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How do mass lay-offs affect regional economies?

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How do mass lay-offs affect regional economies?

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Mass lay-offs from firms and plant restructuring occur regularly and can have potentially large consequences on places and communities. Policy makers may consider supporting firms, in order to prevent mass lay-offs but at the risk of interfering with economic dynamism, or targeting affected workers, to help them transition to new employment. Which strategy (firms versus workers) is the most appropriate and under which circumstances can be informed by better understanding the nature of the economic impact from mass lay-offs. This paper estimates the impact of mass lay-offs between 2008-18 across small regions (TL3) in Europe on regional employment and productivity. It finds there are persistent negative employment effects of mass lay-offs, and rural regions are more negatively affected on average. In part because of differences in the nature of the firm in the region, its relationship with nearby suppliers and clients, and the broader economic context of the region, productivity effects can be both positive and negative over the longer term.

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Keywords: mass lay-offs; local labour market; regional resilience; economic shocks

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Executive summary

The size and impact of mass lay-off events on individual workers and indeed local communities, whether at factories, offices or commercial premises, can often result in significant public attention (OECD, 2018, p. 127[1]). Dismissed workers face income loss and unemployment spells, potentially culminating in further adverse social and health outcomes (Venkataramani et al., 2020[2]; Bertheau et al., 2022[3]). In some cases, affected workers can mobilise the larger community and gain political support to partially reverse mass dismissal decisions (González Begega and Köhler, 2021[4]).

This paper uses data from the European Restructuring Monitor database of Eurofound to estimate the average effect of mass lay-offs on the employment and productivity of small (TL3) regions over the period 2007 to 2018. On average, each year, over a hundred mass lay-offs (defined as lay-offs of over 250 employees or 0.5% of the regional labour force) occurred, affecting more than 50 regions. The average mass lay-off is over 500 workers, representing more than 0.25% of the average local labour force in TL3 regions.

The scale-down or closure of a large employer could, of course, impact on a substantial number of additional businesses, both upstream and downstream in the value chain, as well as businesses providing goods and services to affected workers. The immediate impact of a mass lay-off on the local economy, and the adjustment mechanisms (including capacities) needed to adapt to it, are inevitably more profound than for numerous individual displacements occurring across many employers and spread over time, and so merit particular focus. They are also important to assess as they account for up to 15% off all job displacements (OECD, 2018, p. 131[1]).

Regional measures of productivity can offer insights into the resilience of regions to mass lay-offs. On the one hand, mass lay-offs that occur in underperforming and low productivity firms may result in positive productivity effects over time, especially if affected workers find new jobs in higher productivity firms in the same region. On the other hand, mass lay-offs may also occur in high productivity firms that restructure their business activities across regions or countries. In this case, regional productivity may be affected negatively. Which type of productivity impact is more frequent and in what type of region remains an open question.

Economic policies can address mass lay-off events from two fundamental angles. There are policies that target the firm (in an effort to prevent the mass lay-off), and those that target the affected workers (to facilitate their rapid transition to new jobs). Both present different costs and benefits and, indeed, evidence on effectiveness. National legislation concerning the employee protection from collective dismissals also varies between countries (OECD, 2020[5])

Policies that target the firm, for instance through some form of emergency credit extension, immediately address the event and prevent a large group of workers being affected, whilst also protecting local suppliers and the wider economy. There are however also risks, notably that such interventions run the risk of merely delaying an eventual business failure, if the structural issues in the firm that gave rise to initial restructuring are not addressed, which the support itself may often discourage. The support itself may also distort competition and create unfair advantages with competitors, including internationally (which may lead to retaliatory measures). Indirectly, the additional costs are the loss of allocative efficiency, which arises if workers are kept in a potentially suboptimal place of work while better alternatives are available. During the COVID-19 pandemic, emergency aid to firms, in terms of wage

subsidies or other employment support schemes were widely used in OECD countries to prevent lay-offs (OECD, 2021[6]). However, whilst successful, care is needed in extrapolating the use of these measures to conventional 'lay-offs' as the COVID-19 shock was external to the firms, which were considered viable in normal circumstances.

Policies that target workers include income support during unemployment, the provision of re-training and help with job searches. Naturally, the success of policies targeting workers with the objective to limit the length of their spell in unemployment depends on the efficiency of the government administration, including at the subnational level where active labour policies are often directly implemented, or the scale at which national policies may do so (OECD, forthcoming[7]). The success of job transition also depends on the local economic circumstances such as the availability of a sufficient number of relevant vacancies in the same region.

This paper estimates the average effect of mass lay-offs from 2004 to 2018 on the regional (NUTS3/TL3) economies across seven European countries. Having a better understanding of this regional economic effect can help inform choices of policy approaches that target either mainly the firm or mainly the worker.

This paper finds that mass lay-offs have persistent effects on regional labour markets. A mass lay-off reduces regional employment by around 1% to 1.8%, depending on the size threshold of the scale of the lay-off. Rural regions tend to experience stronger negative employment effects from mass lay-offs, possibly reflecting shallower labour markets in which affected workers need to find new employment. Regions that experienced mass lay-offs since 2010 have experienced a more negative employment impact than regions that experienced shocks during the years of the global financial crisis of 2008 and 2009.

The long-term average effect on productivity, as measured by industrial gross value added per worker, is statistically insignificant from zero. However, when differentiating by year of the event and the threshold, shocks that occurred after 2009 and amount to at least 0.5% of the labour market can have persistent negative effects on regional productivity. Mass lay-offs that happened in 2008 and 2009, as with the employment effect, are estimated to affect productivity positively, but this can be related to the specific context of the global financial crisis. Moreover, the estimates indicate that the productivity effects are generally more mixed across types of regions and their economic context relative to the employment effects.

The robust and persistent negative employment effects suggest that affected workers can always be supported in their job-transition for instance, through active labour market policies. The results on productivity suggest that the effect of mass lay-offs on regional economies can be detrimental over the medium term. However, mass lay-offs may not always be harmful to a region's productivity. The economic characteristics and context of places can further define whether a region's economic development is scarred by a mass lay-off. Therefore, policy makers can consider supporting firms to prevent or limit mass lay-offs in more specific cases, while taking account of the broader economic trends and regional characteristics.

Literature review

The empirical literature on mass lay-offs addresses the direct impact on workers and the aggregate effect on regional economies. Some studies combine the two levels of analysis by looking at workers that are not directly affected by the mass lay-off but can be indirectly affected through geographical proximity or business linkages. Most studies use data from a single country. Table 1 summarises the relevant papers, indicating the unit of analysis (e.g., individuals or regions), the geographical and time coverage, the main findings and the main quantitative estimation method.

Consequences of mass lay-offs for individual workers

Job displacement affects some workers more than others. Specifically, workers that are older or with a lower level of education tend to experience longer negative effects from unemployment and these effects become more important the longer the unemployment spell (OECD, 2018[1]). Moreover, workers without a higher education degree or with a post-secondary technical degree are less likely to move sector relative to people with a higher education degree (Huttunen, Møen and Salvanes, 2011[8]), which needs to be factored into policy responses.

The literature on mass lay-offs combines plant closures and mass displacements, for which studies often take the threshold of 30% of the workforce of a plant or firm. Mass lay-offs can be argued to be events that are exogenous to workers' individual performance and exclude voluntary separations.

There is little evidence that for individual workers, large lay-off events have substantially different longer-term effects on individual workers relative to lay-offs that do not stem from such events. Generally, workers displaced in a mass lay-off experience a reduction in earnings growth relative to earnings prior to the event and relative to suitable counterfactual groups (Fallick et al., 2019[9]). Bertheau et al. (2022[3]) use a harmonised sample and estimation approach for seven European countries to estimate the effect of job displacement from mass lay-offs and plant closures. Five years after the event, workers in southern European countries (Portugal, Italy Spain) experience up to 30% lower earnings. In contrast, workers in Denmark and Sweden see a fall of around 10%. The difference in the likelihood of being re-employed across countries, which is much larger in northern countries, largely explains the earnings difference. The authors argue that the difference in share of spending on active labour market policies of all labour market spending (which ranges as high as 60% in Nordic countries and can be as low as 20% in others) best explains the cross-country variation in re-employment. Moreover, early intervention for affected workers by dismissals, for instance at the moment that lay-offs are announced but not yet executed, potentially increases the effectiveness of any active labour market programme (OECD, 2018[1]).

Do mass lay-off events affect regional economies?

The evidence on repercussions of mass lay-offs on regional economies focuses mostly on the employment effects, while other regional economic indicators, such as output or productivity are studied less frequently. Studies on the regional employment effects of mass lay-offs aim to understand

whether a local labour market is able to absorb a large employment shock through the renewed employment of affected workers. At the same time, a mass lay-off may also have negative consequences for other firms in the same region, for instance if firms have direct business links with the affect firm or the employment shock leads to a reduction in consumption demand. Such economic spill-overs from a large employment shock suggest that a regional economy can be affected beyond employment and measures of regional output and productivity can be analysed too.

Regional employment effects on the firm of the mass lay-off are estimated in several studies. Celli et al. (2022[10]) find that a sector in an Italian local labour market that is affected by a mass lay-off of at least 100 people barely recovers in the following eight years. Gathmann et al. (2020[11]) find that each job lost in a mass lay-off in a German plant may lead to further job losses in other firms, Jofre-Monseny et al. (2017[12]) find for plant closures in Spanish regions that the effect of job losses is mitigated by employment creation in plants of other firms that are active in the same sector that are also located in the same region. Using georeferenced data on plants in Germany, Vom Berge and Schmillen (2022[13]) find no effects on workers in different but nearby firms in the same industry.

A few studies look at local or regional economic outcomes beyond employment. Foote (2019[14]) finds that a shock that represents 1% of a US county's labour force leads to a long-term decrease in the labour force of 0.19%, largely due to emigration out of the county. Gathmann et al. (2020[11]) estimated that a mass lay-off in Germany of at least 500 workers on average decreases productivity of the sector by 0.22% in the region where the event occurs. Part of the reason for differences in effects of mass lay-offs on regional economics across the various studies could be due to differences in the selection of events. Relative to small events, larger events, e.g., those above 1 000 affected workers or representing more than 1% of the local labour force, are more likely to affect the regional economy directly. However, since such events are also relatively sparse, various studies include more frequent but much smaller events, for which spill-over impacts are likely to be much smaller.

Silva et al. (2019[15]) **find that mass lay-offs are not typically driven by technological megatrends, such as automation, but tend to be concentrated in areas that rely on manufacturing employment or that have low employment growth.** They use the same data source as this paper, for the period 2002 to 2016 to better understand what drives lay-off events in the first place. Mass lay-offs tend to be more common in some sectors than others, which could be related to business dynamism of specific sectors and to the production structure that favours larger firms over smaller firms, thus increasing the probability of observing mass lay-off events in such sectors.

Table 1. Empirical evidence of mass lay-off events on workers and regions

Study	Object of study	Region, time period, and event characteristic	Main result	Method
Celli, Cerqua and Pellegrini (2022[10])	local labour market-sectors	Italy, 2004-19, shocks of at least 100 jobs in a plant occurring between 2008-11	Employment shocks to a sector in a local labour market cause on average an immediate reduction of employment in the same sector in the local labour market of 22%, which persists over at least 9 years	DiD matching
Vom Berge and Schmillen (2022[13])	Individual workers	Germany, 2009. Number of events unclear	Attempts to estimate employment and earnings effects on workers not affected by the mass lay-off but geographically working in the same area (within hundreds of meters). The study finds no such effect.	TWFE
Bertheau, Acabbi, Barcelo, Gulyas, Lombardi, Saggio, Acabbi (2022[3])	Individual workers	6 European countries, varying time periods approx. 1993-2017, 30% mass dismissal or plant closure	Loss of earnings for workers following job displacement in southern European countries is much larger five year after a mass lay-off than in northern European countries. The differences in spending on active labour market policies can explain these differences to a large extent.	DiD matching

Behrens, Drabo and Mayneris (2021[16])	City level population	Canadian urban areas, 1 period of 2003-17	Mass lay-off defined as substantial job loss rate at plants over 14-year period. Document negative effect on population with differentiation across groups, and spill-overs across sectors.	OLS with shift-share instrument
Fallick et al. (2019[9])	Individual workers	Five US States, Quarters ranging between 1992-2014. Job-to-job transitions	Comparing earnings patterns between job-to-job transitions allowing for different spans of joblessness and differentiating between distressed and non-distressed firms finds little effect of the cause of joblessness, but longer joblessness spells hurt wage growth.	Various TWFE models
Gathmann, Helm and Schönberg (2020[11])	Individual workers and regional aggregates	(West) Germany, 1975-2008, 69 events of at least 500 job losses in a plant	With an average lay-off event of 1 700 jobs (1.9% of labour force), regional job losses reach 3 000 jobs (3.7% of labour force). Each 1% of job loss may lead to 0.22% in productivity loss in corresponding sector. Only older workers experience a persistent negative effect in income.	TWFE
Foote, Grosz and Stevens (2019[14])	County level	US, 2000-11, following BLS dataset at least 50 job losses in plant	A 1% county LF shock decreases LF by 0.19 percentage points, of which 40% is due to out-migration, and much of the remainder by decrease of participation. During the Great Recession, non-participation channel became more important.	TWFE
Jofre-Monseny, Sánchez-Vidal and Viladecans-Marsal (2017[12])	Municipality-industry	Spain, 2000-08, 45 large manufacturing plant closures, with at least 100 job losses	Plant closures are due to international plant relocations. Analysis at municipality-industry level. For each job lost, between 0.3 and 0.4 are created in other plants. Little response along other margins. Labour market institutions may partly explain the lack of further labour market effects.	DiD Matching
Huttunen, Møen and Salvanes (2011[8])	Individual male workers	Norway, years 1986-2005, manufacturing	Displacement affects earnings negatively and more so for older workers. Transitions between plants (within firm) largely mitigate earnings losses. Between firms (and across sectors) earnings are not fully recuperated after 7 years.	TWFE
Eliason and Storrie (2006[17])	Individual workers	Sweden, 1983-99, plant closures in 1987	Job displacement has long-term effects, which can be aggravated by the economic environment. Workers affected by displacement see worse earnings development during subsequent recessions.	Propensity score matching
Stevens (1997[18])	Individual workers	US, panel surveys, 1968-88	Workers with a long job tenure who experience displacement may experience further subsequent job-changes. Such repeated events contribute to the persistent negative effect on earnings relative to workers who experience only one displacement over a period.	TWFE
Jacobson, Lalonde and Sullivan (1993[19])	Individual workers	US (Pennsylvania), 1974-86, matched employee-employer data	Workers experience substantial losses following displacement, up to 25% after five years. This experience is not much differentiated by gender, age and industry, but it is affected by local job market conditions.	TWFE
Ruhm (1991[20])	Individual workers	US, panel surveys, 1969-82	Differentiating between short- and long-term effects from displacement, finds a reduction in earnings of 10% after 4 years.	OLS

Note: LF: labour force. TWFE: two-way fixed effects linear regression method in a panel framework. Typically, these models control for unobserved time and cross-section heterogeneity. DiD: Difference-in-Differences, use methods that are not implemented using linear regression. Matching methods aim to find counter-factual cases among the non-treated observations to estimate the effect of the shock or treatment.
Source: Author's elaborations.

Using US Bureau of Labour Statistics, Yıldıran (2021[21]) **documents various time, regional (county level), sectoral and firm level differences of mass lay-off events.** The statistics make clear that the events cannot be assumed to be randomly allocated across all regions, but various observed and potentially unobserved factors make the occurrence of an event in specific regions and/or sectors more likely. Therefore, it can be argued that the timing of mass-lay-off events are random to individual regions only once time-constant regional factors and national or international sectoral time dynamics are taken into account.

This paper adds to the literature by combining regional (TL3) regions from multiple European countries, where previous papers are largely country specific. Using yearly data on mass lay-off across these regions, this paper presents estimates of the effect of mass lay-offs on regional employment and gross value added. The estimates on employment serve to explain the average immediate and medium-to-long term effects of mass lay-offs (Foote, Grosz and Stevens, 2019[14]). Regional real gross

value added per worker, as a measure of regional productivity, provides an indicator for wider economic prosperity (Gathmann, Helm and Schönberg, 2020[11]).

Finally, this paper contributes to the literature of regional economic resilience. Mass lay-offs represent a local labour market shock, which in many cases is exogenous to the region because it relates to global factors that affect a particular company. The resilience of a local economy can shown through in the way that the local labour market recovers from an employment shock (Martin and Sunley, 2015[22]; Faggian and Ascani, 2021[23]), for instance, when affected workers can rapidly find new jobs in the same region. In this paper, regions are differentiated through broad characteristics, such as their rural-urban typology, and prevailing unemployment rate. In individual cases, potentially different factors can be relevant in affecting regional resilience, such as industrial diversity, average levels of education and skills, and regional and international linkages. The detailed study of these and other factors lies beyond the scope of this paper, which takes a more high-level view while aiming to include as many European regions as possible.[1]

[1] The conceptual and empirical literature on regional economic resilience is wide. Further related literature include Simmie and Martin (2010[31]), Hassink (2010[32]), Martin (2012[33]), Boschma (2015[34]), Hynes et al. (2020[35]), Eraydin (2016[36]) and Rizzi, Graziano and Dallara (2018[37]).

Empirical analysis

The analysis is structured in three parts. The first part provides a brief section on the empirical methodology of estimating dynamic effects in a panel data framework where shocks occur at different times for different regions. The second part provides an overview of the data, focusing on the database of mass lay-offs from the Eurofound's European Restructuring monitor. The third part provides the estimation results using a subset of the data where mass lay-off events are matched to regions that have sufficient data on employment and productivity over the period 2004-2018.

Estimating the dynamic effects of shocks that occur across regions and time

The paper uses a panel dataset of regions, where some regions experience a mass lay-off at various points in time and other regions function as counterfactuals. As indicated in Table 1, many papers adopt a linear regression estimation method in a panel dataset summarised as "two-way fixed effects" (TWFE). The panel dataset consists of units, e.g., workers or regions, that experience a lay-off event. The units are observed prior to the event and followed for a period after. In a standard TWFE specification, indicator variables are specified to track the difference between treated and non-treated units prior to the event (treatment) and following treatments. The information prior to the occurrence of the event serves to assess whether the observations from treated and non-treated units are following similar paths prior to treatment. If this is the case, the estimates provide a valid estimate on the effect of mass lay-offs on regional outcomes.

The TWFE estimator can be severely biased if the events are not experienced in the same period (de Chaisemartin and D'Haultfœuille, 2020[24]; Goodman-Bacon, 2021[25]). The reason is that under some conditions the TWFE estimator is unable to distinguish within the group of control observations between those that are never treated and those that were treated at an earlier period relative to others. Moreover, if treatment effects are different between units, for instance because some events involve more workers, the issue of estimating the average effect of the shock is biased in the opposite direction of the true effect. In the case of major lay-offs observed in regions, the lay-off dates vary by region, with some regions experiencing such events early in the sample and others later. As the TWFE averages the estimate over all treated cases, some of such cases would be the estimate of a late "light" treatment against an early "strong" treatment, producing a misspecified estimate of the treatment.

This issue of differential timing of events is something that occurs frequently in cases of lay-offs, especially if lay-off events among multiple firms are pooled into one dataset. For the most appropriate estimate of the effect of a lay-off event on individuals or regions, the outcome variable must be compared to the experience of non-treated observations that are sufficiently similar to the treated observations over the same time-period, or to regions that have not yet experienced a shock.

Recently, various studies highlight the econometric issue of TWFE with differential timing of events and proposed solutions to the identified problems (Callaway and Sant'Anna, 2020[26]; Sant'Anna and Zhao, 2020[27]; de Chaisemartin and D'Haultfœuille, 2020[24]; Wooldridge, 2021[28]). This paper follows Wooldridge (2021[28]), which implements an estimator within the standard linear regression framework,

$$y_{i,t} = \sum_{r=q}^{T} \sum_{s=r}^{T} \beta^{r,s} \cdot d_i^r \cdot f_t^s + \theta_i + \mu_t + \theta_i \cdot t + \varepsilon_{i,t}. \qquad \text{Equation 1}$$

This results in a regression model that estimates effects, which can be separated across regions affected by a mass lay-off announcement at different years (called cohorts), and follows the effects of each cohort over time. The dependent variable, $y_{i,t}$, is the log of employment or the log of gross value added per worker. The parameter $\beta^{r,s}$ provides the estimate of the effect of a lay-off for regions affected in year r and observed in year s. In addition, d_i^r and f_t^s are dummy variables that define the region that is treated and the time-periods respectively. Their interaction captures the dynamic effects across regions and time. Finally, the parameters θ_i, $\theta_i t$ and μ_t represent region fixed effects, region specific linear trends and time fixed effects respectively. These are included to control for differences in the levels of the outcome variable across regions, across times and region-specific linear trends. Allowing for region specific linear time trends is specifically relevant to absorb some of the differences in pre-existing trends prior to the shocks.

To elaborate, Equation 1 can be expanded for the sample, where the mass lay-offs from the year 2008 until 2018 are tracked,

$$y_{i,t} = \beta^{08,08} \cdot d_i^{08} \cdot f_t^{08} + \beta^{08,09} \cdot d_i^{08} \cdot f_t^{09} + \cdots +$$

$$\beta^{09,09} \cdot d_i^{09} \cdot f_t^{09} + \beta^{09,10} \cdot d_i^{09} \cdot f_t^{10} + \cdots +$$

$$+ \cdots + \beta^{18,18} \cdot d_i^{18} \cdot f_t^{18} +$$

$$\theta_i + \mu_t + \theta_i t + \varepsilon_{i,t}.$$

The superscripts refer to the calendar years, for instance $\beta^{08,08}$ is the estimated effect of the regions affected by a mass lay-off in 2008, estimated for the year 2008, and $\beta^{08,09}$ is the effect of the same regions but estimated for the year 2009. The dummy variable d_i^{08} is one for all regions affected in the year 2008 and zero for other regions. The dummy variable f_t^{08} is one for observations in the year 2008 and zero for other time-periods.

The equation can also be simplified by removing some of the interactions. For instance, by replacing the interaction with time effects, f_t^s, with an indicator that takes the value one from the period of an event for a region, the resulting coefficient β^r represents the average effect for regions affected by a mass lay-off occurring in time period r, without differentiation over time. This can be useful for understanding if a certain cohort has experienced a permanent effect. Additionally, the sample can be split across countries, or include an interaction that enables the estimation of differentiated effects across regional types. Standard errors are clustered by regions, unless otherwise indicated.

Data on mass lay-offs and regional economies

In this paper a mass lay-off is defined as shocks at various thresholds in absolute numbers and as a percentage of respective the local labour market, approximated by small regions (TL3 following OECD definitions, for European Union countries equivalent to NUTS3). The mass lay-off events can be identified using the Eurofound European Restructuring Monitor, which gathers announcements on 'large' employment loss announcements and gains among European Union member states (including the UK up to 2019). We obtained data up to May 2021, where the dataset has 18 817 separate events, but due to the availability of the other data, events only up to 2018 are taken into account.

Box 1. Data selection

Mass lay-off data

Source

- Eurofound European Restructuring Monitor (ERM)

Selection

- Only EU-OECD countries
- ERM events have NUTS3/TL3 information
- Years are 2003 – 2018
- There is either a minimal or maximal number of jobs at risk provided
- Distinction is made between regions that are treated never, once, and multiple times, but
    - if a region has only two events over the entire sample period and if those two events occur in consecutive years, then the events are merged and timed at the year of the first event.

Economic data (Gross Value Added and employment)

Source

- OECD Regions and Cities statistics

Selection

- Only OECD countries
- Years 2004-2018
- Data availability at NUTS3/TL3 level, specifically for the labour force, Gross Value Added and Employment across all industries.

Final estimation data set

- 2004-2018, with mass lay-offs occurring from 2008 onwards.
- Countries with matched economics and lay-off data: Austria, Belgium, Germany, Spain, Italy, Netherlands, United Kingdom.

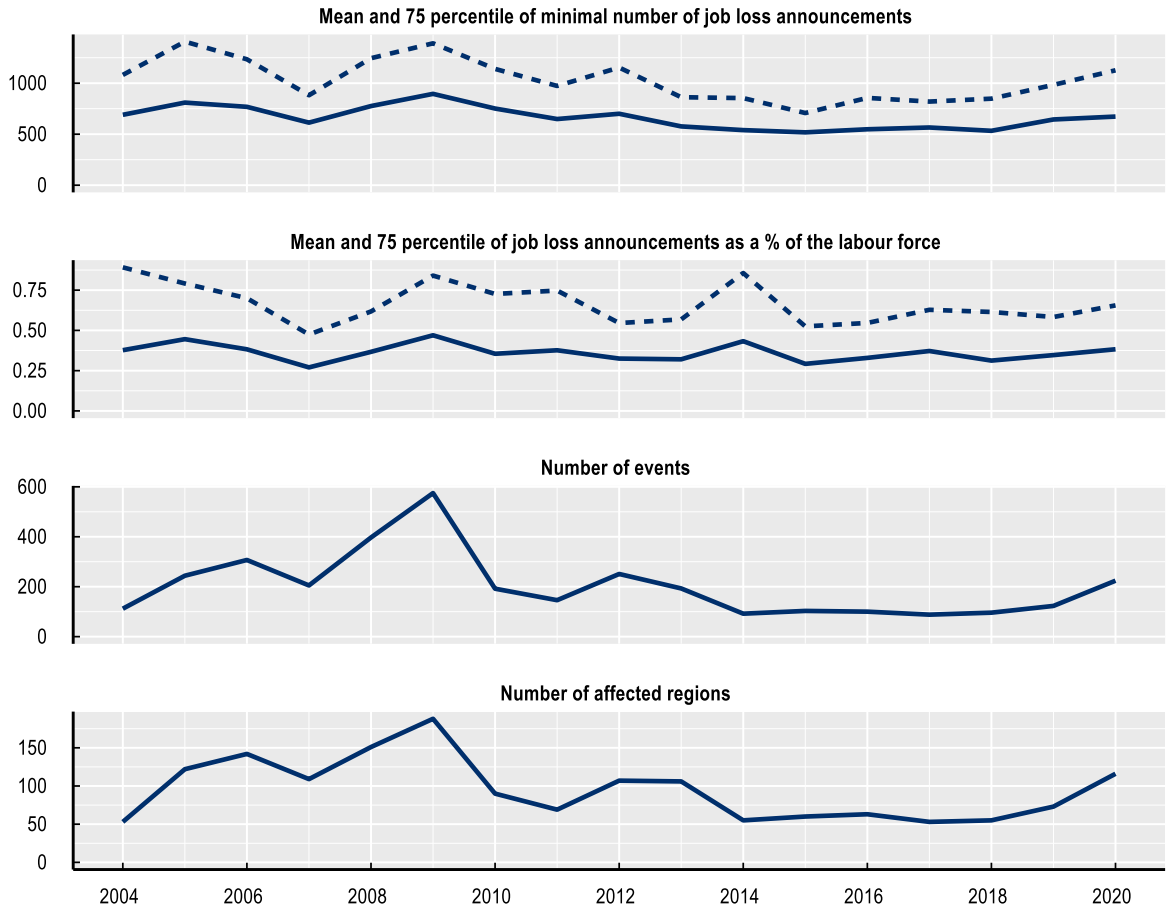
The observations relate to announcements of restructuring at establishments, e.g., plants of manufacturing firms or offices for services oriented firms. For an announcement to be included in the database, it should concern at least 100 jobs or 10% of the work force of more than 250 people.[2] Some of these announcements may be relatively small in terms of absolute numbers and as a percentage of the local labour force. Therefore, it is useful to assess the number of events by different threshold sizes. After some selection on size and matching with available economic data and imposing the requirement that an event is directly associated to a TL3 region, 6 493 events can be included in the analysis (see Box 1).

While these are announcements, this paper takes them as a measure of actual employment shocks. First, the ERM dataset is aimed to follow real restructuring across European based firms, instead of a

[2] Definition from Eurofound, available at https://www.eurofound.europa.eu/observatories/emcc/erm/factsheets

database of potential lay-offs shocks that may not materialise. Second, even if there is some time delay or difference between the announcement and actual lay-offs, this can be understood as having some mismeasurement in the treatment indicator. Since the analysis is based on yearly data, issues around timing differences between announcement and mass lay-off are likely to be minor. The effect of the size is mitigated because the analysis uses thresholds. Only if the announcement size is in a different threshold from the real (but unobserved) lay-off size is an error in the measurement of the treatment recorded. In general, the data of the ERM is taken as a reliable indicator of real mass lay-offs, in line with the work of (Silva et al., 2019[15]).

Figure 1. Announcement lay-off events over time



Note: Agriculture and mining/quarrying excluded. All European OECD countries for which ERM data and regional (TL3) labour force data is available.
Source: Authors' calculations based on Eurofound ERM.

A mass lay-off event represents on average several hundred jobs for the region in which it takes place, but many of such events still represent only small percentages of the regional labour force (Figure 1). In 2020, the average mass lay-off announcement equalled about 500 jobs, but only 0.30% of the local labour force. Instead of the average, taking the 75th percentile of yearly announcements indicates that many events affect 1 000 or more jobs in 2020, and close to 0.6% of the labour force. Finally, mass lay-off events are not sporadic, but occurred in over 200 small regions in 2020. Naturally, if the threshold of what is considered a mass lay-off is increased to larger events, the number of counted events decreases substantially.

Figure 1 also indicates that mass lay-off announcements are correlated with the economic cycle. For instance, in 2009, during the peak of the global financial crisis, there is a peak in the number of jobs affected, the number of events affected regions. However, even in a period of general economic growth, e.g., from 2012 to 2019, there are still around 250 events recorded and around 200 regions affected each year.

The events are distributed across many regions and all countries, but larger countries tend to have a better differentiation between regions affected by lay-off events and those that are not. Table 2 indicates that in countries such as Germany, the UK and Italy about half of all regions have experienced events. In contrast, in countries with fewer regions, there are only few regions not affected.

Table 2. Number of regions affected by country at least one, 2005-2020

Country	N. regions	Country	N. regions	Country	N. regions
Germany	202 / 402	Netherlands (the)	25 / 41	Lithuania	10 / 11
United Kingdom	98 / 182	Bulgaria	20 / 29	Ireland	8 / 9
France	87 / 102	Hungary	20 / 21	Slovenia	8 / 13
Italy	65 / 116	Sweden	18 / 22	Slovakia	8 / 9
Romania	40 / 43	Poland	16 / 74	Latvia	6 / 7
Austria	31 / 36	Finland	14 / 20	Denmark	2 / 12

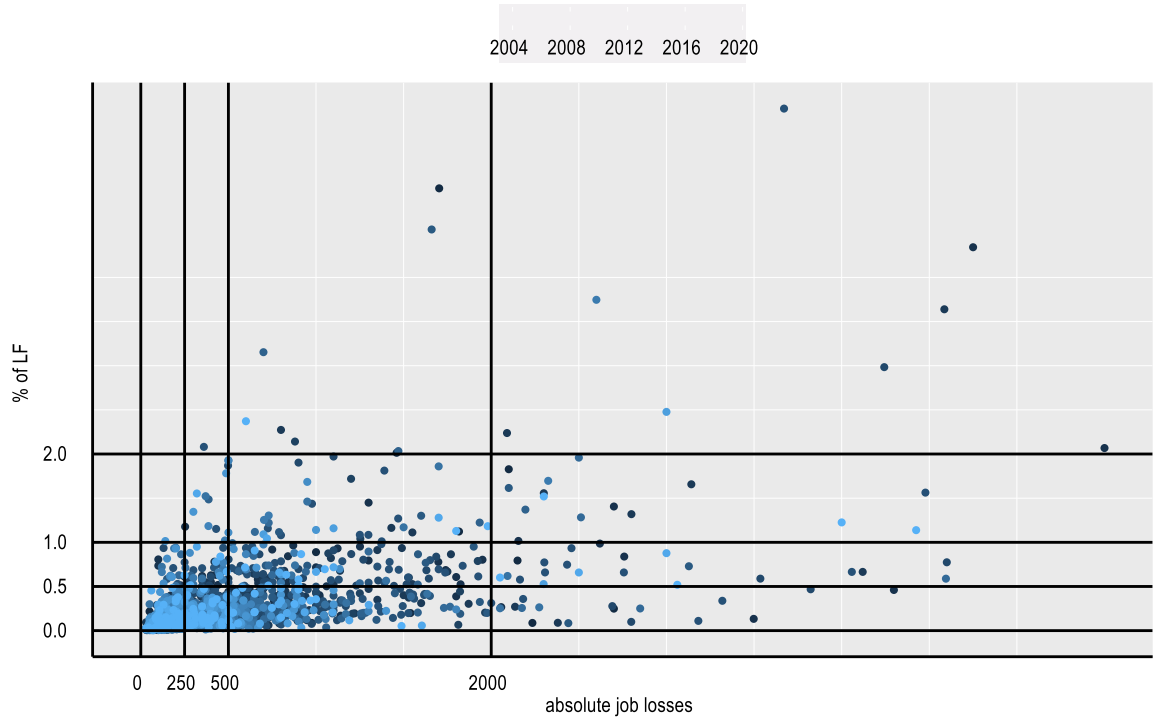
Note: Number of TL3 regions with at least one job-loss announcement, relative to the total number of TL3 regions in the country.
Source: Authors' calculations based on Eurofound ERM, 2005-2020.

In the dataset, lay-off events vary substantially in size, and small events may present irrelevant shocks for a regional economy, especially if the regional labour market is large relative to the number of workers involved in the event. Hence, shocks could be defined based on absolute number of affected workers and as a percentage of the local labour market. For each measure, various thresholds can be used to select only the largest shocks.

Figure 2 and Table 3 indicate that shocks can be as large as a percentage of the local labour market while relatively small in absolute numbers. For instance, mass lay-off announcements between 500 and 1 000 jobs may represent more than 2% of the local labour force or much less than 0.25% of the labour force, and events that represent between 1% and 2% of a local labour force may be as small as 250 jobs or exceed 4 000. Therefore, selecting events based on the absolute or the percentage threshold leads to a different selection of cases. Various thresholds, from 0.5% of the labour force and higher, and in terms of absolute number of workers involved, indicate that the number of events that represent more than 0.5% of the labour market or more than 500 workers is limited. Most shocks involve up to 500 workers and up to 0.5% of the labour force. Using different selection of cases can be helpful to analyse the statistical robustness of the estimates.

Hence, the analysis depends on a selection of regions affected by a shock over a specified threshold and comparison regions that are not affected by mass lay-off events. The thresholds define the number of regions that are considered affected or not. Moreover, some regions may experience multiple years with mass lay-off events. So, regions can be classified as "never treated", "treated once" and "treated multiple times" for each threshold. Table 4 and Table 5 present the number of regions by threshold in terms of absolute workers and as a percentage of the local labour force, respectively. For instance, for events that range between 500 and 2 000 workers, there are 723 regions that never experienced a shock at that threshold or larger, 213 that experience such an event once and 328 that experience it multiple times. As the threshold is increased, the number of regions that never experience an event of the respective size or larger increases, and the number of regions that experience it decreases.

Figure 2. Region by year observations and job loss announcements



Note: Numbers refer to identified region (TL3) by year observations with job loss announcements at the given thresholds. Multiple events for a region-year pair are aggregated.
Source: Authors' calculations based on Eurofound ERM, 2005-2020.

Table 3. Region-by-year observations and job loss announcements

	% of labour force				
Number of jobs	Less than 0.01%	0.01 to 0.5%	0.5% to 1%	1% to 2%	2% and higher
2 000 10 000	0	19	21	15	8
500 to 2 000	0	420	130	37	8
250 to 500	0	619	41	10	1
1 to 250	20	1 311	20	1	0

Note: Numbers refer to identified region (TL3) by year observations with job loss announcements at the given thresholds. Multiple events for a region-year pair are aggregated.
Source: Authors' calculations based on Eurofound ERM, 2005-2020.

Table 4. Number of regions by treatment category and minimum threshold level, absolute numbers

treatment	At least 250	At least 500	At least 2 000	More than 2 000
Never	494	723	907	1217
Once	202	213	176	36
Multiple	568	328	182	13

Source: Authors' calculations based on Eurofound ERM, 2005-2020.

Therefore, the choice of the threshold for the shock affects the number of treated regions. However, the choice of counterfactual regions does not need to follow the same threshold, but instead can be taken from

more restricted groups. For instance, there are 146 regions that experience a shock of at least 0.5% of the local labour market, and 530 regions that never experience a shock larger than 0.5%. These would form a potentially more reliable counterfactual set than the 1 064 regions that never experienced a shock larger than 0.5% of the local labour force but of which some may have experienced a slightly smaller shock during the period of observation.

The maps in Figure 3 present where events take place at the different threshold levels. At the lowest threshold, the events can be observed largely throughout Europe. With increasing thresholds in terms of absolute numbers and as a percentage of the local labour force, the affected regions become sparser. France and Spain appear relatively immune from the largest shocks.

Finally, the two main outcome variables of interest are industrial employment (Empl.) and real industrial gross value added per worker (GVA pw) (Table 6). Data are available from 2004 to 2018 and summary statistics are provided Table 7.

Table 5. Number of regions by treatment category and minimum threshold level, % of LF

Treatment	At least 0.01%	At least 0.5%	At least 1%	At least 2%
Never	530	1 064	1 196	1 249
Once	218	146	60	17
Multiple	518	56	10	0

Source: Authors' calculations based on Eurofound ERM, 2005-2020.

Table 6. Dependent variables, description

Variable name	Description	source
GVA pw	Gross Value Added of industry (sectors B to N) per worker real PPP	OECD
Empl	Employment in all industries (B to N)	OECD
LF	Labour force of all workers aged 15-64 or MAX, depending on available data	OECD
UNEM.RA	Unemployment rate (%) of all workers aged 15-64 or MAX, depending on available data	OECD

Source: OECD Statistics.

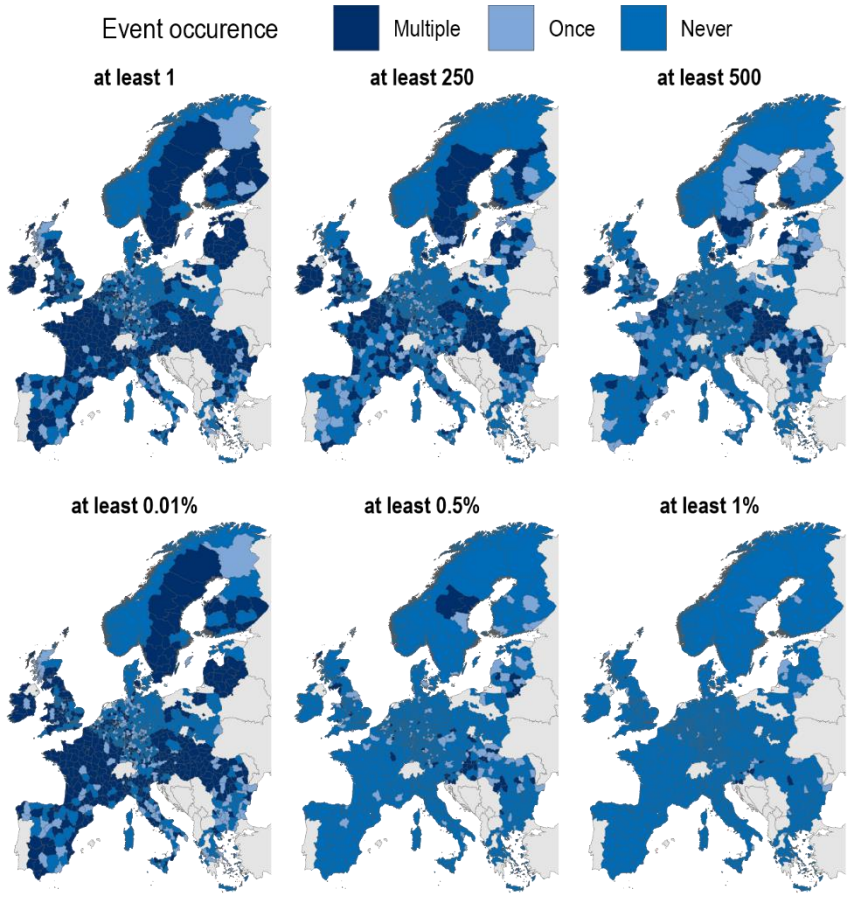
Table 7. Dependent variables, descriptive statistics

Variable	Empl	GVA pw	LF	UNEM.RA
First year	2004	2004	2004	2004
Last year	2018	2018	2018	2018
Unique regions	611	611	610	610
Observations	9154	9154	8441	8337
Mean	125 865	75 190	127 439	7.5
St. Dev	192 622	13 778	191 943	5.2
Minimum	8 100	49 604	9 800	0.7
Maximum	3 448 100	188 998	3 469 200	39.5

Source: OECD calculations based on OECD Regional Statistics.

Figure 3. Spatial distribution of lay-off events by size and frequency

Occurrence of mass lay-offs by varying thresholds, 2008-2018.



Note: Top panels indicate occurrences based on threshold of absolute numbers of worker affected in a TL3 region, the bottom panels as a percentage of labour force in the TL3 region.
Source: OECD Calculations based on ERM.

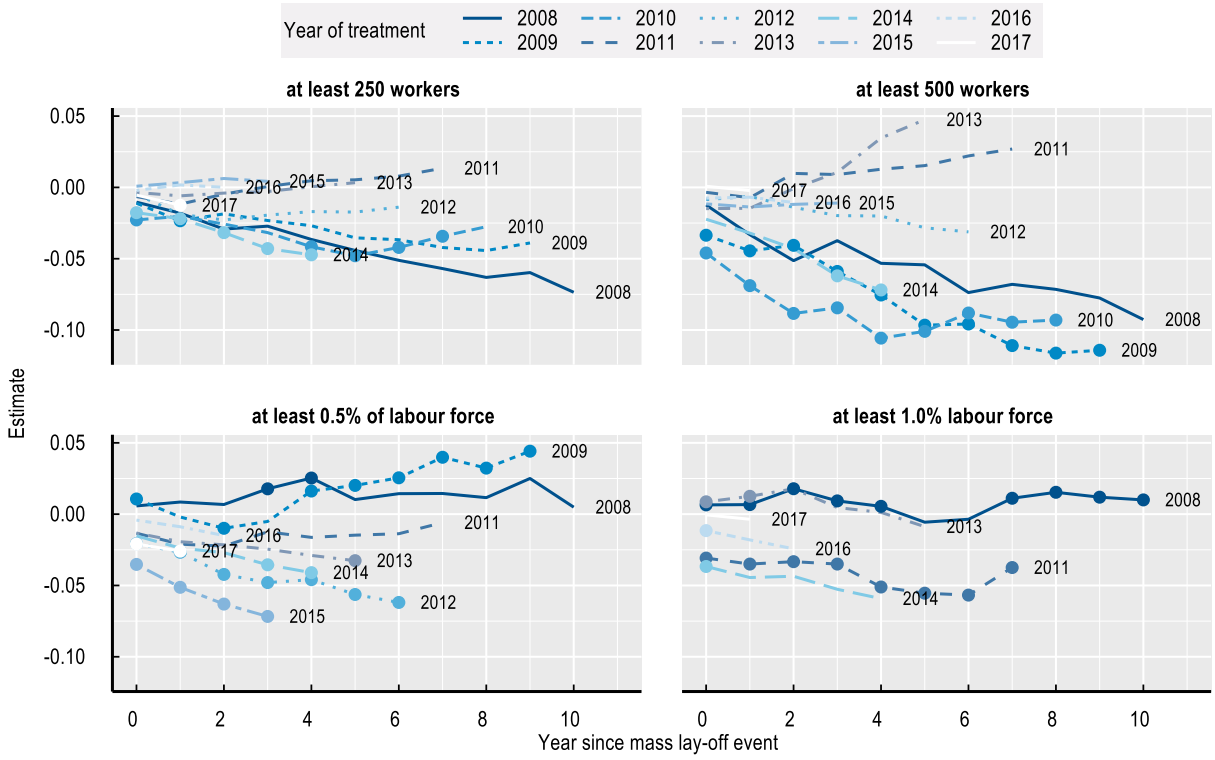
Do mass lay-off announcements affect regional economies?

Equation 1 is estimated on a sample of regions from 2004 to 2018. Regions are included if they never experience a mass lay-off independent of the threshold, or if they experienced an event that reaches the threshold in 2008 or later. This ensures that all regions have at least three years before the first lay-off is observed in the data. Additionally, the relevant employment and gross value added data must be available over the time span. The countries that are included in the estimation are Austria, Belgium, Germany, Spain, Italy, Netherlands, United Kingdom for the threshold of 250 affected workers, but some countries drop out of the sample for the other thresholds. After all the required data matching, described in Box 1, the dataset includes 110 regions with a mass lay-off of at least 250 workers across seven countries, 38 with at least 500 workers across six countries, 42 regions with a shock of at least 0.5% of the labour force across six countries and 16 regions with at least 1% of the labour force across two countries.

Figure 4 presents the results for employment and Figure 5 for GVA per worker. In each figure, the horizontal axis indicates the year since the event, denoted at zero. The vertical axes indicates that percentage change in the level of the respective dependent variable. The panels provide the results for the four threshold levels, the first two in terms of absolute job numbers (at least 250 jobs and 500 jobs)

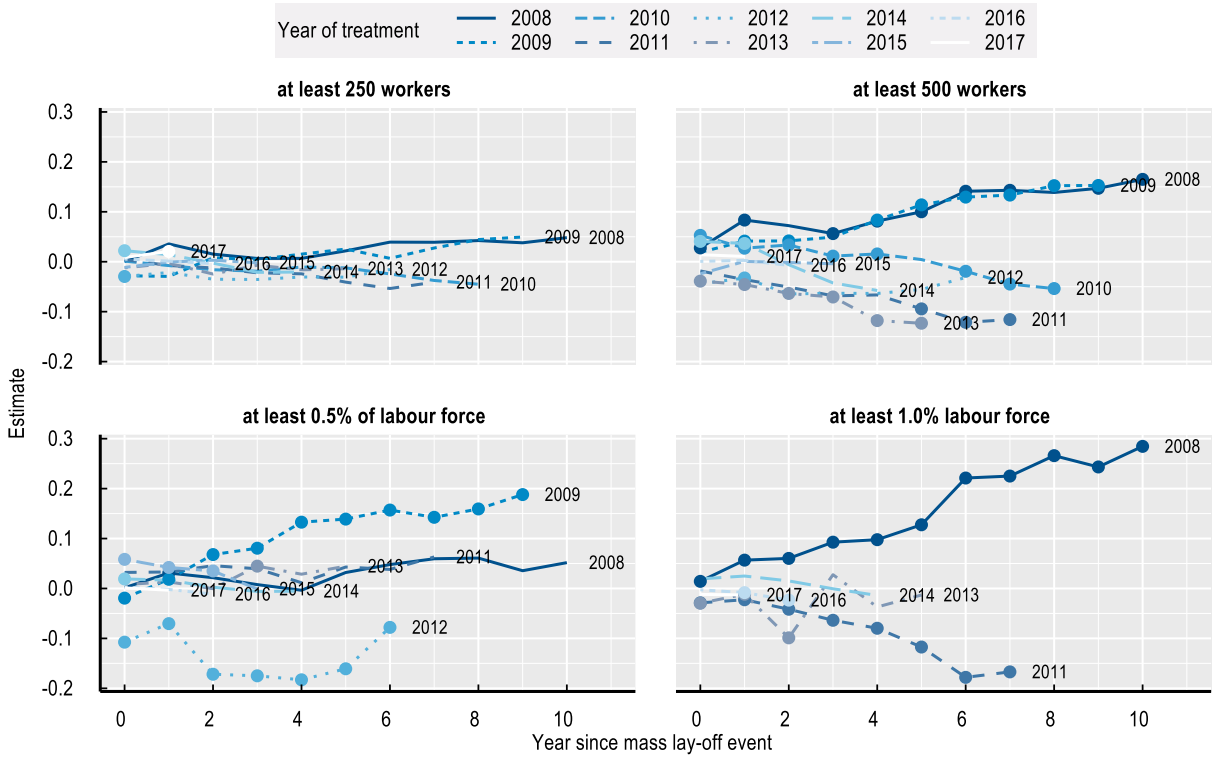
and the last two in terms of the percentage of the labour force, 0.5% or 1.0%. Each line provides the effect of an event occurring in a specific year over time. Events that occur further in the past can be followed for a longer time than those that happened more recently.

Figure 4. The dynamic effect of mass lay-offs on regional employment, by year of event and threshold level



Note: Coefficients are estimated following Equation 1 and the percentage change in the level of the dependent variable following a mass lay-off can be read from the vertical axis. A dot represents statistical significance at the 95% confidence level, based on standard errors that are clustered by region. Mass lay-offs that occurred further back in time, e.g. 2008, can be followed for longer than those that occurred more recently. Regions in Belgium and Germany are always included. Austria is included in at least 250, 0.5 and 1.0. Italy and Spain in at least 250 and 0.5, Netherlands and UK in all but "1.0".
Source: Author's calculations based on OECD statistics and Eurofound ERM.

Figure 5. The dynamic effect of mass lay-offs on GVA per worker, by year of event and threshold level



Note: Coefficients are estimated following Equation 1 and the percentage change in the level of the dependent variable following a mass lay-off can be read from the vertical axis. A dot represents statistical significance at the 95% confidence level, based on standard errors that are clustered by region. Mass lay-offs that occurred further back in time, e.g. 2008, can be followed for longer than those that occurred more recently. Regions in Belgium and Germany are always included. Austria is included in at least 250, 0.5 and 1.0. Italy and Spain in at least 250 and 0.5, Netherlands and UK in all but "1.0".
Source: Author's calculations based on OECD statistics and Eurofound ERM.

Mass lay-offs tend to have negative effect on local labour markets that grow with time. For instance, for the mass lay-offs of at least 250, those that occurred in 2008, 2009, 2010, 2012 and 2014 show a similar downward trending pattern that grows to an employment decline of more than 5%. For the threshold of at least 500 workers, a selection that reduces the number of cases in the estimation, 2008, 2009, 2010 and 2014, the estimated effects are larger, reaching 10%. For both thresholds, mass lay-offs that occurred in 2011 and 2012 indicate a small negative effect in early years but a positive effect after a few years. Mass lay-offs of at least 0.5% of the regional labour force, are mostly negative. The shocks of at least 1% of the labour force indicate a similar pattern as for 0.5% of the labour force, but the effect of employment does not appear to be much larger. For mass lay-offs reaching the thresholds of both 0.5% and 1.0% of the labour force and occurred in 2008 and 2009 appear to result in positive long-term effects on employment. These 2008 and 2009 mass lay-offs are possibly related to the global financial crisis, and the longer-term positive effects may also capture the general economic recovery that most countries experienced in the following years. Other variation in the results across years is potentially due to the specific mass lay-off cases that are included in each threshold, the countries in which they occur and the economic circumstances that vary by year in which events take place.

Mass lay-offs also have longer-term negative effects on regional GVA per worker, although the estimates show varying effects by year of event and threshold. As Figure 5 indicates, mass lay-offs that affects at least 250 people appear with both positive and negative effects. Especially mass lay-offs that occurred in

2008 and 2009 indicate a long-term positive effect (although not statistically significant), while for other years there is a downward trend. For the threshold of 500 workers, the effects are negative for all years except 2008 and 2009 and reach between 5% and 10% over the longer term. For mass lay-offs measured relative to the size of the regional labour force, a similar division between the years 2008 and 2009 relative to other years is visible. Relative to the employment effect, the positive effects for mass lay-offs that occurred in 2008 and 2009 is consistently observed across the thresholds.

Table 8. Average long-term effects of mass lay-offs

	Dependent variable:							
	GVA pw	Empl.	GVA pw	Empl.	GVA pw	Empl.	GVA pw	Empl.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treated	-0.003	-0.008**	-0.003	-0.014***	0.003	-0.018***	-0.011	-0.01
	-0.004	-0.003	-0.007	-0.004	-0.008	-0.005	-0.016	-0.007
Treatment	Threshold as number of affected workers.				Threshold as % of local labour force			
	250	250	500	500	0.5	0.5	1.0	1.0
Newey-White SE	-0.003	(0.002)***	-0.006	(0.003)***	-0.006	(0.003)***	-0.011	(0.004)***
Observations	9 154	9 154	8 869	8 869	7 924	7 924	5 385	5 385

Note: * p<0.1; ** p<0.05; *** p<0.01. The effects represent a weighted average over all effects indicated in Figure 4. Accordingly, it combines effects at different times since mass lay-offs. White SE indicates alternative standard errors on the coefficients, based on heteroskedastic Newey-White variance estimation. Regions in Belgium and Germany are always included. Austria is included in at least 250 and 0.5. Italy in at least 250 and 500, Spain, Netherlands and UK in all but "1.0".
Source: Author's calculations based on OECD statistics and Eurofound ERM.

The average long-term effects, as presented in Table 8, indicate that employment effects can be sizeable but productivity effects are statistically insignificant. For instance, shocks of at least 250 jobs reduce employment by 0.8%, but this estimate grows with larger shocks: 1.4% with shocks of at least 500 jobs and 1.8% of shocks of at least 0.5% of the labour force. In comparison, Gathmann et al. (2020[11]) presents estimates of around 1.8% of the local labour force following mass lay-offs in Germany. The largest shocks, those of 1% of the labour force, do not appear to present a clear negative effect. However, the selection of mass lay-offs of at least 1% of the regional labour force reduces substantially the number of events and included regions in the estimation. In contrast, the average effects on GVA per worker are closer to zero for each thresholds relative to the effect of employment and never statistically significant. Using Newey-White standard errors instead of clustered standard errors does not affect the findings. However, the average effect as estimated here also hides some of the heterogeneity that is visible in Figure 4 and Figure 5. Therefore, small or statistically insignificant effects on average do not mean that the experience is the same for all regions and all time periods.

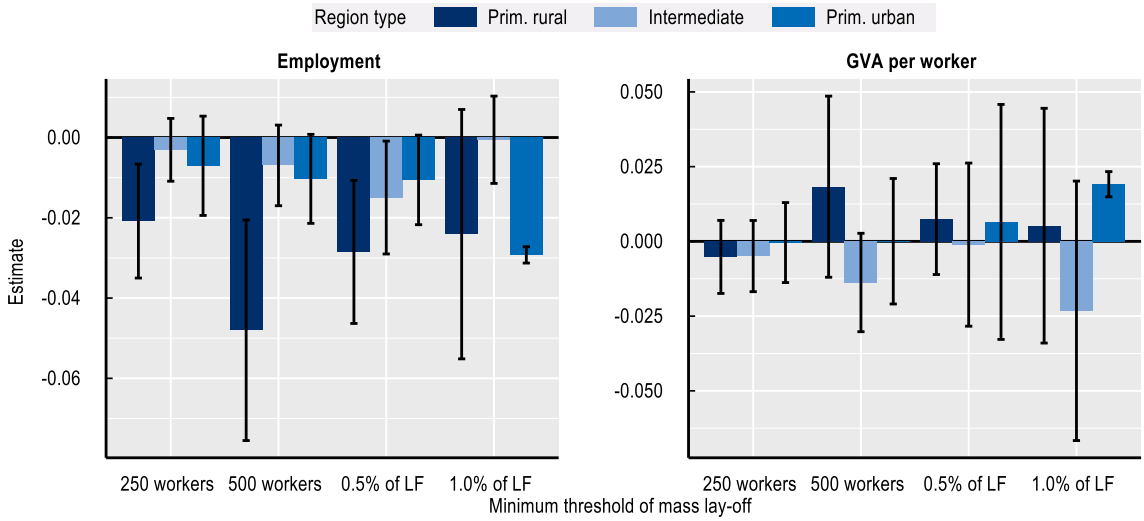
Do economic or institutional characteristics interact with the effect of mass lay-offs?

Various structural factors may underlie the spillover effects of mass lay-offs. These factors could be related to the economic context as well as the institutional context. For the economic context, the typology of regions (rural, urban, metropolitan, Brezzi, Dijkstra and Ruiz (2011[29])) and the unemployment rate at the year prior to the lay-off event can be considered. The institutional context can relate to the ability of regional governments to address mass lay-offs, for instance through effective active labour market policies.

Figure 6 presents the results where the effects are separated according to the typology of the region where the events occur (Table A.1 in the Annex provides the precise numbers). Table 9 provides results for affected regions differentiated based on their unemployment rate taken relative to the country average. Figure 8 presents results where the effects are differentiated across countries (Table A.2 in the Annex provides the precise numbers).

Employment effects are consistently negative across regions, but tend to be more negative for rural areas than for the other types of regions. In addition, the effects on rural regions are statistically significant for all thresholds except the most stringent. Rural regions with smaller labour markets may have more difficulties placing workers affected by mass lay-offs into alternative employment that are aligned with their experience and skills. More generally, the negative employment effects across the three types of regions are consistent with the average effects of Table 8. However, the estimated effects are not very precisely estimated as indicated by the wide standard errors. The exception is the effect for shocks in primary urban areas of at least 1% of the labour force, where the size of the estimate dominates that of the other regions and is statistically significant. The estimated effects for GVA per worker provide little evidence for strong effects for specific regions. Rural regions appear to be more positively, or less negatively, affected than the other regions across the different threshold levels, but the standard errors do not provide confidence that these effects are generalizable across years and regions. Urban regions affected by a shock of at least 1% of the labour force tend to experience positive effect on GVA per worker on average.

Figure 6. Mass lay-off effects differentiated by regional typology



Notes: The error bars represent 95% confidence bands. Regions in Belgium and Germany are always included. Austria is included in at least 250 workers, 0.5% of LF and 1.0% of LF. Italy and Spain in at least 250 workers and 0.5% of LF, Netherlands and UK in all but 1.0% of LF.
Source: Author's calculations based on OECD statistics and Eurofound ERM.

The prevailing unemployment rate in a region where a mass lay-off occurs can be an important differentiating factor in measuring the long-term outcomes. Where the prevailing unemployment rate is relatively high to the national average, an additional large employment shock may have a stronger negative effect relative to regions that are otherwise more prosperous. Table 9 indicates that for the sample and taking the 75th percentile as a threshold, this is not the case.[3] In fact, regions that have lower unemployment

[3] Taking the median (50th percentile) as the threshold does not change the results qualitatively.

rates tend to see stronger negative effects on employment relative to the other regions. The effects on productivity are statistically insignificant across the range of mass lay-off thresholds.

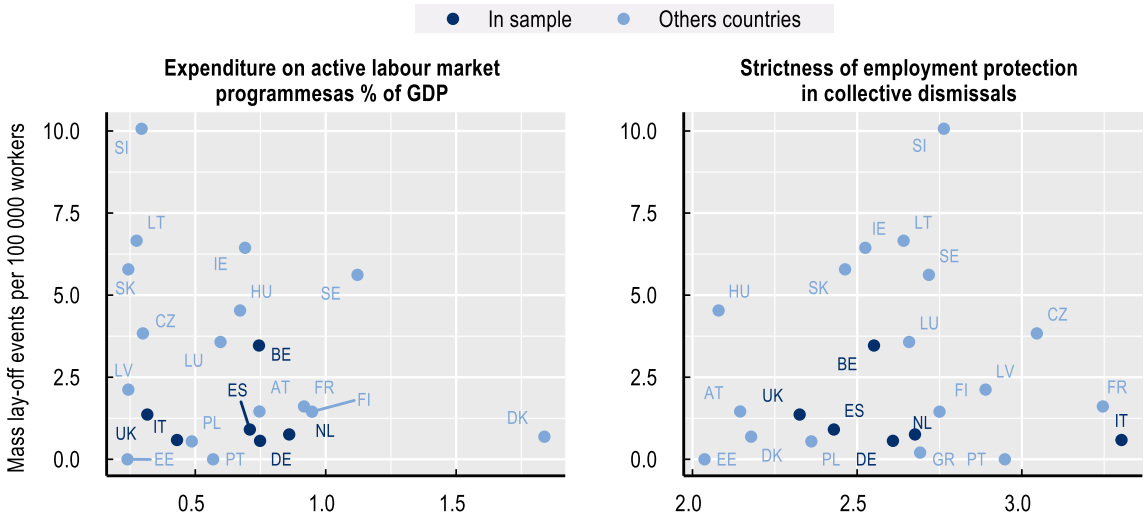
Regional fixed effects and regional time-trends are included in the estimation and consequently absorb much of the prevailing trends across regions. Therefore, the effect of mass lay-offs in underperforming regions may be absorbed by the regional trend rather than that such an event indicates a negative shock. In contrast, mass lay-off in otherwise prosperous regions represent a shock that strongly deviates from the prevailing trend. To check for this effect, Table A.3 in the Annex presents the results on the unemployment rate for an estimation that does not include region-specific trends. In this case, regions with higher unemployment rates relative to the country are strongly negatively affected by mass lay-offs, whereas other regions experience a positive effect.

Table 9. Mass lay-off effects by prevailing unemployment rate

	Dependent variable:							
	GVA pw	Empl.	GVA pw	Empl.	GVA pw	Empl.	GVA pw	Empl.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treated: Unemployment rate above 75th ptile	-0.011	-0.0002	-0.006	-0.01	0.009	-0.003	0.024	-0.004
	-0.008	-0.007	-0.01	-0.006	-0.013	-0.009	-0.023	-0.011
Treated: Unemployment rate below 75th ptile	-0.002	-0.008**	-0.001	-0.014**	-0.005	-0.018***	-0.031	-0.008
	-0.004	-0.004	-0.008	-0.006	-0.01	-0.006	-0.024	-0.007
	Threshold as number of affected workers.				Threshold as % of local labour force			
Treatment	250	250	500	500	0.5	0.5	1.0	1.0
Observations	9 154	9 154	8 869	8 869	7 924	7 924	5 385	5 385

Note: * p<0.1; ** p<0.05; *** p<0.01. The 75th percentile of the unemployment rate is based on country-year distributions.
Source: Author's calculations based on OECD statistics and Eurofound ERM.

Figure 7. Number of mass lay-offs, national labour market policies and labour market institutions



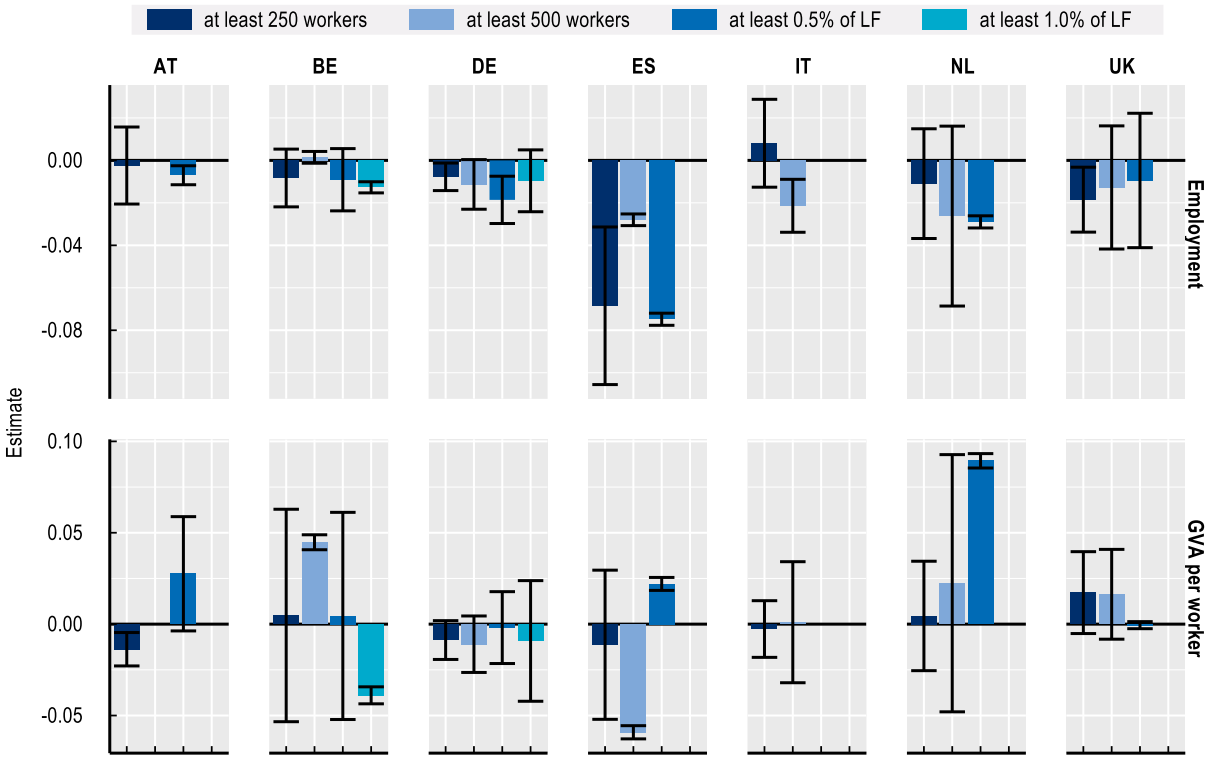
Note: Number of mass mass-lays of at least 250 workers, by country, divided by the national labour force. Labour force, expenditure on active labour labour market programmes as % of GDP and Strictness of employment protection in collective dismissals (version 4) are taken as the average over the period 2007-2018, but due to data availability the time span for the three indicators varies between countries. Legend indicates the countries that are part of the sample of the statistical analysis.
Source: Authors' calculations based on Eurofound ERM, OECD Labour force statistics, OECD Employment Protection.

The protection granted to workers from mass dismissals and the resources made available for active labour market programmes (ALMPs) varies across countries. OECD (2020[5]) documents how employment protection for collective dismissals through regulation varies across OECD countries. OECD (2018[1]) discusses the role of active labour market policies in helping dismissed workers, including those from mass lay-offs. Early intervention for workers can be more effective in finding new jobs for job seekers relative to programmes that are accessible to workers after they have become (long-term) unemployed. Such early intervention may even take place prior to a lay-off, for instance at the time of a mass lay-off announcement. With announcing a mass redundancy with ample notice, public employment services can potentially offer services that are directly targeted at the group of affected workers.

The intensity of providing active labour market programmes to job seekers and the strictness of employment protection varies across countries, but this variation is not evidently related to the number of mass lay-offs that occur in a country. Figure 7 sets the number of mass lay-off events per 100 000 workers, affecting at least 250 workers, against an indicator of spending on active labour market programmes and against the strictness of employment protection in collective dismissals (OECD, 2018[1]; OECD, 2020[5]). The figure includes all European countries for which there is data, while highlighting the countries that are included in the regression analysis. Most countries are clustered between zero and seven mass lay-offs per 100 000 workers and between 0 and 1% of GDP spending on ALMPs. Denmark spends substantially more than other European countries. A similar range of values is present in the strictness of employment regulation in collective dismissals. There may be some trade-offs between the policy/institutional measures. For instance, Italy is positioned towards the lower end of expenditure on ALMPs while having a relative high score on the employment protection while for Denmark the opposite is observed. Yet for neither measure there is a clearly visible pattern with the observed number of mass lay-offs (selecting only mass lay-offs of at least 500 workers does not alter this pattern).

As a first approximation on the potential role that economic institutions play in the regional effects of mass lay-offs model is estimated allowing for country specific effects. This is done under the assumption that institutional differences vary mostly between countries and not within countries, even though country estimates may be affected also by the selection of events and country-specific economic contexts. The employment effects are negative across most countries and threshold levels, consistent with the previous results (Figure 8). For productivity, however, the effects are more scattered across the countries and threshold levels, suggesting a wider variety of regional experiences within countries, and not just across countries. The size of the effects varies widely across countries too, suggesting that both the variety of shocks across countries, and the regional and country-specific characteristics can result in very different outcomes following mass lay-offs. This is in line with Bertheau et al. (2022[3]), who present evidence that the employment and earning effects on individual workers affected by mass lay-offs varies across countries.

Figure 8. Mass lay-off effects across countries



Notes: The error bars represent 95% confidence bands.
Source: Author's calculations based on OECD statistics and Eurofound ERM.

What do mass lay-offs mean for the size of the labour force?

Previous research suggested that regional mobility of workers can be one adjustment factor of lay-offs. Workers may move if other places provide better opportunities for new stable employment (Foote, Grosz and Stevens, 2019[14]). The results on employment thus far indicate that there can be small permanent negative effects of mass lay-offs. Expanding the outcome to the overall labour force, which includes job seekers, provides a way to establish whether this channel is relevant across all regions. However, the labour force may also be affected by unemployed workers that stop looking for a job. Figure 9 and Table 10 present the results.

The dynamic effects indicated in the figure suggest a much smaller effect on the labour force relative to employment. This is confirmed in Table 10. Mass lay-offs based on absolute thresholds show no statistically significant effects. For the mass lay-offs that represent at least a 0.5% shock to the local labour force, the labour force increases by 1.3% on average, and decreases by 0.8% for shocks of at least 1% of the local labour force. The implication is that on average, regional mobility (across TL3 regions) and participation rates may be affected by mass lay-offs in some cases.

Figure 9. Mass lay-off effects on the regional labour force



Note: Coefficients are estimated following Equation 1. A dot represents statistical significance at the 95% confidence level. Regions in Belgium, Germany are always included. Austria is included in at least 250 workers, 0.5% of LF and 1.0% of LF. Italy and Spain in at least 250 workers and 0.5% of LF, Netherlands and UK in all but 1.0% of LF.
Source: Author's calculations based on OECD statistics and Eurofound ERM.

Table 10. Mass lay-off effects on the regional labour force

	Dependent variable: LF			
	(1)	(2)	(3)	(4)
treated	0.001	-0.001	0.013**	-0.008***
	(0.002)	(0.003)	(0.005)	(0.003)
Treatment	Threshold as number of affected workers		Threshold as % of local labour force	
	250	500	0.5	1.0
Observations	8 441	8 156	7 253	5 327

Note: * p<0.1; ** p<0.05; *** p<0.01. Regions in Belgium and Germany are always included. Austria is included in at least 250, 0.5 and 1.0. Italy and Spain in at least 250 and 0.5, Netherlands and UK in all but "1.0".
Source: Author's calculations based on OECD statistics and Eurofound ERM.

Conclusion

This paper documents the spatial distribution of mass lay-off announcements across European regions. Regions in some countries are more strongly and more frequently affected. While on average mass lay-offs measured by announcements consistently occur across European countries, they do range from small to large, both in terms of absolute employment and as a share of the regional labour force.

The evidence in this paper indicates that many regions can experience a persistent negative effect on employment after a mass lay-off. Using larger events of at least 250 jobs or at least 0.5% of the regional labour force, the estimates indicate that mass lay-offs tend to have a persistent negative effect on employment in the region that lasts at least several years, whereas the effects on productivity tend to be mixed and depend on the time periods, regions and countries. While there is evidence that some regions experience drops in productivity, large uncertainty around the point estimates indicates wide variation across events occurring in regions. On top of the effects on local economies, mass lay-offs can have detrimental social effects on local communities and households of dismissed workers.

To prevent or minimise the scale of a mass lay-off, one option is firm-targeted measures. The persistent negative employment effects, as well as broader social and community effects, can justify multiple policy interventions to counter the detrimental effects of mass lay-offs. Some public programmes may even help a firm that is about to conduct a mass lay-off to invest in worker reskilling to remain competitive in the medium term. However, if the firm truly has an unsustainable business model in a competitive market, the costs of intervention on government budgets and the effect of policy on local economic dynamism must be considered too.

Another option is policy measures targeted at affected workers to support the transition to new employment following a mass lay-off. Active labour market policies that are available to all jobseekers to help workers through job-search, (re-)training and other services can be used for those who experience a mass lay-off. Public employment services develop targeted programmes, and potentially help workers early when a mass lay-off is anticipated or announced but before it takes effect. For instance, in Austria, labour foundations for mass dismissals allow the firm to collaborate with local public employment services and other employers to find new jobs for affected workers, potentially facilitated by reskilling and retraining of workers, often reaching their objective of having 70% of affected workers back in work within three months. In Finland following the downsizing of Nokia, the public employment service created special programmes to support the high-skilled workers concentrated in particular local labour markets who were not their typical clients. Up to 90% of affected workers found new employment through the targeted support (OECD, 2022[30]). While such services can be resource intensive, unemployment spells of laid-off workers can also be costly given longer passive unemployment income transfers as well as the loss and depreciation of peoples' knowledge, skills and expertise during unemployment periods. Above and beyond the costs to individuals, the economic and social effects on local communities can also be costly to people and the public purse, for instance through increased use of social welfare transfers.

Context specific policy measures for local firms and sectors may be appropriate when a mass lay-off threatens to affect a region for many years. The long-term impact of mass lay-offs on employment indicates that regional economies can struggle to recover from it. This paper also showed that mass lay-offs can have detrimental effects on regional productivity, which indicates economic spillovers beyond local employment. Moreover, mass lay-offs may be the result of local long-term trends,

for instance resulting from changing demand of energy resources, or restructuring in local manufacturing industries. Therefore, policies to counter mass lay-offs with support for local economic development can be appropriate to reorientate the local private sector to business growth, new employment creation and a stronger local entrepreneurial ecosystem. However, the variation in the productivity consequences across types of regions and time presented in this paper also underlines that each event and its effect on a region is context specific. Further research to understand when the loss of employment in a firm can be detrimental to the productivity of other firms in the region is still needed.

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Annex A. Tabular results of estimates

Table A.1. Mass lay-off effects, differentiated by regional typology

	Dependent variable:							
	GVA pw	Empl.	GVA pw	Empl.	GVA pw	Empl.	GVA pw	Empl.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
treated: Prim. rural	-0.005	-0.021***	0.018	-0.048***	0.007	-0.029***	0.005	-0.024
	-0.006	-0.007	-0.015	-0.014	-0.009	-0.009	-0.02	-0.016
treated: Intermediate	-0.005	-0.003	-0.014	-0.007	-0.001	-0.015**	-0.023	-0.001
	-0.006	-0.004	-0.008	-0.005	-0.014	-0.007	-0.022	-0.006
treated: Prim. urban	-0.0004	-0.007	0.0001	-0.010*	0.007	-0.011*	0.019***	-0.029***
	-0.007	-0.006	-0.011	-0.006	-0.02	-0.006	-0.002	-0.001
treatment								
	250	250	500	500	0.5	0.5	1.0	1.0
Observations	9 124	9 124	8 839	8 839	7 894	7 894	5 355	5 355

Note: Estimates of Figure 6. Regions in Belgium and Germany are always included. Austria is included in at least 250 workers, 0.5% of LF and 1.0% of LF. Italy and Spain in at least 250 workers and 0.5% of LF, Netherlands and UK in all but 1.0% of LF. * p<0.1; ** p<0.05; *** p<0.01.
Source: Author's calculations based on OECD statistics and Eurofound ERM.

Table A.2. Mass lay-off effects across countries

	Dependent variable:							
	GVA pw	Employment	GVA pw	Employment	GVA pw	Employment	GVA pw	Employment
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
treated: AT	-0.014***	-0.002			0.028*	-0.007***		
	(0.005)	(0.009)			(0.016)	(0.002)		
treated: BE	0.005	-0.008	0.045***	0.001	0.004	-0.009	-0.039***	-0.013***
	(0.030)	(0.007)	(0.002)	(0.001)	(0.029)	(0.007)	(0.002)	(0.001)
treated: DE	-0.009	-0.008**	-0.011	-0.011*	-0.002	-0.019***	-0.009	-0.010
	(0.005)	(0.003)	(0.008)	(0.006)	(0.010)	(0.006)	(0.017)	(0.007)
treated: ES	-0.011	-0.068***	-0.059***	-0.028***	0.022***	-0.075***		
	(0.021)	(0.019)	(0.002)	(0.001)	(0.002)	(0.001)		
treated: IT	-0.003	0.008	0.001	-0.021***				
	(0.008)	(0.011)	(0.017)	(0.006)				
treated: NL	0.004	-0.011	0.022	-0.026	0.089***	-0.029***		
	(0.015)	(0.013)	(0.036)	(0.022)	(0.002)	(0.001)		
treated: UK	0.017	-0.018**	0.016	-0.013	-0.001	-0.009		
	(0.011)	(0.008)	(0.013)	(0.015)	(0.001)	(0.016)		
treatment	Threshold as number of affected workers.				Threshold as % of local labour force			
	250	250	500	500	0.5	0.5	1.0	1.0
Observations	9 154	9 154	8 869	8 869	7 924	7 924	5 385	5 385

Note: Estimates of Figure 8. * p<0.1; ** p<0.05; *** p<0.01.
Source: Author's calculations based on OECD statistics and Eurofound ERM.

Table A.3. Mass lay-off effects by prevailing unemployment rate, alternative estimation

	Dependent variable:							
	GVA pw	Empl.	GVA pw	Empl.	GVA pw	Empl.	GVA pw	Empl.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treated : UR above 75th ptile	-0.010	-0.019*	-0.011	-0.034***	-0.012	-0.013	-0.008	-0.013
	(0.013)	(0.010)	(0.017)	(0.012)	(0.019)	(0.015)	(0.020)	(0.027)
Treated : UR above 75th ptile	0.004	0.004	0.027	0.012	0.029**	-0.003	0.023	0.006
	(0.008)	(0.007)	(0.017)	(0.011)	(0.013)	(0.011)	(0.015)	(0.022)
treatment	Threshold as number of affected workers.				Threshold as % of local labour force			
	250	250	500	500	0.5	0.5	1.0	1.0
Observations	9 154	9 154	8 869	8 869	7 924	7 924	5 385	5 385

Note: Regional and time fixed effects included. Relative to Table 9, estimations do not account for region specific linear trends. * p<0.1; ** p<0.05; *** p<0.01.
Source: Author's calculations based on OECD statistics and Eurofound ERM.