending on the country.

[32] See e.g. Jan Maarten et al. (2021) or Battistini and Stoevsky (2021).
[33] Labour productivity based on real gross value added and employment by main industry breakdown [nama_10_a10] downloaded on November 15, 2021.
[34] Sectoral characteristics seem to matter more during the Covid pandemic. Bureau et al. (2021) show that the industry the firm operates in explains up to 48% of the monthly activity shocks' variance weighted by employment, a much larger share than in a normal year.

Figure 5.2 Micro-aggregated labour productivity growth in the pandemic year



Note: Based on projected firm-level values calculated using cost elasticities to sales and sectoral turnover index.
Source: Authors' calculations based on micro-data from Croatia, Finland, Slovakia and Slovenia.

Micro-data, compiled with a significant time lag, remains still unavailable. To shed more light on the granular consequences of the pandemic on productivity, we follow Lalinsky and Pal (2021) and utilize cost elasticities to sales estimated by Maurin and Pal (2020). Our projections employing pre-pandemic firm-level value-added figures, together with industry level sales developments in 2020 and industry level cost elasticities to sales, suggest that significant pandemic drops in sales and value added were accompanied by reductions in the number of employees.[35]

Employment subsidies substituted part of the lost income and sustained value added, at the cost of smaller adjustments in number of employees, however. The aggregate changes in value added and employment with and without government support presented in Table 5.1 show that the overall impact of Covid-19 subsidies on productivity was relatively mild in all countries, except Netherlands.[36] The significantly stronger effect of subsidies in the Netherlands is to a large extent driven by the efficient allocation of employment (wage) subsidies that helped to sustain value added and labour productivity. However, additional direct subsidies also contributed to a lower pandemic-time drop in labour productivity.

[35] Here we assume that the decline in number of employees equal the decline in labour costs.
[36] Similar conclusion holds for the 20e version, i.e. sample of firms with 20 and more employees.

Table 5.1 Annual growth in micro-aggregated productivity, value added and employment in the pandemic year (in %) – all firms

Country	Government support	Value added	Employment	Labour productivity
Croatia	Without support	-12.58	-4.98	-8.00
	With wage support	-11.13	-4.59	-6.85
Netherlands	Without support	-9.25	-2.53	-6.89
	With wage support	-5.26	-1.94	-3.38
Slovakia	Without support	-5.30	-3.09	-2.30
	With wage support	-4.78	-3.01	-1.82
Slovenia	Without support	-10.60	-3.54	-7.32
	With wage support	-9.47	-3.40	-6.29
Finland	Without support	-4.25	-1.83	-2.46
	With overall support	-3.01	-1.72	-1.31
Netherlands	Without support	-9.25	-2.53	-6.89
	With overall support	-4.55	-1.87	-2.73

Note: Projected values based on firm-level value added from 2019, industry level changes in sales in 2020 and cost elasticities to sales from Maurin and Pal (2020). Only sustaining firms, entries and exits not considered.
Source: Authors' calculations.

The Covid-19 shock did not hit firms homogenously. Besides the standard accounting framework, one might find it important to learn to what extent the pandemic-time decline in productivity is driven by individual firm behaviour and to what extent it can be explained by reallocation of resources and productivity between firms. In line with the literature (e.g. Bloom et al., 2020b), in next section we show that the drop in productivity was predominantly driven by a huge temporary deterioration in within-firm productivity. However, as documented in section 4.2, the pandemic shock resulted also in temporary shifts in productivity distributions.

5.1 Pandemic productivity decomposition

When decomposing the overall productivity growth, our calculations for all four countries confirm the main findings for the UK economy presented by Bloom et al. (2020). We find large reduction in productivity within firms that is (in most of the countries) partially offset by a positive between effect. The positive between-firm effect can be explained by the fact that firms operating in low productivity sectors making a smaller contribution to the overall productivity are disproportionately affected.

As Bloom et al. (2020b), we follow Baily et al. (1992) who decompose the overall productivity growth to the within firm growth, reallocation between surviving firms, reallocation to new firms and

reallocation from exiting firms:

$$\Delta\prod_t = \sum_{i\in Surv} \bar{\varphi}_i \, \Delta\pi_{i,t} + \sum_{i\in Surv} \Delta\varphi_{i,t} \, (\bar{\pi}_i - \bar{\prod}) + \sum_{i\in \Delta Entry} \varphi_{i,t} \, (\bar{\pi}_i - \bar{\prod}) + \sum_{i\in \Delta Exit} \Delta\varphi_{i,t-1} \, (\pi_{i,t-1} - \bar{\prod}) \quad (9)$$

Where $\pi_{i,t}$ denotes value added in firm *i* at time *t*. Π_t is aggregate country value added, $\varphi_{i,t}$ is the employment share of firm *i* at time *t* and a bar over a variable indicates the average across times *t* and *t-1*. Δ refers to the difference between the value in time *t* and *t-1*.

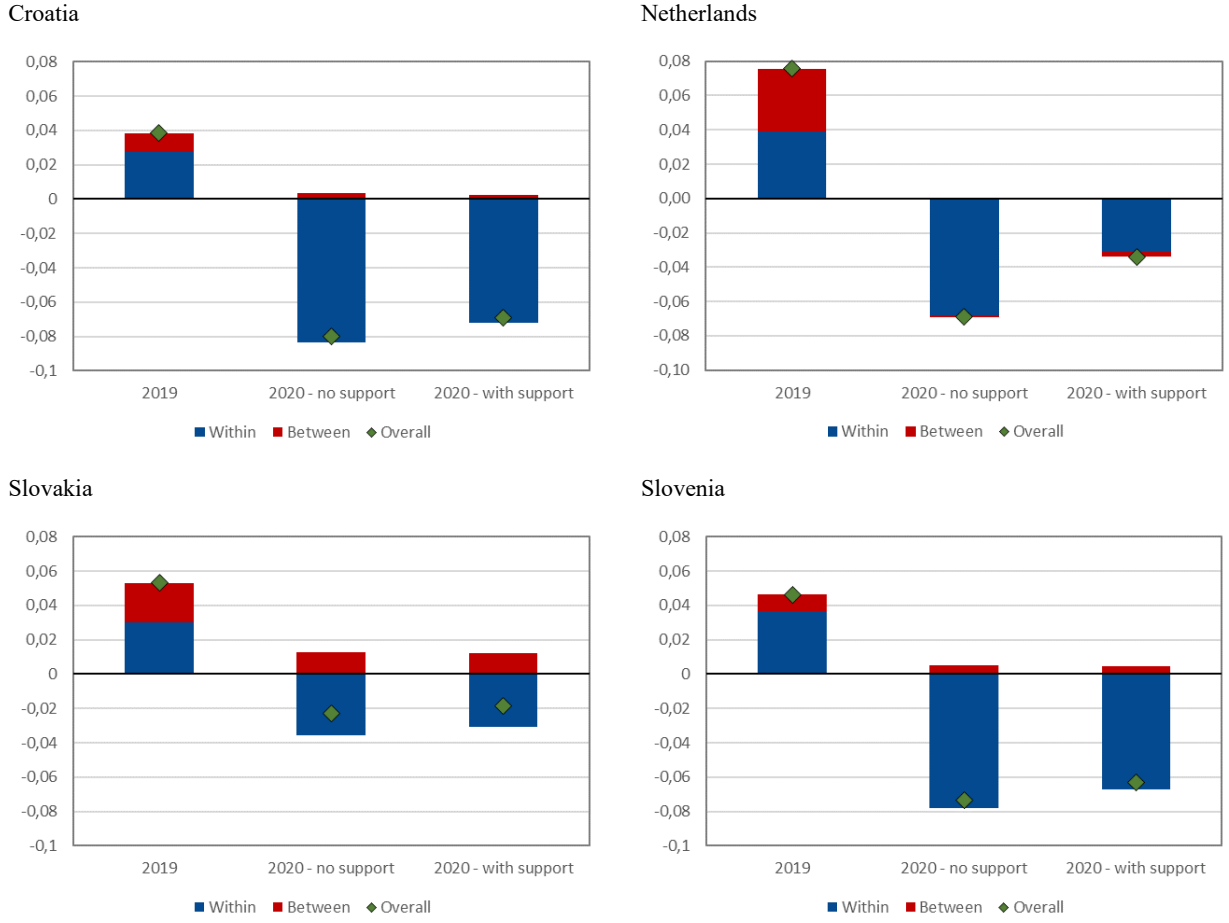
Our analysis builds on the pre-pandemic values of productivity, true firm-level entries and exits are not available. In addition, in 2020 firm entries and exits followed different patterns than in the past, which makes an extrapolation very inaccurate. Therefore, our estimates of the between effects abstract from the effects arising from firm entries or exits. However, available information on firm dynamism in the EU suggest a significant reduction in entries and exits during the pandemic, which makes their potential contribution to the between firm reallocation even smaller than previously observed and suggests a negligible effect on our estimates of the between-growth in productivity.[37]

Figure 5.1.1 and 5.1.2 summarize our estimates of the within and between-firm productivity growth. The COVID-19 pandemic lead to a significant decline in the overall productivity across all analysed countries. The drop in productivity was predominantly driven by a huge temporary deterioration in the within-firm productivity that resulted from loss of firm sales revenue exceeding potential adjustments in employment and it holds across countries. The pandemic reduced also the reallocation of resources to more productive firms, but due to a generally higher burden faced by less productive firms, the between-firm term contributed positively to the overall productivity growth during the pandemic year, with exception of the Netherlands. There we can observe a large year-on-year decline in reallocation and slightly negative between-firm component.

As indicated in Table 5.1, the effect of government support on overall productivity growth was relatively mild. An economically significant effect of the overall, but also of employment subsidies, was recorded only in the Netherlands. As further documented in Figure 5.1.1 the pandemic support reduced mainly the drop in within-firm productivity and had negligible effect on the reallocation term component.[38]

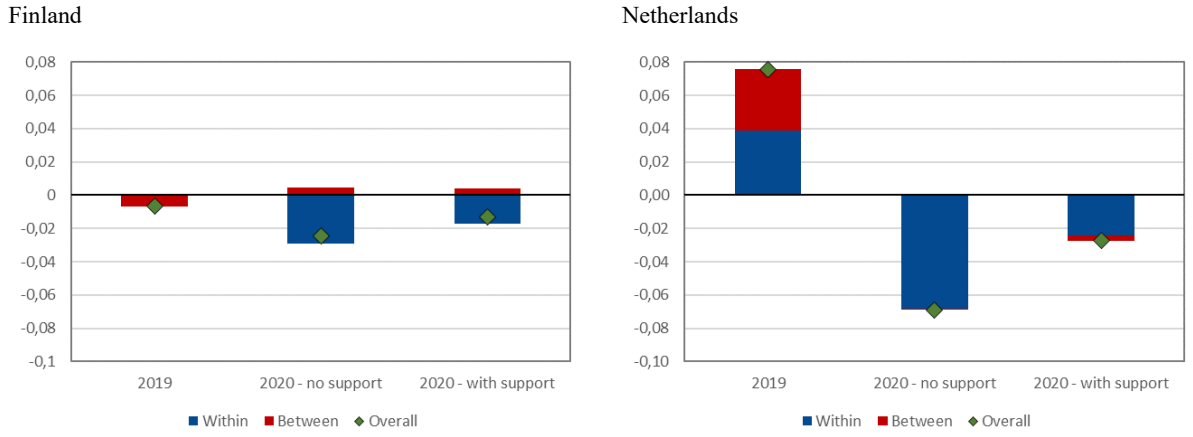
[37] Figure A3.1.1 in Appendix confirms the unusual evolution of firm entries and exits in the EU.
[38] In Slovakia, the support reduced the between-firm component by 0.05 percentage points. In the Netherlands, it reduced the between-firm component (i.e. increased adverse allocation) by 0.02 percentage points.

Figure 5.1.1 Within and between-firm productivity growth with and without employment support



Source: Authors' calculations based on micro-data from Croatia, Netherlands, Slovakia and Slovenia.

Figure 5.1.2 Within and between-firm productivity growth with and without overall support



Source: Authors' calculations based on micro-data from Finland and Netherlands.

Alternatively, we decompose the aggregate productivity growth to within-firm, between-firm and cross-term following Foster, Haltiwanger and Krizan (2001), but considering again only surviving firms:

$$\Delta\prod_t = \sum_{i\in Surv} \bar{\varphi}_i \, \Delta\pi_{i,t} + \sum_{i\in Surv} \Delta\varphi_{i,t} \, (\bar{\pi}_i - \bar{\prod}) + \sum_{i\in Surv} \Delta\varphi_{i,t} \, \Delta\pi_{i,t} \tag{10}$$

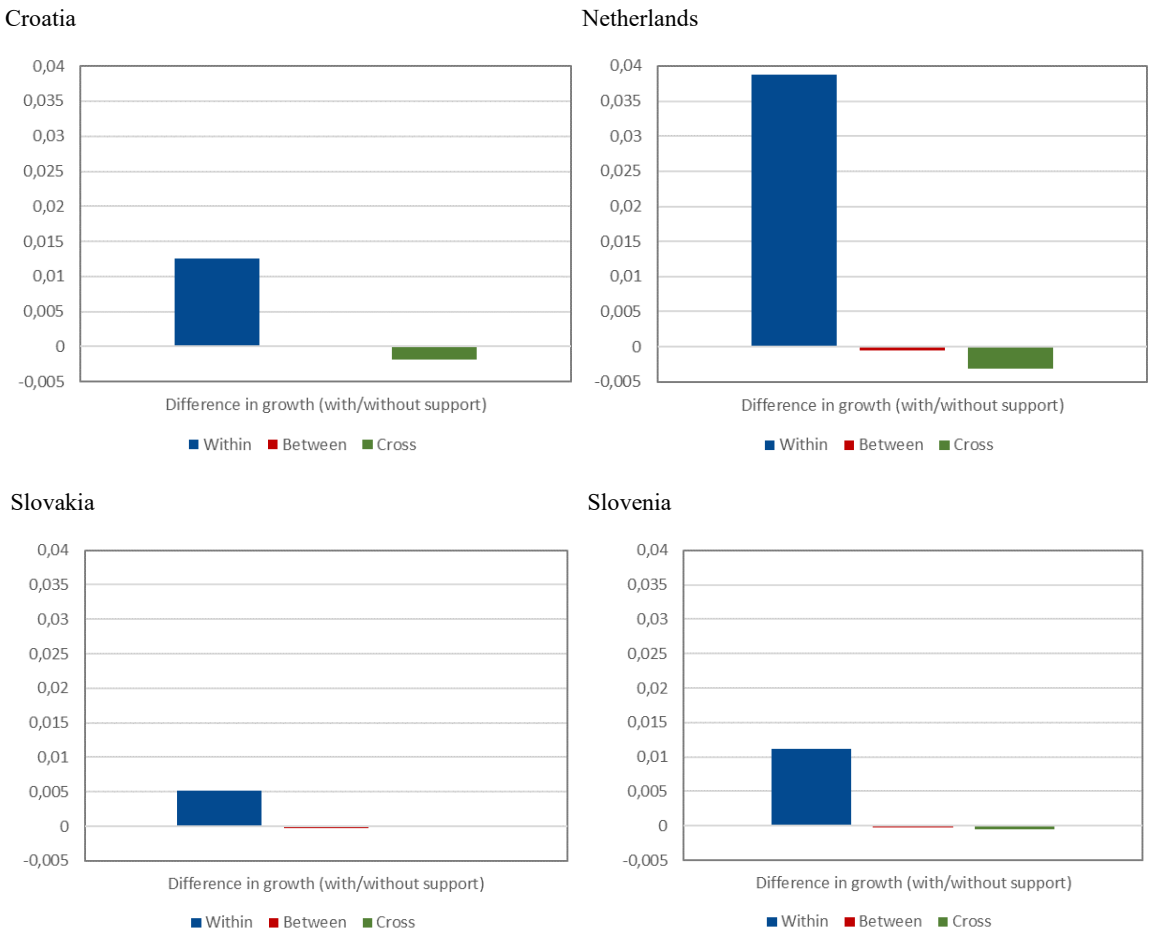
Where $\pi_{i,t}$ denotes value added in firm *i* at time t. Π_t is aggregate country value added, $\varphi_{i,t}$ is the employment share of firm *i* at time *t* and a bar over a variable indicates the average across times *t* and *t-1*. Δ refers to the difference between the value in time *t* and *t-1*.

In line with the previous results following Bloom et al. (2020b), we find that the pandemic-time decline in productivity reflects mainly a drop in within-firm productivity and to some extent also a year-on-year reduction in the between-firm reallocation. In addition, this approach shows a small, but positive contribution of the cross term that quantifies the between-firm reallocation of resources to firms with higher productivity growth.[39]

Figure 5.1.3 and 5.1.4 present the effect of the Covid-19 government support distributed to firms. The support somewhat mitigated the adverse impact of the pandemic on within-firm productivity. Our simulation shows that its effect on between-firm productivity growth and reallocation from less to more productive firms was negative, but mostly negligible. The figures also confirm a much stronger positive effect of subsidies on the within-firm growth in productivity in the Netherlands, where we also see a somewhat larger negative impact on reallocation.[40] The striking difference in the effect of overall subsidies implemented in the Netherlands and Finland is to a large extent driven by the different composition of included subsidies and their sectoral scope.

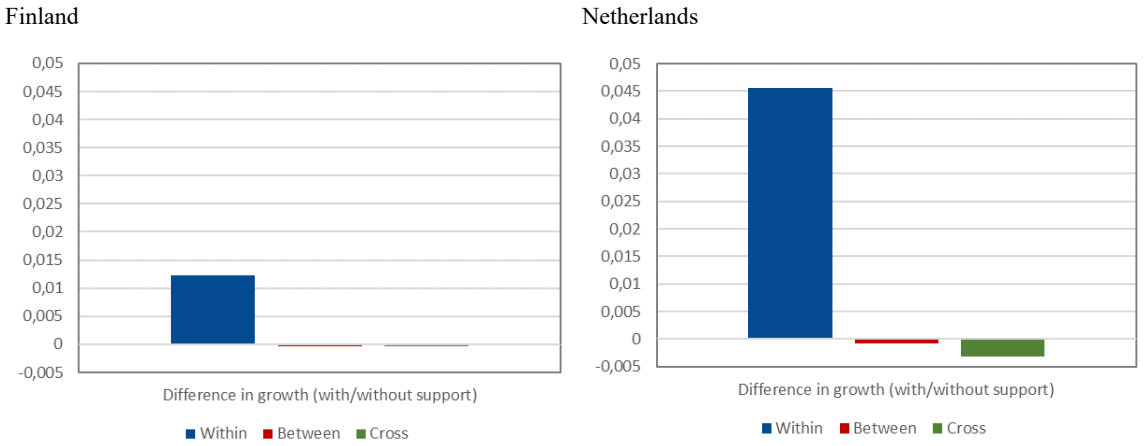
[39]See Table A3.1.1 in Appendix for further details on the decomposition of the labour productivity.
[40] Freeman et al. (2021) suggest that this may be a result of more widely and readily available support in the Netherlands.

Figure 5.1.3 Impact of the employment subsidies on labour productivity growth components



Note: Difference in productivity growth components with and without COVID-19 support.
Source: Authors' calculations based on micro-data from Croatia, Netherlands, Slovakia and Slovenia.

Figure 5.1.4 Impact of the overall subsidies on labour productivity growth components



Note: Difference in productivity growth components with and without COVID-19 support.
Source: Authors' calculations based on micro-data from Finland and Netherlands.

5.2 Pandemic-time productivity distribution with and without support

Different levels of material cost and employment elasticities suggest that the pandemic-time economic decline resulted in temporary shifts in productivity distributions. Our analysis shows that the shifts are visible not only in the most adversely affected sectors, but also at the country level. At the same time, Covid-19 subsidies introduced to compensate part of the lost revenue and to cover part of the costs somewhat revert the pandemic-time shifts in productivity.

An individual firm's pandemic-time productivity after receiving subsidy may be higher, but also lower than the pandemic productivity without support. It depends on the individual proportions of labour and material costs, their elasticities and on the size of the firm-level support, but also type of the support. Especially in the case of employment subsidies, we may expect them to increase firm revenue, but usually at the cost of keeping the affected employment stable.

As confirmed by Figure 5.2.1, the distribution of productivity after receiving government subsidies lies mostly somewhere between the pre-pandemic productivity and pandemic productivity without support.

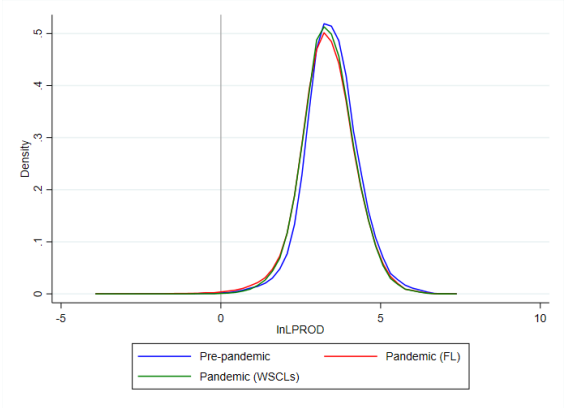
The most significant changes can be observed in the macro-sector of Accommodation and food service activities[41]. Following Figure 5.2.2, this sector was most severely hit in Slovenia and Croatia, where we can see a clear shift in the overall productivity distribution leftwards. At the same time, the implemented employment subsidies only partially offset the negative developments. As confirmed by the pandemic productivity distributions for Finland and Netherlands, Accommodation and food service activities benefited more from overall subsidies than just employment subsidies.

[41] A cross-country comparison of projected productivity distributions for all firms in the analysed countries is available in the Appendix 3.

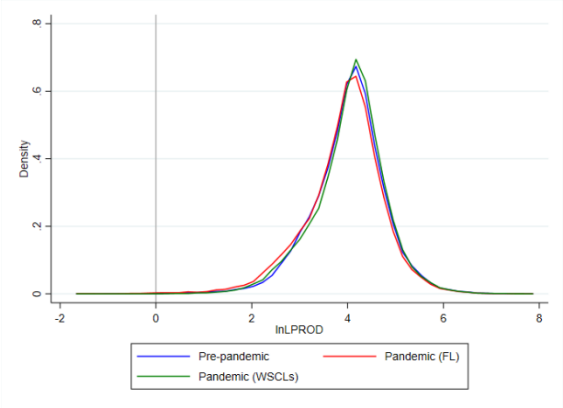
Figure 5.2.1: Distribution of the labour productivity with and without support– all supported firms

Employment subsidies

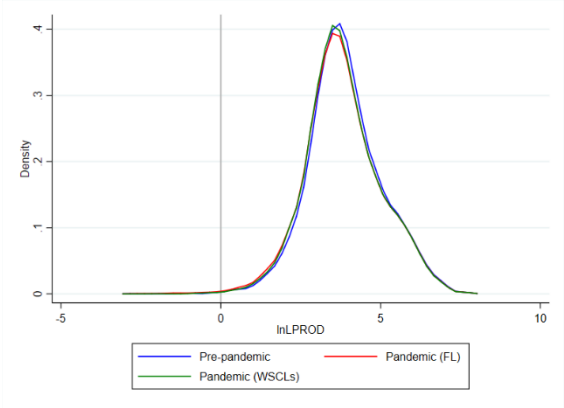
Croatia



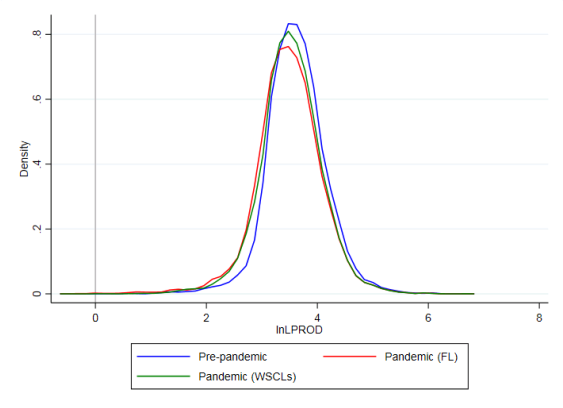
Netherlands



Slovakia

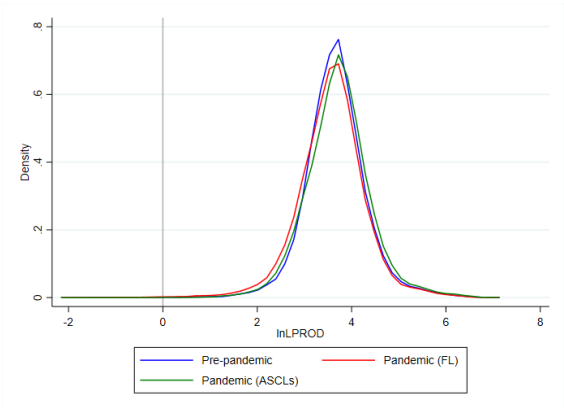


Slovenia

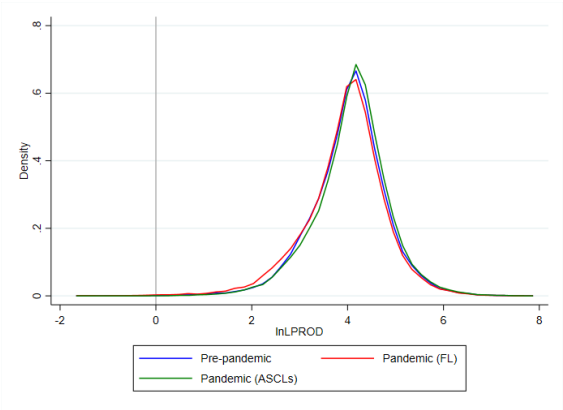


Overall subsidies

Finland



Netherlands

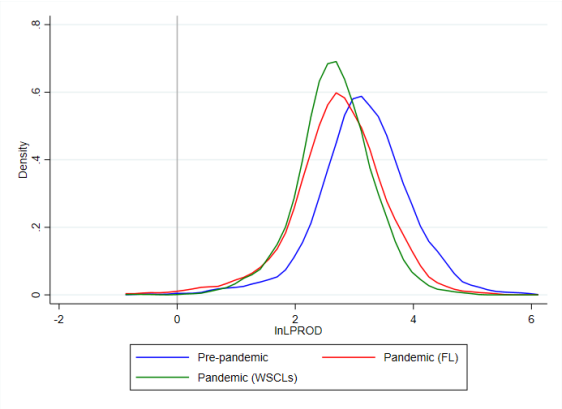


Note: Kernel density estimates. Pre-pandemic – based on 2019 data; Pandemic (FL) – projection assuming flexible costs and employment; Pandemic (WSCLs) – projection considering employment support and assuming constant supported part of the employment. Pandemic (ASCLs) – projection considering overall support.
Source: Authors' calculations based on micro-data from Croatia, Netherlands, Slovakia and Slovenia.

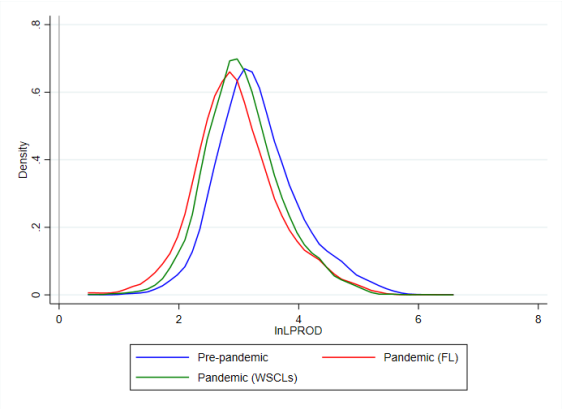
Figure 5.2.2: Distribution of the labour productivity with and without support – Accommodation and food service activities

Employment subsidies

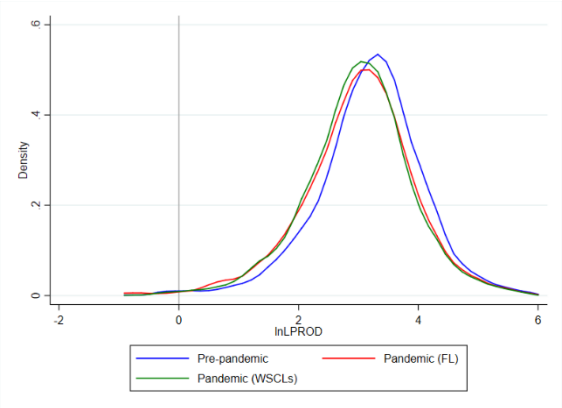
Croatia



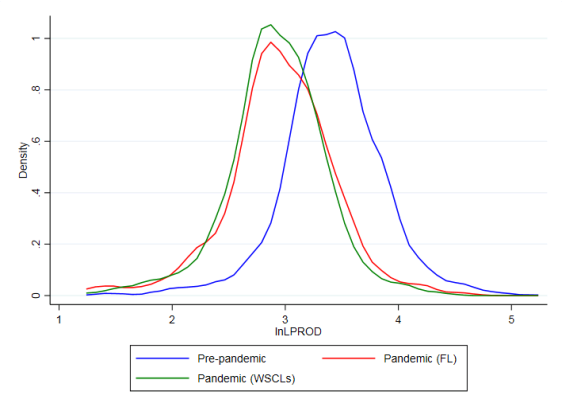
Netherlands



Slovakia

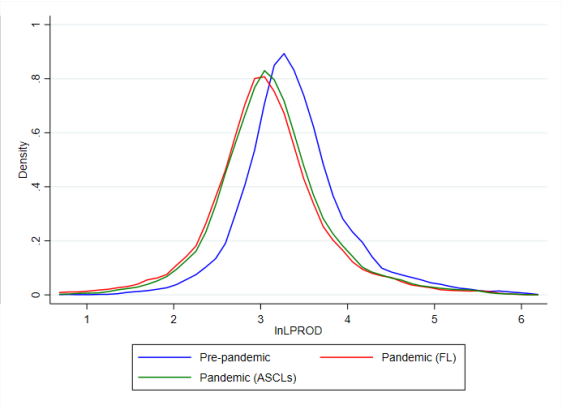


Slovenia

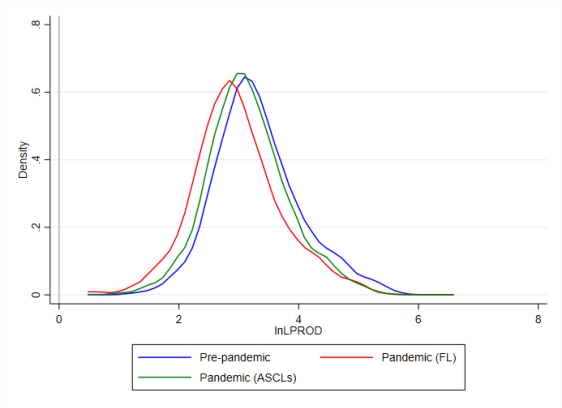


Overall subsidies

Finland



Netherlands



Note: Kernel density estimates. Pre-pandemic – based on 2019 data; Pandemic (FL) – projection assuming flexible costs and employment; Pandemic (WSCLs) – projection considering employment support and assuming constant supported part of the employment. Pandemic (ASCLs) – projection considering overall support.
Source: Authors' calculations based on micro-data from Croatia, Finland, Netherlands, Slovakia and Slovenia.

The distributions of projected pandemic labour productivity after receiving government support (presented in Figure 5.2.2) are based on the assumption that supported employees cannot be laid off. This assumption may be viewed as too strict for Finland, where we consider overall direct firm subsidies and not employment subsidies. On the other hand, especially in continental Europe, it can be quite difficult to adjust the number of employees within a short time. So, productivity could in 2020 temporarily decline even more than shown in the figure above.[42]

Our estimates show that low productivity firms recorded highest productivity declines in the pandemic. As shown in Figure 5.2.2, mean productivity decline for the firms in the first decile of labour productivity ranges between 5.5% and 13%, whereas the most productive firms record much smaller decline (not exceeding 2.2% in any country). At the same time, we can see that the mitigation effect of the Covid-19 support decreases with firm productivity deciles. The calculations based on projected value added and employment suggest the strongest effect for low productivity firms in Netherlands, where the government subsidies reduced most of the mean pandemic decline and possibly resulted in an annual increase in mean (and median) labour productivity (of the low productivity deciles).[43]

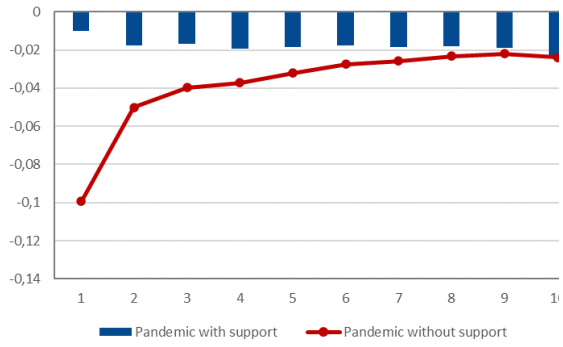
Similar relationships hold for mean productivity developments across firm size deciles or firm size classes. Higher firm size classes record lower mean productivity declines and Covid-19 subsidies reduce mostly productivity declines in small firms. See Figure A3.2.3 in Appendix 3 for further details.

[42] For an additional comparison of the pandemic productivity based on fully fixed and flexible employment in 2020, see Figure A3.2.2 in Appendix 3.
[43] Especially the results for overall subsidies should be taken with caution, as other than employment subsidies are usually not conditioned on keeping effected employment stable.

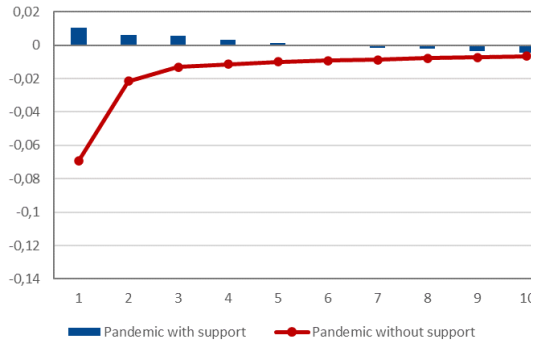
Figure 5.2.2: Mean percentage decline in labour productivity – by firm productivity deciles

Employment subsidies

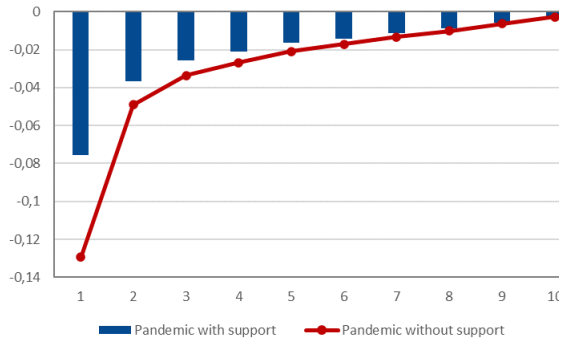
Croatia



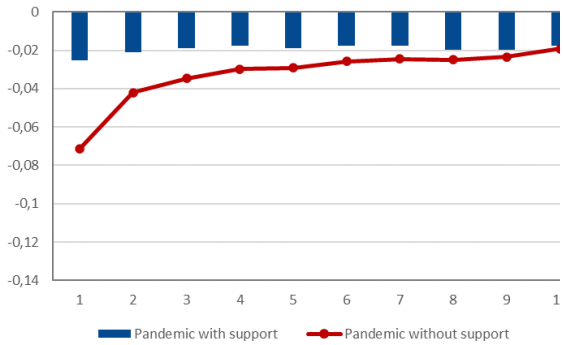
Netherlands



Slovakia

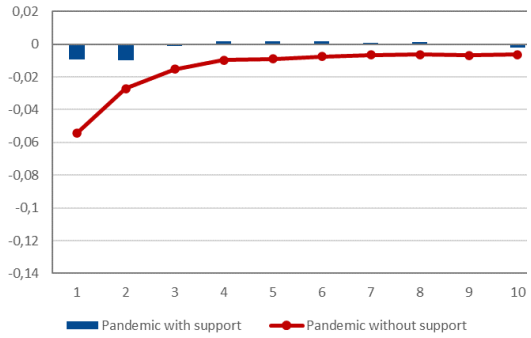


Slovenia

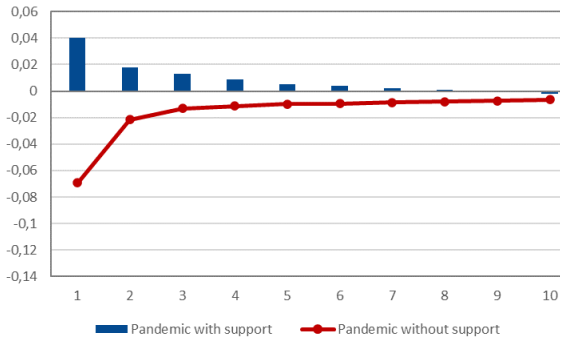


Overall subsidies

Finland



Netherlands



Note: Pandemic with support - projection considering government support and assuming constant supported part of the employment; Pandemic without support - projection based on sectoral decline in sales, material and labour costs elasticities to sales.
Source: Authors' calculations based on micro-data from Croatia, Finland, Netherlands, Slovakia and Slovenia.

6 Conclusion

Supporting companies with public funds was a key part of the economic policy response to the Covid-19 crisis. Without the strong response, the recession could have been much deeper and longer than what it turned out to be. Moreover, to the degree that the Covid-19 shock may produce long lasting scarring effects leading to economies remaining far below the precrisis trends for prolonged time-periods, as discussed in the recent empirical and theoretical literature on hysteresis and busines cycles (Cerra et al. 2021), the strong policy responses may be justified. The considerable size of the funds spent on business support, their distribution on a fast schedule and the possible harmful side effects of support still raises legitimate questions about the targeting and effectiveness of support.

A feature of the Covid-19 crisis has been that it hit companies unevenly across but even within sectors. Consequently, macro or industry level data only partially uncover the effects of the pandemic and related support measures on the economy. Therefore, the targeting and effectiveness of the Covid-19 subsidies should be examined on the basis of firm-level data.

By employing the information on actual business developments and early available firm-level information on the distribution of the state aid, we contribute to the discussion on the impact of the Covid-19 pandemic and government support on productivity. We analyse the experience of a group of five EU member states representing both less and more advanced economies, as well as economies experiencing mild and severe economic consequences, or weak and strong policy responses to the pandemic.

Covid-19 related lockdowns and temporary supply chain disruptions resulted in significant annual declines in sales. Firms tried to compensate the gaps in revenue by adjusting their costs. However, with generally lower elasticities of labour costs and employment to sales than elasticities of material costs to sales, the majority of firms recorded lower labour productivity during the first pandemic year. We confirm that the pandemic led to a significant short-term decline in productivity mainly driven by the within-firm growth component, changes in between or cross terms played a small role.

We also bring the first in-depth cross-country firm-level evidence on the allocation of government employment support and other direct subsidies implemented in 2020. Although, the conditions and scale of support differs across countries, a relatively large share of subsidies has been allocated to “deserving” productive and growing firms in temporary need of support, while only a small share of support has accrued to zombies or declining firms. We decompose the overall allocation of government subsidies

to the firm-level probability of being supported and the relative firm-level size of the support and find several common patterns. Larger or older firms and firms supplying accommodation and food services had higher chance to be supported. The probability of receiving support was higher for domestic or growing firms. And the support seemed to reach more frequently firms from less developed regions. In terms of the relative size of the support, we find that more productive or growing firms received lower relative subsidies. The support decreased also with firm size or firm age. More labour-intensive firms or dominant firms received higher support and the same is true for dominant firms. Relatively timely and efficient state aid has probably reduced not only the long-run scarring effect of the pandemic on the labour market, but also on output and productivity.

Importantly, our further estimations suggest that Covid-19 state aid has positively affected productivity mainly via reducing the negative within-firm margin and the magnitude of the impact appears to largely depend on the country's sectoral composition. If present, the pandemic support had only negligible adverse effect on reallocation from less to more productive firms. However, the implemented stimulus packages only partially offset the large negative shock of the pandemic on productivity.

These results underscore important policy consequences. In the acute crisis, productivity issues and the renewal of the economy were hardly the main concern of policy makers, as the main objective of the subsidies was, with good reason, to prevent an economic collapse. Under normal circumstances, public support to firms is more tightly linked to the long-run development of companies. Even in crisis situations, the economic rationale of business support remains at least partly relevant. With higher than expected persistence of the pandemic, possible distortive effects on competition or the potential conflict between the short- and long-term effects of aid gain their relevance. Also, although we find that in the short-run the pandemic and Covid-19 state aid have affected productivity mainly via the within-firm margin, it is possible that in the medium- to long-run more reallocation and structural change at the sectoral level will take place. Withdrawal from support measures quickly enough is justified both from the point of view of public finances and from the point of view of cyclical policy. It is also important for creative destruction that companies are not kept on artificial life support for too long. Once the pandemic comes closer to its end, the governments should soften their focus on safeguarding jobs and reconsider the role of productivity in boosting economic growth by strengthening supporting schemes for innovating, productive and growing firms in order to smooth the transition to the new normal.

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Appendix 1

Table A1.1 Description of explanatory variables

Variable	**Description**
Labour productivity	Value added divided by number of employees
Wage share	Labour costs divided by revenue
HHI	Hirsch-Herfindahl index based on revenue (labour)
Markup	Estimate based on firm intermediate and labour input decision, see CompNet (2021) for details
Price-cost margin	(Revenue - Material costs - Labour costs - Capital costs)/Revenue
Firm growth class	High – firm with annual growth of employment more than 20% over period of the last 3 years Normal – firm with positive annual growth of employment more less than 20% over period of the last 3 years Negative – firm with negative or zero annual growth of employment over period of the last 3 years
Binary dummy variables	
Public firm (dummy)	Binary dummy equal 1 for a firm owned by public sector institutions; 0 otherwise
Foreign firm (dummy)	Binary dummy equal 1 for a firm owned by a foreigner owner; 0 otherwise
Loss-making firm (dummy)	Binary dummy equal 1 for a firm making loss for three consecutive years and not a high growth firm (see definition above); 0 otherwise
Zombie firm (dummy)	Binary dummy equal 1 for a firm not able to cover its interest costs for three consecutive years and not a high growth firm (see definition above); 0 otherwise
Control (dummy) variables	
Firm age	Start-up – less than 3 years Young – from 3 to 4 years Mature – from 5 to 24 years Old- 25 and more years
Size class	0-9 employees 10-19 employees 20-49 employees 50-249 employees 250 and more employees
Region	Croatia – Jadranska Hrvatska, Kontinentalna Hrvatska (NUTS 2016) Finland – Länsi-Suomi, Helsinki-Uusimaa, Etelä-Suomi, Pohjois- ja Itä-Suomi, Åland Slovakia – Bratislavský kraj, Západné Slovensko, Stredné Slovensko, Východné Slovensko Slovenia – Vzhodna Slovenija, Zahodna Slovenija

Sector	Manufacturing; Construction; Wholesale and retail trade; Transportation and storage; Accommodation and food service activities; Information and communication; Real estate activities; Professional, scientific and technical activities; Administrative and support service activities

Table A1.2 Cost elasticities to sales

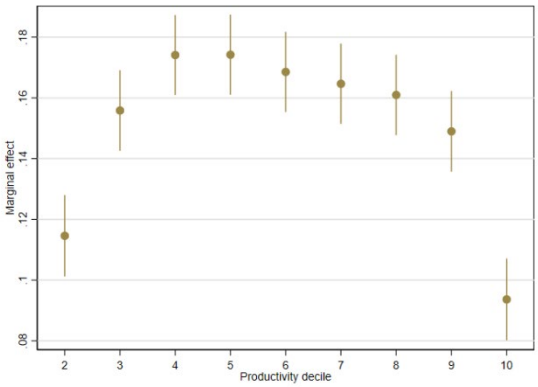
NACE Rev.2	ISIC Code	Industry	Labour cost elasticity to sales (β_s)	Material cost elasticity to sales (α_s)
1-3	A	Agriculture	0.298	0.668
5-9	B	Mining	0.353	0.824
10-12	CA	Food manufacturing	0.437	0.861
13-15	CB	Textiles	0.466	0.943
16-18	CC	Wood	0.415	0.911
19	CD	Coke and petroleum	0.324	1.461
20	CE	Chemicals	0.370	0.889
21	CF	Pharmaceuticals	0.266	0.776
22-23	CG	Rubber and plastic	0.431	0.966
24-25	CH	Basic metal	0.468	0.987
26	CI	Manuf. Of computer electronics	0.381	0.881
27	CJ	Manuf. Of electrical equipment	0.398	1.088
28	CK	Machinery	0.420	0.992
29-30	CL	Transport equipment	0.420	0.851
31-33	CM	Other manufacturing	0.478	0.957
35	D	Electricity and gas	0.276	0.725
36-39	E	Water	0.381	0.855
41-43	F	Construction	0.423	0.804
45-47	G	Trade	0.386	0.767
49-53	H	Transportation	0.479	0.848
55-56	I	Accommodation and food services	0.569	0.786
58-60	JA	Publishing	0.357	0.636
61	JB	Telecommunication	0.353	0.698
62-63	JC	IT	0.436	0.700
68	L	Real estate	0.293	0.637
69-71	MA	Legal and accounting	0.352	0.645
72	MB	R&D	0.309	0.640
73-75	MS	Other professional services	0.382	0.701
86-88	Q	Health	0.512	0.779
90-93	R	Art and recreation	0.393	0.638

Source: Maurin and Pal (2021).

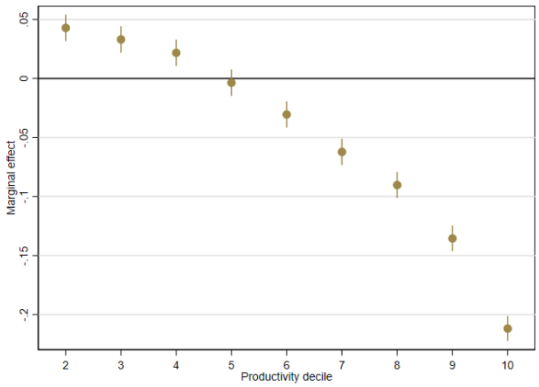
Appendix 2

Figure A2.1.1: Firm probability of receiving employment support – by within sector productivity deciles

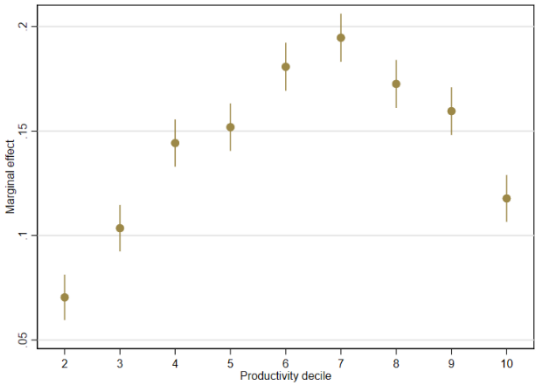
Croatia



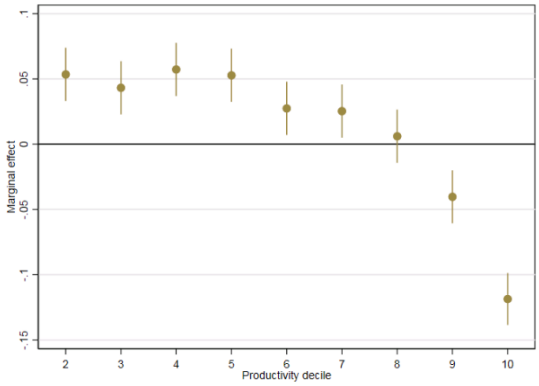
Netherlands



Slovakia



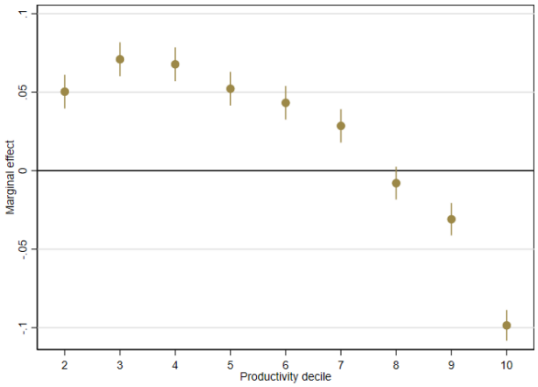
Slovenia



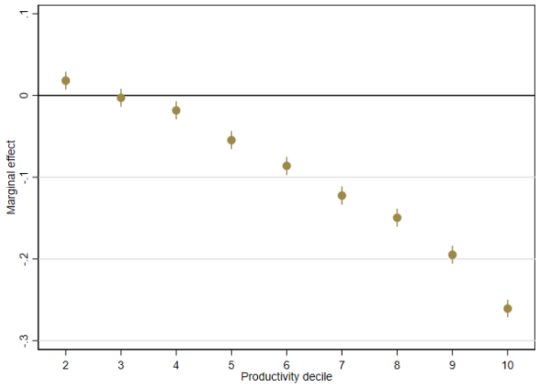
Note: Within sector – firms assigned to deciles of the macro-level distribution of labour productivity.
Source: Authors' calculations based on micro-data from Croatia, Finland, Netherlands, Slovakia and Slovenia.

Figure A2.1.2: Firm probability of receiving overall support – by within sector productivity deciles

Finland



Netherlands



Note: Note: Within sector – firms assigned to deciles of the macro-level distribution of labour productivity.
Source: Authors' calculations based on micro-data from Croatia, Finland, Netherlands, Slovakia and Slovenia.

Table A2.1.1: Probability of receiving support – by firm age

	Wage subsidies				**Overall subsidies**	
VARIABLES	Croatia	Netherlands	Slovakia	Slovenia	Finland	Netherlands
Firm age	**0.0164*** **	**0.0096*** **	**0.0279*** **	**0.0220*** **		**-0.0089*** **
	(0.0020)	**(0.0016)**	**(0.0021)**	**(0.0032)**		**(0.0016)**
Control variables:						
Productivity	Yes	Yes	Yes	Yes	**N/A**	Yes
Sector	Yes	Yes	Yes	Yes		Yes
Size class	Yes	Yes	Yes	Yes		Yes
Observations	59,497	98,147	74,687	30,197		98,147

Note: The table shows average marginal effects from the logit regression for binary dummy representing receipt of COVID-19 government support in 2020. Lagged explanatory variables from year 2019. Age of Finnish firms not available. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

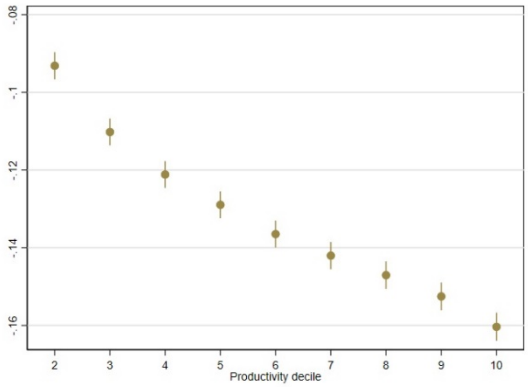
Table A2.1.2: Probability of receiving support – by firm price-cost margin

	Wage subsidies				**Overall subsidies**	
VARIABLES	Croatia	Netherlands	Slovakia	Slovenia	Finland	Netherlands
Price-cost margin	**0.0022**	**-0.1975*** **	**-0.0357*** **	**0.0939*** **	**-0.0841*** **	**-0.2838*** **
	(0.0023)	**(0.0125)**	**(0.0087)**	**(0.0210)**	**(0.0108)**	**(0.0125)**
Control variables:						
Productivity	Yes	Yes	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes	Yes	Yes
Size class	Yes	Yes	Yes	Yes	Yes	Yes
Observations	68,688	99,916	74,933	30,670	90,814	99,916

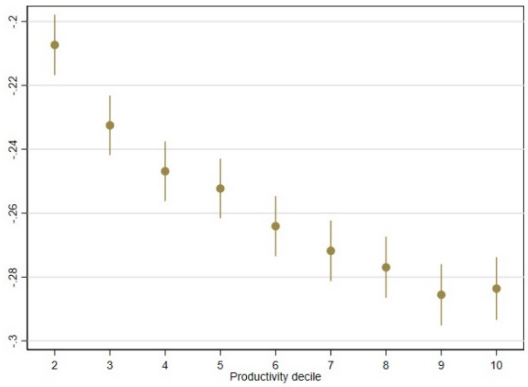
Note: The table shows average marginal effects from the logit regression for binary dummy representing receipt of COVID-19 government support in 2020. Lagged explanatory variables from year 2019. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Figure A2.2.1: Relative size of the employment support – by productivity deciles

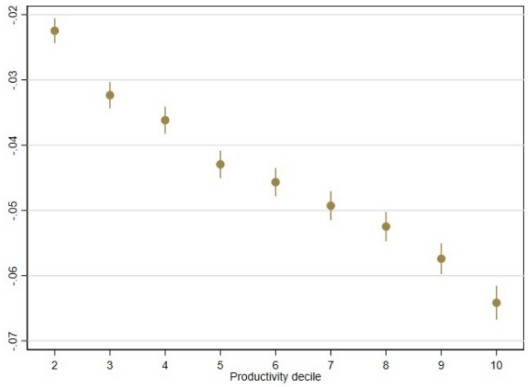
Croatia – with respect to revenue



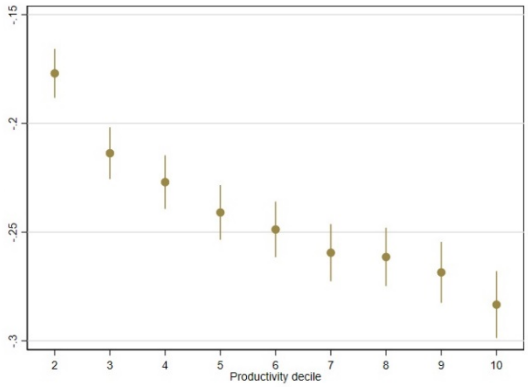
Croatia – with respect to labour costs



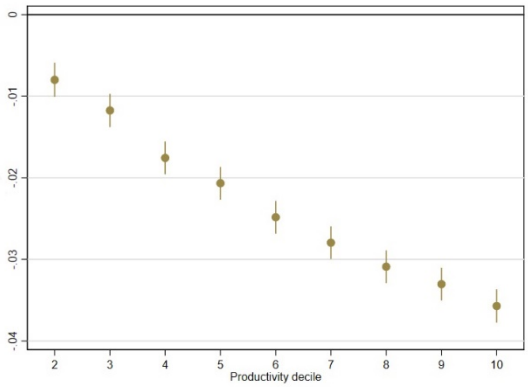
Netherlands – with respect to revenue



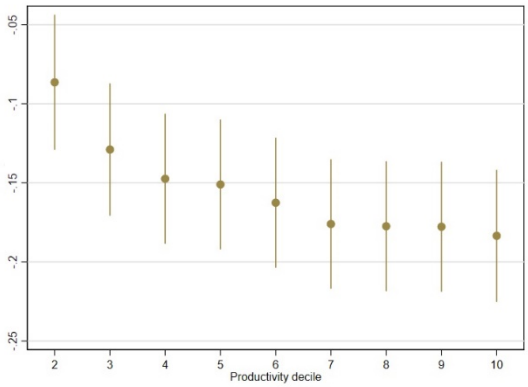
Netherlands– with respect to labour costs



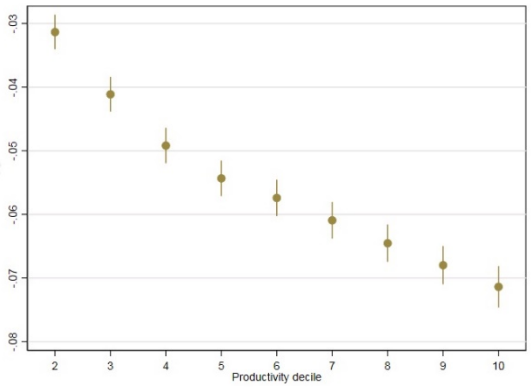
Slovakia – with respect to revenue



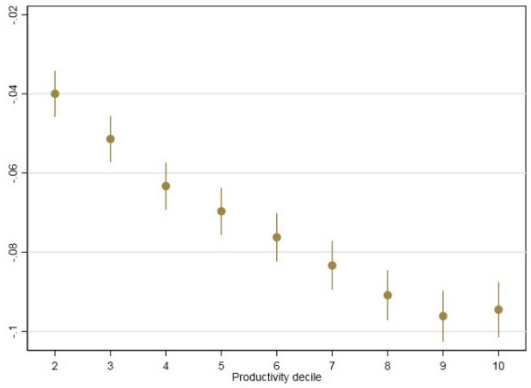
Slovakia – with respect to labour costs



Slovenia – with respect to revenue



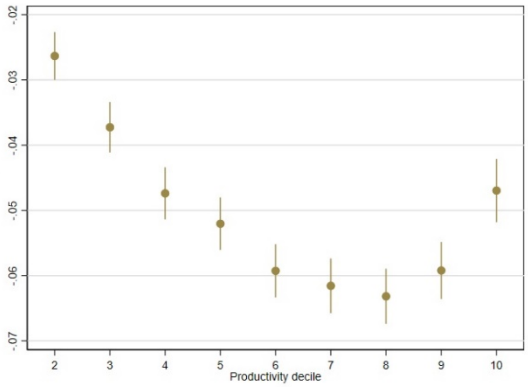
Slovenia – with respect to labour costs



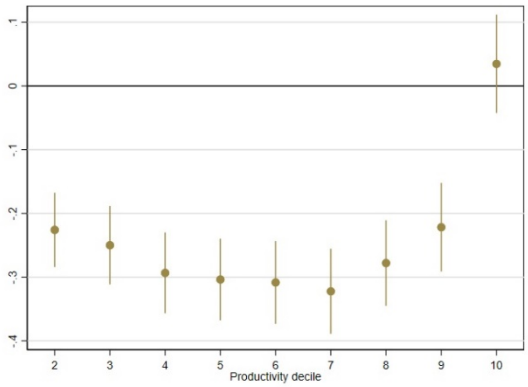
Note: Within country – firms assigned to deciles of the country-level distribution of labour productivity. Conditional OLS estimates for supported firms.
Source: Authors' calculations based on micro-data from Croatia, Finland, Netherlands, Slovakia and Slovenia.

Figure A2.2.2: Relative size of the overall direct support – by productivity deciles

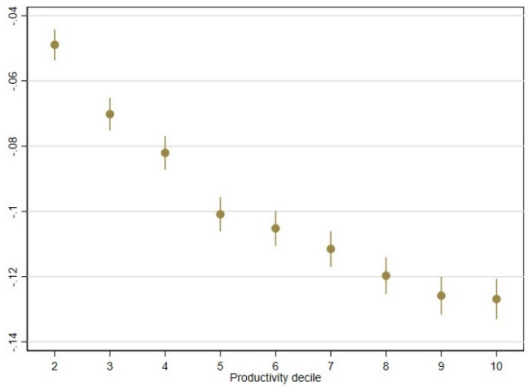
Finland – with respect to revenue



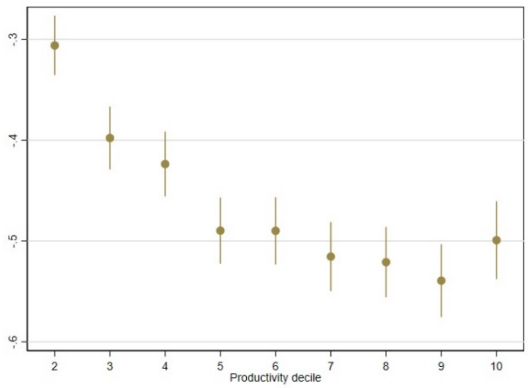
Finland – with respect to labour costs



Netherlands – with respect to revenue

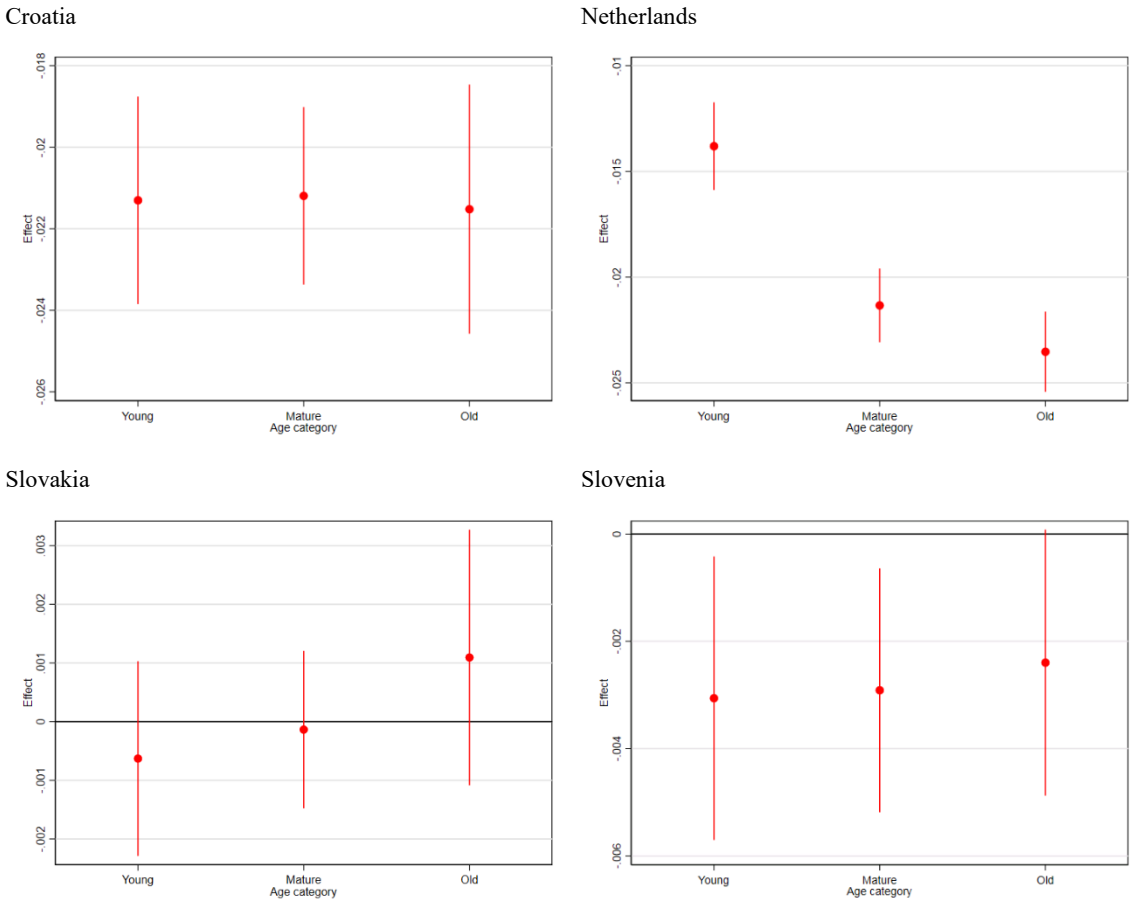


Netherlands – with respect to labour costs



Note: Within country – firms assigned to deciles of the country-level distribution of labour productivity. Conditional OLS estimates for supported firms.
Source: Authors' calculations based on micro-data from Croatia, Finland, Netherlands, Slovakia and Slovenia.

Figure A2.2.3: Relative size of the employment support – by firm age



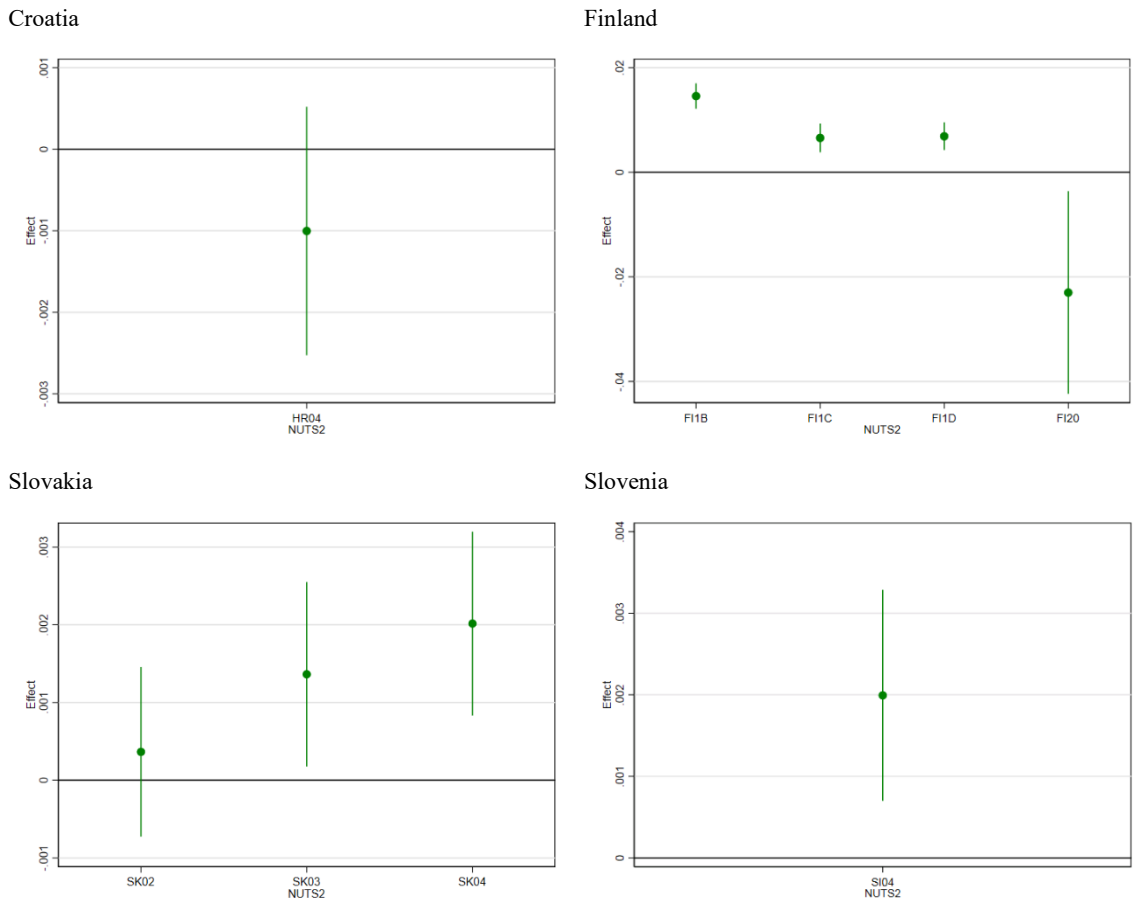
Note: Relative support with respect to revenue. Conditional OLS estimates for supported firms.
Source: Authors' calculations based on micro-data from Croatia, Finland, Slovakia and Slovenia.

Table A2.2.1: Relative size of support – by firm age

	Wage subsidies				**Overall subsidies**	
VARIABLES	Croatia	Netherlands	Slovakia	Slovenia	Finland	Netherlands
Firm age	**-0.0119*** **	**-0.0290*** **	**-0.0089**	**-0.0014* **		**-0.1000*** **
	(0.0008)	**(0.0016)**	**(0.0065)**	**(0.0008)**		**(0.0045)**
Constant	0.2058***	0.3156***	0.1971***	0.1293***		0.8308***
	(0.0028)	(0.0070)	(0.0207)	(0.0030)		(0.0200)
Control variables:					**N/A**	
Productivity	Yes	Yes	Yes	Yes		Yes
Sector	Yes	Yes	Yes	Yes		Yes
Size class	Yes	Yes	Yes	Yes		Yes
Observations	37,100	42,511	23,646	14,621		50,877
R-squared	0.0972	0.0909	0.0038	0.1609		0.0377

Note: The table shows coefficients of OLS regressions for supported firms with the share of firm subsidies on labour costs as dependent variable. Continuous variables in logarithm. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Figure A2.2.4: Relative size of the support – by region



Note: Relative support with respect to revenue. Overall direct support for Finland and employment support for all other countries. Conditional OLS estimates for supported firms.
Source: Authors' calculations based on micro-data from Croatia, Finland, Slovakia and Slovenia. Information on Dutch firms' location not available.

Table A2.2.2: Relative size of support – by firm concentration of employment

	Wage subsidies				**Overall subsidies**	
VARIABLES	Croatia	Netherlands	Slovakia	Slovenia	Finland	Netherlands
HHI (employment)	**0.0170*** **	**0.0081**	**0.0080*** **	**0.0085*** **	**-0.0080*** **	**0.0131** **
	(0.0011)	**(0.0056)**	**(0.0020)**	**(0.0007)**	**(0.0010)**	**(0.0052)**
Constant	0.5298***	0.2511***	0.7426***	0.2763***	0.0991***	1.4723***
	(0.0077)	(0.0352)	(0.0131)	(0.0059)	(0.0060)	(0.0338)
Control variables:						
Productivity	Yes	Yes	Yes	Yes	Yes	Yes
Size class	Yes	Yes	Yes	Yes	Yes	Yes
Observations	44,523	23,961	43,193	14,838	28,481	51,785
R-squared	0.0852	0.0035	0.0975	0.1237	0.0707	0.0417

Note: The table shows coefficients of OLS regressions for supported firms with the share of firm subsidies on labour costs as dependent variable. Continuous variables in logarithm. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table A2.2.3: Relative size of support – by firm price-cost margin

	Wage subsidies				**Overall subsidies**	
VARIABLES	Croatia	Netherlands	Slovakia	Slovenia	Finland	Netherlands
Price-cost margin	**0.0725*** **	**0.1503*** **	**0.0500*** **	**0.0283*** **	**-0.0196*** **	**0.2964*** **
	(0.0034)	**(0.0138)**	**(0.0073)**	**(0.0058)**	**(0.0046)**	**(0.0402)**
Constant	0.2467***	0.2527***	0.1467***	0.1333***	0.1153***	0.6178***
	(0.0041)	(0.0055)	(0.0057)	(0.0028)	(0.0021)	(0.0169)
Control variables:						
Productivity	Yes	Yes	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes	Yes	Yes
Size class	Yes	Yes	Yes	Yes	Yes	Yes
Observations	44,523	42,819	19,762	14,838	28,476	51,262
R-squared	0.0792	0.0946	0.0246	0.1393	0.1612	0.0304

Note: The table shows coefficients of OLS regressions for supported firms with the share of firm subsidies on labour costs as dependent variable. Continuous variables in logarithm. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

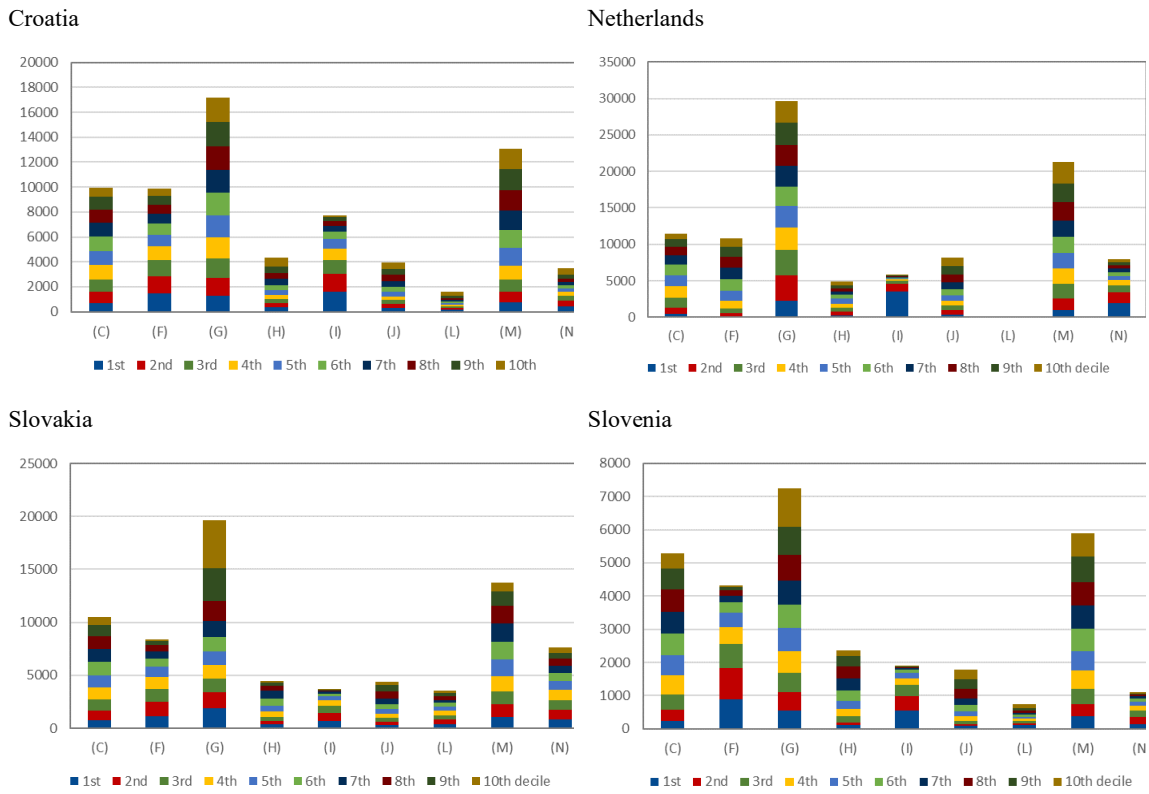
Table A2.2.4: Classification of sectors according to technology and knowledge intensity

Industry classification	Nace 2-digit industry	Description
High-medium technology and knowledge intensive services	20-21	Manufacture of basic pharmaceutical products and pharmaceutical preparations; Manufacture of chemicals and chemical products
	26 - 30	Manufacture of computer, electronic and optical products; Manufacture of electrical equipment; Manufacture of machinery and equipment n.e.c.; Manufacture of motor vehicles, trailers and semi-trailers; Manufacture of other transport equipment
	50-51	Water transport; Air transport;
	58-63	Publishing activities: Motion picture, video and television program production, sound recording and music publish activities; Programming and broadcasting activities; Telecommunications; computer programming, consultancy and related activities; Information service activities
	64-66	Financial and insurance activities
	69-75	Legal and accounting activities; Activities of head offices, management consultancy activities; Architectural and engineering activities, technical testing and analysis; Scientific research and development; Advertising and market research; Other professional, scientific and technical activities; Veterinary activities
	78,80,84-93	Employment activities; Security and investigation activities; Public administration and defence, compulsory social security; Education, Human health and social work activities; Arts, entertainment and recreation.

	19	Manufacture of coke and refined petroleum products
	22-25	Manufacture of rubber and plastic products; Manufacture of other non-metallic mineral products; Manufacture of basic metals; Manufacture of fabricated metals products, excepts machinery and equipment
	33	Repair and installation of machinery and equipment
	10-18	Manufacture of food products, beverages, tobacco products, textile, wearing apparel, leather and related products, wood and of products of wood, paper and paper products, printing and reproduction of recorded media
	31-32	Manufacture of furniture; Other manufacturing
Medium-low technology and less knowledge intensive services	45-47,49,52-53,55-56	Wholesale and retail trade; Repair of motor vehicles and motorcycles (section G); Land transport and transport via pipelines; Warehousing and support activities for transportation; Postal and courier activities; Accommodation and food service activities (section I)
	68,77,79,81,82	Real estate activities; Rental and leasing activities; Travel agency, tour operator reservation service and related activities; Services to buildings and landscape activities; Office administrative, office support and other business support activities;
	94-99	Activities of membership organization; Repair of computers and personal and household goods; Other personal service activities; Activities of households as employers of domestic personnel; Undifferentiated goods- and services-producing activities of private households for own use; Activities of extraterritorial organizations and bodies

Notes: The shows the classification of NACE Rev.2 2-digit sectors according to technology and knowledge intensity.
Source: Eurostat.

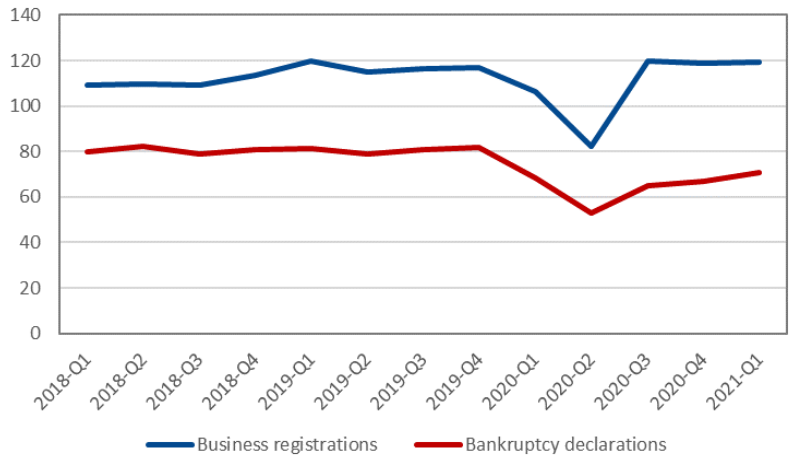
Figure A2.3.1 Firms by sectors and firm productivity



Note: Colours represent deciles of firm productivity. Vertical axis shows number of firms. Horizontal axis represents macro sectors: (C) Manufacturing; (F) Construction; (G) Wholesale and retail trade; (H) Transportation and storage; (I) Accommodation and food service activities; (J) Information and communication; (L) Real estate activities; (M) Professional, scientific and technical activities; (N) Administrative and support service activities.
Source: Authors' calculations based on micro-data from Croatia, Netherlands, Slovakia and Slovenia.

Appendix 3

Figure A3.1.1 Business registrations and bankruptcy declarations in the EU



Note: Seasonally and calendar adjusted data for EU-27 [STS_RB_Q].
Source: Eurostat.

Table A3.1.1 Decomposition of the aggregated productivity growth (in %) – all firms

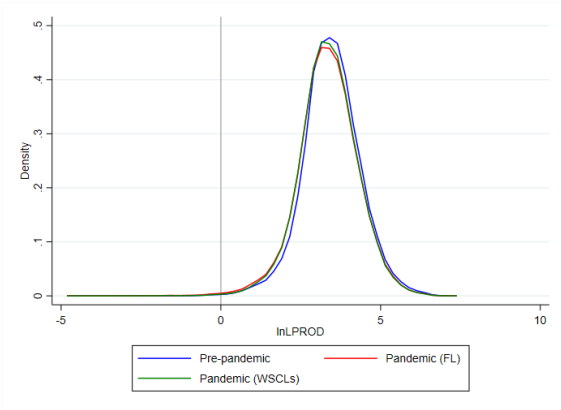
Country	Year	Within	Between	Cross
Croatia	2018	3.42	2.05	-1.45
	2019	3.63	2.01	-1.81
	2020 (no support)	-9.08	-0.36	1.44
	2020 (with wage support)	-7.82	-0.36	1.25
Netherlands	2018	2.78	-1.06	-1.36
	2019	4.70	4.51	-1.66
	2020 (no support)	-7.29	-0.05	0.97
	2020 (with wage support)	-3.42	-0.61	0.65
Slovakia	2018	4.57	3.19	-3.70
	2019	4.42	3.66	-2.78
	2020 (no support)	-3.63	1.21	0.13
	2020 (with wage support)	-3.12	1.18	0.12
Slovenia	2018	2.87	1.07	-0.72
	2019	4.08	1.38	-0.83
	2020 (no support)	-7.96	0.35	0.30
	2020 (with wage support)	-6.85	0.32	0.25
Finland	2018	1.39	0.38	-1.55
	2019	1.45	0.68	-2.78
	2020 (no support)	-3.09	0.29	0.34
	2020 (with overall support)	-1.87	0.25	0.30
Netherlands	2018	2.78	-1.06	-1.36
	2019	4.70	4.51	-1.66
	2020 (no support)	-7.29	-0.05	0.97
	2020 (with overall support)	-2.73	-0.65	0.65

Note: Projected pandemic values based on firm-level value added from 2019, industry level changes in sales in 2020 and cost elasticities to sales from Maurin and Pal (2020). Only firms sustaining for five years taken into account, firm entries and exits not considered.
Source: Authors' calculations.

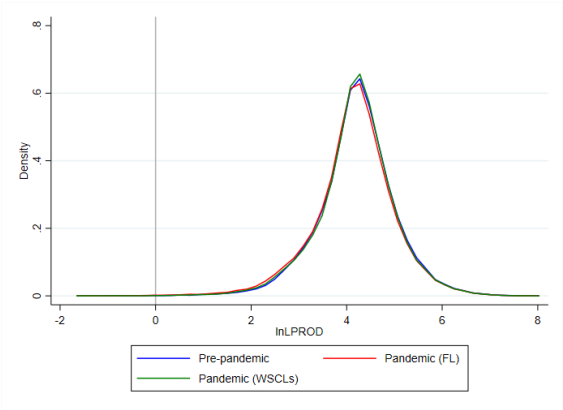
Figure A3.2.1: Distribution of the labour productivity with and without support – all firms

Employment subsidies

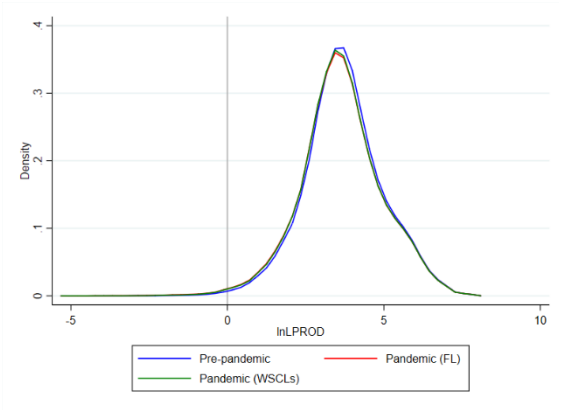
Croatia



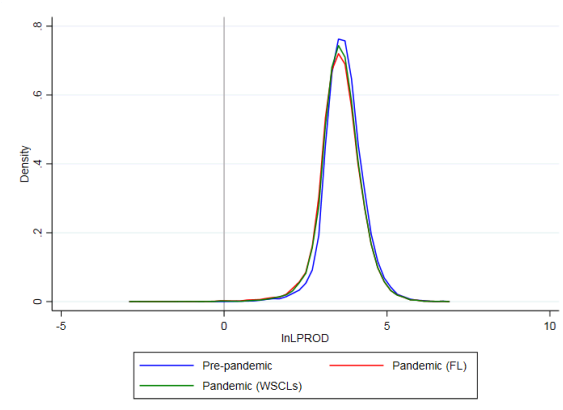
Netherlands



Slovakia

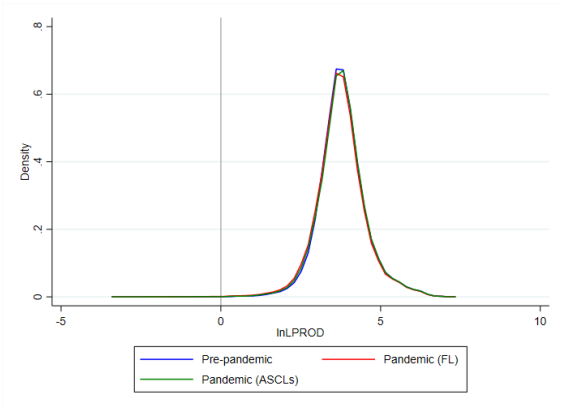


Slovenia

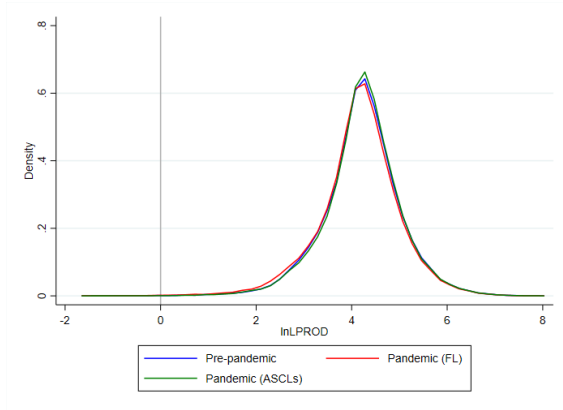


Overall subsidies

Finland

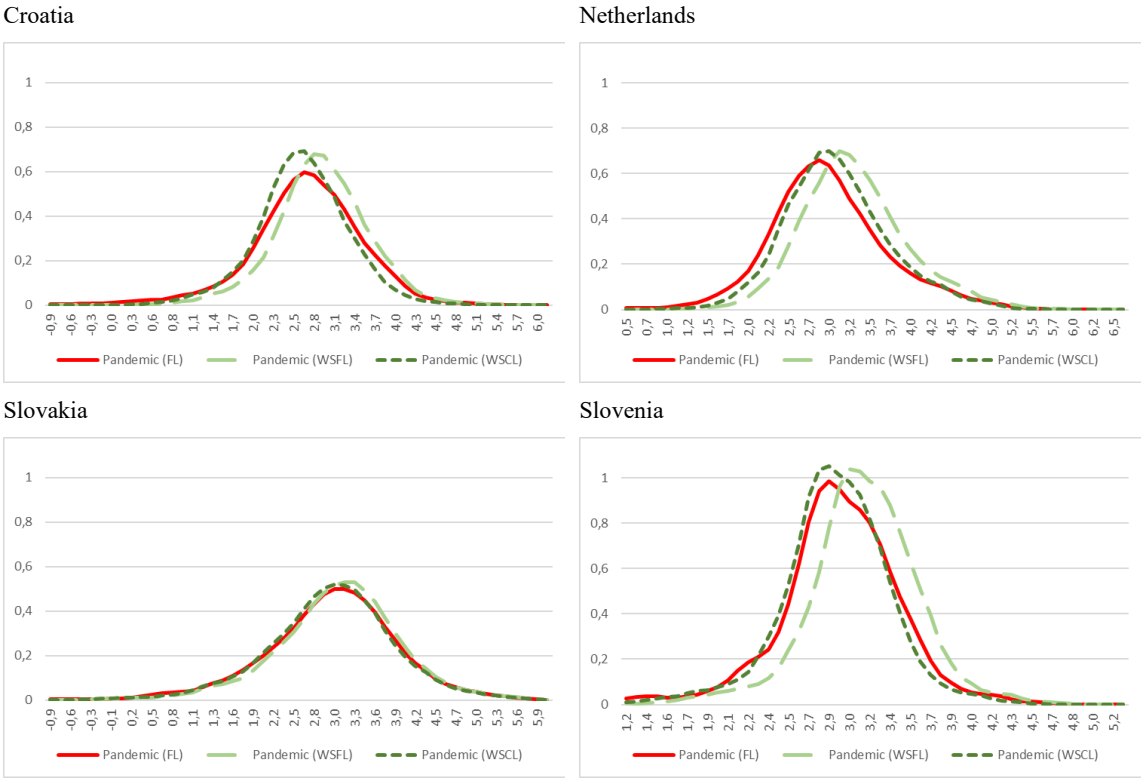


Netherlands



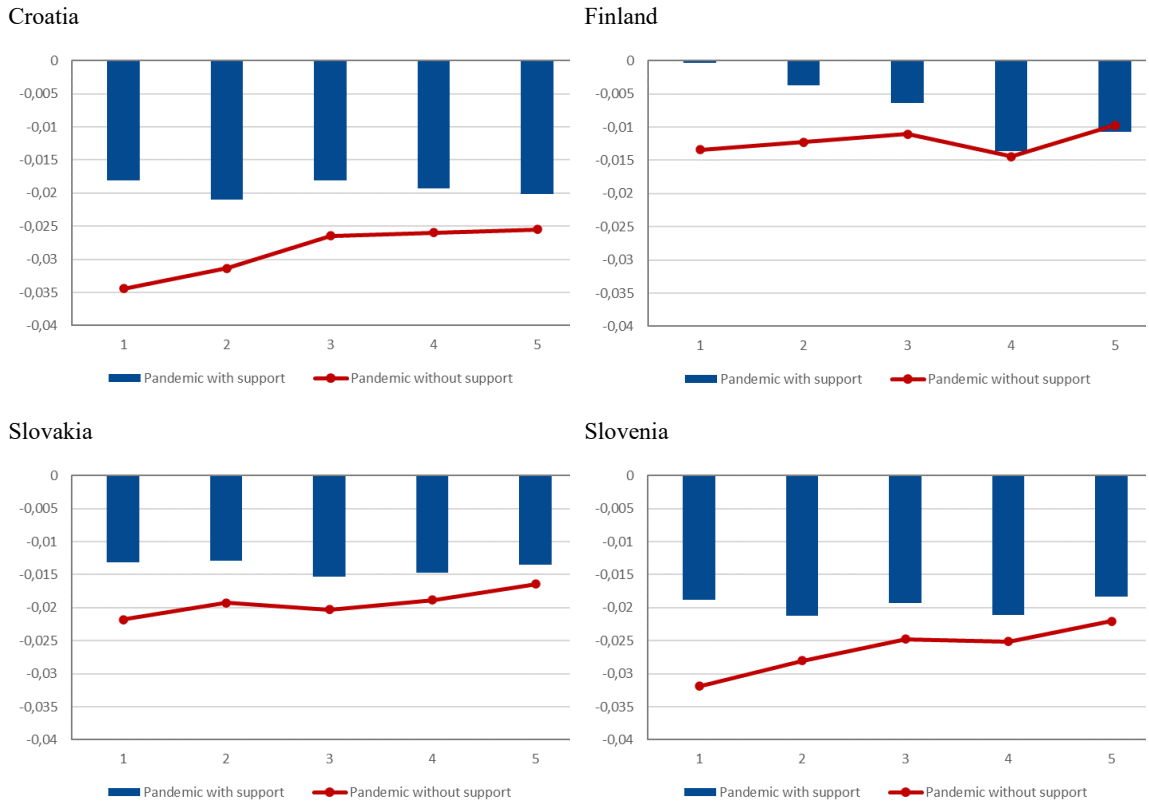
Note: Kernel density estimates. Pre-pandemic – based on 2019 data; Pandemic (FL) – projection assuming flexible costs and employment; Pandemic (WSCLs) - projection considering employment support and assuming constant supported part of the employment; Pandemic (ASCLs) - projection considering overall support.
Source: Authors' calculations based on micro-data from Croatia, Finland, Netherlands, Slovakia and Slovenia.

Figure A3.2.2: Distribution of the labour productivity with employment support – fixed and flexible employment, supported firms from Accommodation and food service activities



Note: Kernel density estimates. Pandemic (FL) – projection assuming flexible costs and employment; Pandemic (WSFL) - projection considering government support and assuming flexible employment, Pandemic (WSCL) - projection considering government support and assuming constant total firm employment.
Source: Authors' calculations based on micro-data from Croatia, Netherlands, Slovakia and Slovenia.

Figure A3.2.3: Mean percentage decline in labour productivity – by firm size classes



Note: Pandemic with support - projection considering government support and assuming constant supported part of the employment; Pandemic without support - projection based on sectoral decline in sales, material and labour costs elasticities to sales. Overall direct support for Finland and employment support for all other countries. Size classes represent firms with less than 10 employees (1); between 10 and 19 employees (2); between 20 and 49 employees (3); between 50 and 249 employees (4); 250 and more employees (5).
Source: Authors' calculations based on micro-data from Croatia, Finland, Slovakia and Slovenia.

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