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IZA DP No. 15033

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ABSTRACT

The Unequal Cost of Job Loss across Countries*

We document the consequences of losing a job across countries using a harmonized research design. Workers in Denmark and Sweden experience the lowest earnings declines following job displacement, while workers in Italy, Spain, and Portugal experience losses three times as high. French and Austrian workers face earnings losses somewhere in-between. Key to these differences is that Southern European workers are less likely to find employment following displacement. Loss of employer-specific wage premiums accounts for 40% to 95% of within-country wage declines. The use of active labor market policies predicts a significant portion of the cross-country heterogeneity in earnings losses.

JEL Classification: J30, J63, J64

Keywords: job loss costs, wage dynamics, labor turnover, layoffs, labor market institutions, cross-country matched employer–employee dataset

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1 Introduction

Losing a job entails lasting negative consequences for a worker (Jacobson et al., 1993). This finding is among the most influential in labor economics because it provides a simple test of how well labor markets are functioning. More efficient labor markets reallocate workers quicker and generate lower earnings losses after job displacement. Comparing the cost of job loss across labor markets might therefore reveal which ones are functioning better than others and why.

However, such comparisons remain challenging for two fundamental reasons. First, meta-analyses from existing research are often clouded by differences in the sample selection, the definition of the displacement event, and the econometric specifications. These discrepancies tend to deliver different estimates of the cost of job loss and thus complicate the interpretation of competing results reached by different studies. Second, existing research on job displacement is based on data from a single country, making it often difficult both to grasp the importance of diverse labor market institutions and to observe large institutional changes over time.

This paper addresses these challenges by building a harmonized dataset that combines matched employer-employee data from almost three decades and seven countries characterized by a wide range of diverse labor market institutions (Austria, Denmark, France, Italy, Portugal, Spain, and Sweden). We focus on job displacements, defined as the permanent loss of a long-term job due to mass-layoffs or establishments shutdowns for economic reasons. By adopting a common research design, a common definition of displacement event and a common criteria for sample selection, this work provides the first comparable estimates on the consequences of job displacement across countries.

These harmonized data and empirical methods are then used to disentangle the sources of displaced workers' pay losses both within and between countries. We begin by quantifying the importance of employer changes in driving post-displacement wage losses within each country, thus enriching a growing but still inconclusive literature (Lachowska et al., 2020; Schmieder et al., 2020; Gulyas and Pytka, 2020). Next, twenty-five years of micro-level estimates on the cost of job loss are combined with rich data on labor market institutions. This provides us with a unique framework in which we assess the importance of active labor market policies, unions, employment protection, and other labor institutions in driving the differences in the cost of job loss across countries.

The key insight of this paper is that the labor market consequences of losing a job are vastly different across Europe. Scandinavian countries experience by far the lowest earnings losses: five years after job displacement, earnings are about 10% lower than the earnings observed pre-displacement. By contrast the earnings of displaced workers from Southern Europe (Italy, Portugal, and Spain) are around 30% lower. Austrian workers experience earnings losses in between those of the Scandinavian and Southern European countries while French workers experience losses similar to those of Scandinavian workers.

Interestingly, existing research leads to drastically different conclusions from ours. For instance, by comparing Leombruni et al. (2013) to Bennett and Ouazad (2019), one would conclude that Italian workers suffer lower earnings losses than Danish workers. As detailed in the paper, this highlights the importance of using a harmonized research design when conducting a cross-country analysis on the consequences of job loss.

We then show that a large part of these cross-country differences in earnings losses are due to different responses on the extensive margin. Around 20% of displaced workers from Spain, Portugal, and Italy are unable to find employment five years after job displacement. This fraction is only around 5% in Sweden and Denmark and around 10% in France and Austria. Losses in daily wages are less dispersed and are clustered between 5% and 10% five years after displacement for most countries.

The second part of the paper analyzes the extent to which transitions from better- to worse-paying firms contribute to the displaced workers' wage losses, and whether these transitions differ across countries. We find that employer-specific wage policies explain a remarkably large share of these wage losses across all countries. The share ranges from around 40% for Spain to more than 95% for Portugal. These results are in line with Schmieder et al. (2020) and Gulyas and Pytka (2020), who point to the importance of changes in employers' wage premiums in driving long-term wage losses from job displacement. This is in contrast to what found by Lachowska et al. (2020) who note that in the US loss of employer wage premium explain little of the long-term wage losses following displacement.

The last part of the paper analyzes which factors can account for the large cross-country heterogeneity in average earnings losses from job displacement. An Oaxaca-Blinder decomposition reveals that observed differences in worker and employer characteristics do not explain the diverse effects of job displacement across countries. Informed by these results, we then look at the role of labor market institutions.

Our analysis reveals that a country's overall spending on active labor market policies represents a key factor in predicting earnings losses from job displacement. This result persists after controlling for a wide range of additional demographic characteristics, employer characteristics, country and year fixed effects, and when using Lasso to select variables that can predict earnings losses due to displacement across countries. By contrast, other institutional factors, such as union coverage and employment protection legislation, have very limited explanatory power. Overall, these results suggest that active labor market policies have the potential to attenuate the negative consequences of job loss.

The remainder of the paper is structured as follows. Section 2 describes the data and the empirical methods used in the main analysis. Section 3 presents evidence on the costs of job loss. Section 4 studies the role of employers in explaining the job loss effects. Section 5 investigates the role of observable characteristics and labor market institutions. Section 6 concludes.

2 Harmonized Research Design

Do earnings losses due to job displacement differ across countries and institutional settings, and if so, by how much? Table 1, which summarizes selected papers on job displacement, shows that this question is not readily answered by comparing existing studies. First, earnings loss estimates for a specific country tend to vary. For example, available earnings loss estimates for France vary from 16% to 36%. The reason for these varying estimates is that studies on the costs of job loss use different definitions of the displacement event, sample restrictions, definitions of the control group, and time periods.

These differences in the research design also cloud cross-country comparisons. For example, comparing Leombruni et al. (2013) to Bennett and Ouazad (2019), one would conclude that Danish displaced workers face higher earnings losses than Italian workers. But the use of different sample restrictions (displaced workers' employers must have at least 30 employees vs. no restriction on firm size) and different definitions of the mass layoff event (plant closure vs. decline in firm size by over 30%) could also be driving the differences in the estimates.

The definition of the control group is another important margin that tends to differ across papers. Some studies, like Jacobson et al. (1993) and Lachowska et al. (2020), impose that control workers must *always* be employed by the same employer. Table A.1 shows that imposing this tenure restriction on control workers can double the estimated earnings losses from job displacement.

To overcome these limitations, we build a harmonized cross-country matched employer-employee dataset by combining high-quality administrative registers from Austria, Denmark, France, Italy, Portugal, Spain and Sweden. Specifically, in our analysis we make sure to use the same variable definitions, sampling restrictions and research design for each country. We study job loss events due to mass layoffs occurring between at least the 1990s and the 2010s.[1]

[1]For Spain, data on job displacements is available from 2007 onwards. Appendix Table A.2 shows that the extent of information available is comparable across countries. Country-specific details concerning the construction of the matched employer-employee dataset are reported in Appendix C.

In our empirical approach, we adopt an event study design where workers displaced in a mass layoff are compared to similar workers that do not experience such an event (Jacobson et al., 1993). We select comparison (control) workers through propensity score matching (e.g., Schmieder et al., 2020) and compute dynamic job loss effects by following workers up to 5 years before and after the job displacement event.

2.1 Sample Selection and Definition of Main Outcomes

Sample selection. To limit the influence of early-retirement programs, we select workers who are at most 50 years old in the year preceding the job displacement event. We consider stable jobs by sampling workers with at least three years of tenure with their main employer in the year preceding the job displacement event.[2] Moreover, in order to identify exogenous job separations due to mass layoffs, we further restrict our sample to workers employed in private-sector establishments with at least 50 employees at the end of the pre-displacement year. Identical sampling restrictions are applied for the control workers as described below.

Definition of main outcomes. We define earnings, deflated to 2010 EUR, as the sum of yearly labor earnings (possibly from different employers) before taxation. Labor earnings include overtime, bonuses, and severance payments when available. Earnings are thus set equal to zero if a worker becomes non-employed in a given year. Wages are defined as daily earnings from the main employer, and are computed as labor earnings over days worked. We do not have information on hours worked for all countries (see Table A.2). A person is defined as employed if she has any positive labor earnings during the year.

2.2 Definition of treated and control workers

Treatment group. Let t^* be the year of a job displacement event due to a mass layoff. We define treated workers as those satisfying the following three conditions, which seek to capture exogenous and permanent job separations: (i) workers separate from their main employer in t^*; (ii) employment at the current establishment drops by at least 30 percent in t^*; (iii) workers are not recalled by their main employer up to $t^* + 5$.

Restriction (ii) is aimed at alleviating concerns about mischaracterizing voluntary separations as layoffs. The 30-percent threshold is standard in the mass layoff literature (see, e.g., Davis and Von Watcher, 2011; Flaaen et al., 2019). Our mass layoff definition includes plant closures. We additionally use explicit information on the

[2] The main employer is the establishment at which the worker's annual earnings are largest.

Table 1: Review of Research Designs and Estimates from the Job Loss Literature

Paper	Country	Year	Tenure	Type of Event	Firm size	Gender	Control group: same employer	Earnings in year 5
Gulyas and Pytka (2020)	Austria	1984-2017	2	Mass layoff $\geq$ 30%	30	Male	No	-16%
Halla et al. (2020)	Austria	1990-2007	1	Mass layoff	10	Male	No	-20%
Bennett and Ouazad (2019)	Denmark	1990-1994	3	Mass layoff $\geq$ 30%	30	Male	No	- 23%
Roulet (2021)	Denmark	2001-2006	5	Plant closure	5	Both	No	- 12%
Royer (2011)	France	1995-1999	2	Plant closure	10	Both	No	-16%
Brandily et al. (2020)	France	2002-2012	2	Reason for Separation	none	Both	No	-36%
Schmieder et al. (2020)	Germany	1975-2005	3	Mass layoff $\geq$ 30%	50	Male	No	-20%
Fackler et al. (2021)	Germany	2002-2014	3	Reason for Separation	none	Male	No	-12%
Leombruni et al. (2013)	Italy	1989-1994	3	Plant closure	0	Both	No	-9%
Mossucca (2016)	Italy	2005-2010	6	Mass layoff	0	Both	Yes	-9%
Carneiro and Portugal (2006)	Portugal	1991-1998	3	Plant closure	none	Both	Yes	-6%
Raposo et al. (2021)	Portugal	1988-2014	2	Plant closure	20	Both	No	-27%
Garcia-Cabo (2018)	Spain	2005-2015	1.5	Reason for separation	none	Both	Yes	-32%
Garda (2012)	Spain	1999-2004	3	Reason for separation	5	Male	No	-25 %
Eliason and Storrie (2006)	Sweden	1987-1988	none	Plant closure	10	Both	No	-11%
Seim (2019)	Sweden	2002-2004	1.5	Reason for separation	5	Male	No	-15%
Jacobson et al. (1993)	USA	1974-1986	6	Mass layoff $\geq$ 30%	50	Both	Yes	-25%
Lachowska et al. (2020)	USA	2002-2014	6	Mass layoff $\geq$ 30%	50	Both	Yes	-17%

Notes: Selection of papers studying the costs of job loss in the US and in Europe (the countries in our sample plus Germany). *Year* denotes the years of the displacement. *Tenure* (in years) report the minimum number of years that displaced workers must have worked with their employer up to to the moment of displacement; *Firm size* is the minimum firm-size of the employer of displaced workers before displacement; *Type of event* distinguishes how a paper defines a displacement event; (*Mass layoff* $\geq$ *30%* defines a displacement event when a firm is laying off more than 30% of the its workforce). (*Plant-Closure*) means that the paper is considering displacement event only when an employer permanently shut-down. (*Reason for Separation*) means that the paper is using administrative information to determinate the job displacement event. *Control group: same employer* specifies whether the comparison group comprises workers that are restricted to stay with the same employer after the displacement of the treated workers. *Earnings in year 5* reports the job loss effects on earnings 5 years after job displacement in terms of the percent change from the pre-displacement earnings level.

reason for job separation (involuntary layoff vs. voluntary resignation) whenever the information is available.[3]

Control group. Control workers are selected in two steps. First, we identify potential control workers as those who do not meet the three conditions (i)-(iii) listed above at the same time in a given year, and thus cannot be classified as treated. Second, we partition potential control workers and treated workers in cells defined by calendar year, gender, and industry category. We then estimate a propensity score separately by cell by fitting a probit model of job displacement on observable characteristics. These controls include earnings measured in $t^* - 2$ and $t^* - 3$, age, tenure, and employer size in $t^* - 1$. We also match control and treated workers by contract type (temporary vs. permanent) and full-time status whenever this information is available. We then apply a 1:1 nearest neighbor matching algorithm without replacement to assign one control worker to each treated worker. See Appendix B for further details.

2.3 Summary Statistics

Table A.3 presents descriptive statistics of the matched sample. For each country in the study, the matching algorithm returns treated and comparison workers with well-balanced observable characteristics. In our sample, workers are on average between 33 to 38 years old, and between 35% to 48% are women. Treated and control workers are employed at the same employer for an average 5 to 10 years depending on country. Most workers work full-time (81% to 89%) on a permanent employment contract (6% to 15% have a fixed-term employment contract).

Comparing across countries, we observe that most variables tend to be relatively balanced. However, some differences exist, such as in length of tenure. For this reason, in Section 5.1 we formally check whether the heterogeneous effects of displacement across countries are driven by cross-country differences in sample composition. We do not find this to be the case.

The table further shows that the probability of experiencing a mass layoff is around 2% for most countries in our sample. By virtue of using the same definition of the mass layoff, we may conclude that the similar incidence of mass layoffs across countries further suggests that the job loss events we capture are indeed comparable across countries.

[3]This information is available for Spain and Italy. The main results are unaffected when we do not use the reason for job separation for these countries; see Figure A.4.

3 The Cost of Job Loss across Countries

This section documents the consequences of job loss across Europe in terms of total yearly earnings, employment, and daily wages.

3.1 Event study model

Let i index a treated or matched control worker and t_i^* be the year when a treated worker experiences a separation due to a mass layoff. We estimate the following event study model separately for each country:

$$y_{it} = \alpha_i + \lambda_t + \sum_{k=-5}^{k=5} \gamma_k \mathbf{1}\{t = t_i^* + k\} + \sum_{k=-5}^{k=5} \theta_k \mathbf{1}\{t = t_i^* + k\} \times \text{Displaced}_i + X_{it}'\beta + r_{it}, \tag{1}$$

where y_{it} measures total yearly earnings, employment status, and daily wages in year t; $Displaced_i$ is an indicator variable equal to 1 for treated workers that lose their job in a mass layoff, and X_{it} includes age squared. The worker fixed effects α_i control for time-invariant worker characteristics and λ_t are calendar year fixed effects. Under the assumptions of no anticipation of the job loss event and parallel trends between the treated and control units, the coefficients of interest, θ_k, capture the effect of job loss at time $k = t - t^*$ for the treated units (normalized to 0 in $k = -3$). Standard errors are clustered at the worker level.

3.2 The Unequal Cost of Job Loss across Countries

Figure 1 shows how the cost of job displacement estimated through model (1) evolves before and after the mass layoff in year t^* and across countries, relative to the reference year $t^* - 3$. Before t^* there is no evidence of pre-trends for any of the outcomes of interest. The results on earnings are reported by scaling the event study coefficients $\{\theta_k\}$ to the pre-period average value (up to 5 years before job displacement).

The figure reveals substantial cross-country heterogeneity in the cost of job loss. Panel (a) shows that, despite large and persistent effects of job displacement in all countries, workers displaced in Northern European countries suffer substantially lower losses in total earnings. One year after displacement, earnings drop by 20% in Northern Europe and by twice as much in Southern Europe. Five years after displacement, Northern European workers still suffer a 10% loss in total earnings compared to a 30% for their Southern European counterparts. Austrian and French workers face earnings losses somewhere in between.

Panel (b) further highlights that a large part of cross-country differences are driven by different responses on the extensive margin. Five years after displacement, about 20% workers in Italy, Spain and Portugal are not employed. This makes them around 7 times less likely to be employed compared to workers in Sweden, Denmark and France and half as likely to be employed compared to workers in Austria.[4] By contrast, wage losses, which of course are computed only for workers currently employed, are relatively more uniform across countries and, with the exception of Austria and Spain, range between 5% and 10% (Panel c).[5,6]

Below we assess how the definition of control workers, year of job loss, and gender differences can alter our main result reported in Figure 1a.

Alternative definition of control group. Table A.1 reports earnings losses under our baseline control group specification and under an alternative control group definition where workers are restricted to have positive earnings at the same employer for 5 years after t^* (as in Lachowska et al., 2020; Jacobson et al., 1993). Conditioning control workers to stay at the same employer increases the estimated earnings losses, often substantially. Under the alternative control group definition, 5 years after job displacement, earnings losses for Danish, French, and Italian workers are more than twice as much as those in the baseline specification. This finding reveals how important sample selection and method consistency are for the estimation and interpretation of the cost of job loss.[7]

Effects of job displacement over time and by gender. Figure A.1 reports estimates of model (1) by year of job loss to detect trends in earnings losses from the 1980s to the 2010s. Italy is the only country characterized by a clear and significant increase in the cost of job loss over time. Italian workers suffered earnings losses around 25% in the 1990s, but 40% in the 2010s.[8] Apart from the case of Italy, the results are not driven by

[4] Fallick et al. (2021) also find that duration of non-employment is a driver of earnings losses. Our findings hold after we control for the different periods of analysis, worker and employer characteristics (see Section 5.1).

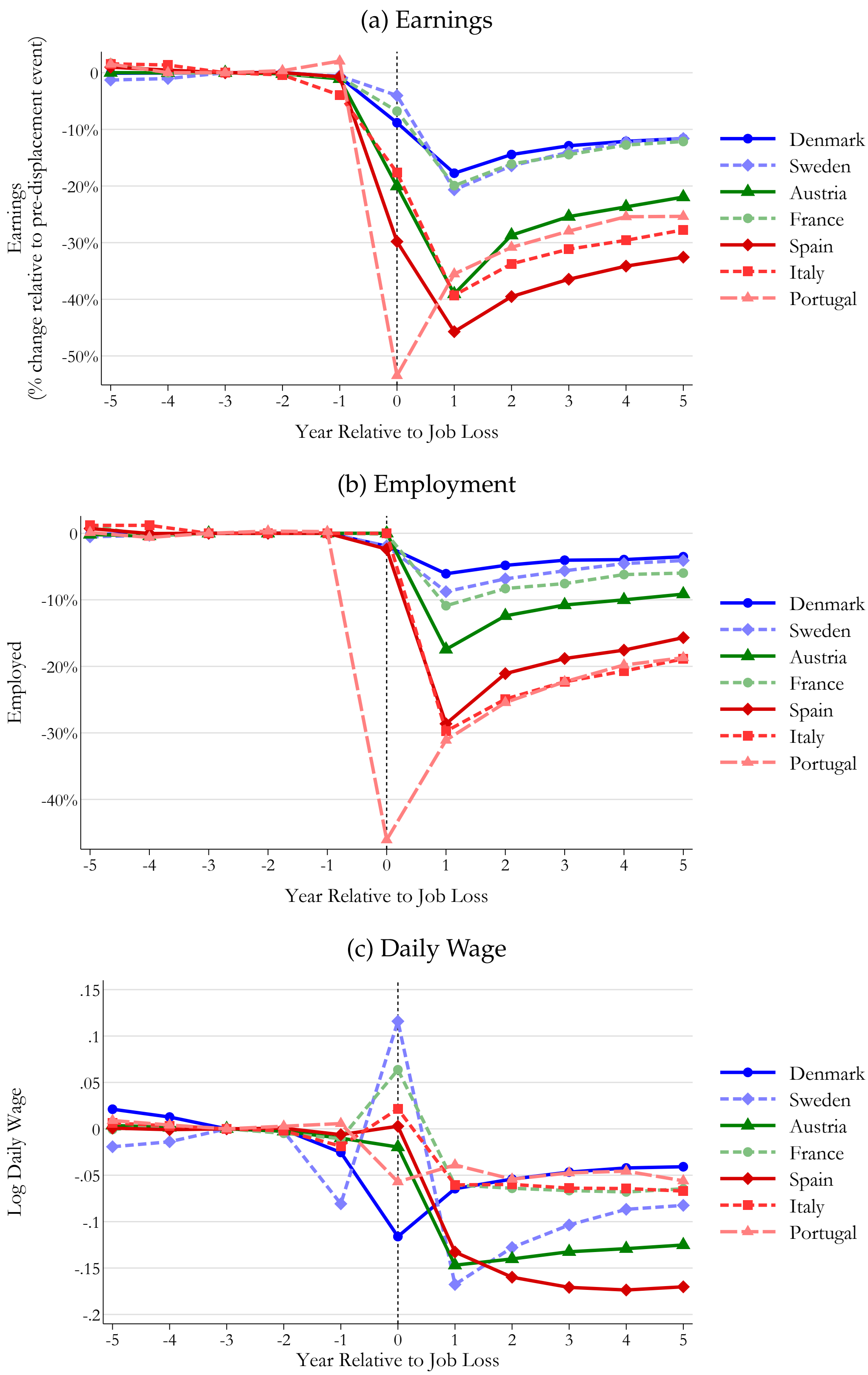
[5] Panel (c) shows a spike in the wages during the job displacement year for some countries. This happens when the drop in days worked is larger than the relative loss in earnings, which typically occurs due to extra payments received by worker upon job displacement such as severance payments or accumulated leave time; see, e.g., Lachowska et al. (2020) for a similar pattern.

[6] The pattern of the event-study coefficients on employment in Portugal looks slightly different because its underlying matched employer-employee data (QP) only provides a snapshot of the labor market in October. Given our definition of displacement event, displaced workers in this country are thus employed by the long-term employer up to October of $t^* - 1$ but are either non-employed or employed by a different employer in t^*. Shifting the event time for Portugal by one year does not qualitatively affect our main results.

[7] See also Krolikowski (2018) who shows that the control group's definition matters for earnings losses.

[8] Section C.4 shows that this increase in the cost of job loss over time for Italy appears to be due to displaced workers being increasingly more likely to obtain lower-paying temporary jobs following job

Figure 1: The Effect of Job Loss across Countries



Notes: Event study estimates of the job loss effects from equation (1). Estimates are relative to $t^* - 3$, where t^* is the job loss year. Coefficients in Panel (a) are rescaled using average pre-displacement labor earnings. Outcome in Panel (b) is an indicator equal to 1 if a worker has at least one day of work in the corresponding year. See Appendix C for further details.

any specific decades during which job losses occur.

The remarkable differences in earnings losses across countries do not vary when we focus on the sample of men only (Figure A.2).[9]

Main findings. All in all, when interpreting earnings losses as a proxy for how well labor markets are functioning, we obtain the clear conclusion that Northern European labor markets are more efficient in reallocating workers to new jobs with limited earnings losses 5 years following the displacement event. By contrast, workers in Spain, Portugal and Italy face significant earnings losses due to displacement that persist well after the job displacement event. Before we study the sources of the unequal cost of job loss observed across countries in terms of earnings losses (Section 5), we turn our attention to wage losses and in particular the role of employer-specific wage premiums in driving these wage losses.

4 Loss of Employer-Specific Wage Premiums

We now focus on the extent to which transitions from better- to worse-paying firms contribute to displaced workers' wage losses, and whether these transitions differ across countries. Two recent studies indicate large cross-country differences in workers' ability to find similarly well-paying firms after job displacement. Lachowska et al. (2020) document that displaced workers in Washington State during the great recession did not face significant loss of employer-specific wage premiums. By contrast, Schmieder et al. (2020) show that in Germany many displaced workers move to worse-paying firms, which explains a large fraction of their wage losses.

However, the fact that these two studies use somewhat different sample restrictions and econometric specifications, as illustrated in Table 1, makes it hard to draw firm conclusions on the importance of employer quality in explaining wage losses. Does the ability of displaced workers to find similarly well-paying jobs significantly differ across countries? To answer this question we compare what fraction of wage losses can be explained by a transition to worse-paying firm after job displacement.

4.1 Employer Fixed Effects

We focus on the sample of workers with positive earnings and estimate an AKM model on log daily wage as follows:

$$y_{it} = \alpha_i + \psi_{J(i,t)} + \lambda_t + X'_{it}\beta + u_{it}, \quad (2)$$

displacement, consistent with the findings of Woodcock (2020) for Germany.

[9] See also Illing et al. (2021) who study the gender gap in earnings losses due to job displacement in Germany.

where $J(i,t)$ is the main employer of worker i in year t; α_i and $\psi_{J(i,t)}$ are worker and establishment fixed effects, λ_t are year indicators to adjust for macroeconomic conditions, and X_{it} is a cubic polynomial in age. To alleviate the concern that job loss contributes directly to the estimates of establishment effect in the AKM model, we exclude treated and control workers when estimating equation (2). Our focus is on the estimates of $\psi_{J(i,t)}$, which captures the time-invariant common wage policy of a given employer and which we denote as the employer-specific wage premium. As employer-specific wage premiums tend to correlate with productivity, the typical interpretation is that they capture rents accrued by the worker from the current job (Card et al., 2016).

After estimating the AKM model, we first re-estimate the event study model (1) by using $\hat{\psi}_{J(i,t)}$ as an outcome. The interaction terms in the event study model return the change in the employer-specific wage premiums, relative to the matched control worker, for the displaced workers that find a job after t^* at employers for which the fixed effects are defined. Next, following Lachowska et al. (2020), we take the ratio of the job displacement effect on the employer-specific wage premiums estimated in the AKM model to the overall job displacement effect on log wages for the workers employed after t^*. This gives a measure of the share of wage losses explained by changes in employer-specific wage premiums.

4.2 Job Displacement Effects due to Loss of Employer-Specific Wage Premiums

Table 2 shows the estimated loss of employer-specific wage premiums (Column 1), the total job loss effects on wages (Column 2), and the resulting share of the total job loss effect due to loss of employer-specific wage premiums (Column 3).

The results highlight that loss of employer-specific wage premiums are remarkably important in explaining overall wage losses across all countries. Five years after displacement, the change in employer-specific premiums explains between 40% and 60% of wage losses in Austria, Denmark, Italy, Spain, and Sweden. In France this share is almost 70% and in Portugal it reaches 95%. Table A.4 additionally shows that changes in employer-specific wage premiums matter in explaining the cyclicality of job loss effects. (see Appendix B.2.2). This confirms our previous findings on the importance of employers.

Overall, these results suggest that the transition of displaced workers from better- to worse-paying employers is an important factor in explaining the wage losses due to displacement observed within each country.

We now turn our attention to cross-country differences in earnings losses and in particular on why some labor markets appear to function better in reallocating displaced workers following the loss of a job.

Table 2: Loss of Employer-Specific Wage Premiums

	Effect of Job Displacement				
	Employer Wage Premiums (1)		Log Daily Wage (2)		Ratio (3)
Denmark					
$t=1$	-0.025	(0.001)	-0.062	(0.002)	0.41
$t=5$	-0.018	(0.001)	-0.039	(0.002)	0.46
Sweden					
$t=1$	-0.031	(0.001)	-0.104	(0.003)	0.31
$t=5$	-0.029	(0.001)	-0.055	(0.004)	0.53
Austria					
$t=1$	-0.061	(0.001)	-0.105	(0.002)	0.59
$t=5$	-0.064	(0.001)	-0.112	(0.002)	0.59
France					
$t=1$	-0.024	(0.002)	-0.041	(0.003)	0.60
$t=5$	-0.030	(0.002)	-0.044	(0.004)	0.68
Italy					
$t=1$	-0.022	(0.001)	-0.052	(0.002)	0.43
$t=5$	-0.027	(0.002)	-0.057	(0.003)	0.47
Spain					
$t=1$	-0.025	(0.003)	-0.097	(0.004)	0.27
$t=5$	-0.046	(0.003)	-0.130	(0.006)	0.37
Portugal					
$t=1$	-0.029	(0.001)	-0.029	(0.002)	1.00
$t=5$	-0.043	(0.001)	-0.045	(0.002)	0.95

Notes: The table reports estimates from the event study model (1), with t denoting the time since mass layoff, and with (i) AKM employer fixed effects as dependent variable (Column 1); and (ii) log daily wage as dependent variable (Column 2). The resulting share of total job displacement effects due to the loss of employer-specific wage premiums is shown in Column (3). Standard errors in parentheses.

5 Sources of Unequal Cost of Job Loss across Countries

In this section, we investigate the potential sources of the cross-country differences in the cost of job loss documented in Section 3. First, we rule out that compositional differences in worker and job characteristics of displaced workers explain the unequal consequences of job loss across countries. Second, we explore the role of differences in labor market institutions in shaping the recovery of earnings losses.

5.1 Differences in Sample Composition across Countries

According to Table A.3, the composition of displaced workers differs somewhat across countries. Given that Gulyas and Pytka (2020) document large heterogeneity of earnings losses across workers with different attributes within a country, we next investigate whether compositional differences in worker- and employer characteristics can explain the heterogeneous job loss effects across countries shown in Figure 1.

5.1.1 Oaxaca–Blinder Decomposition of Job Loss Effects

To quantify the role of different observable characteristics of displaced workers in driving the heterogeneous effects of job displacement across countries, we perform pairwise Oaxaca–Blinder decompositions between each country c and a reference country r (Denmark).[10] For each country, we regress the individual-level job loss effects on earnings measured in $t^* + 3$ (relative to $t^* - 3$) on a vector of worker- and employer-level characteristics X.[11] Individual-level job loss effects are individual-level difference-in-differences effects computed for each treated-matched control worker pair, see Schmieder et al. (2020) for a similar approach and Appendix B.2.2 for details. We use the estimated coefficients from each country-level regression to decompose Δ_c, which denotes the average gap in the job loss effect between country c and r as follows:

$$\Delta_c = \sum_{x \in X} \underbrace{(E[x_{i,c}] - E[x_{i,r}])\beta_x^c}_{\text{Composition}} + \underbrace{E[x_{i,r}](\beta_x^c - \beta_x^r)}_{\text{Unexplained}} \tag{3}$$

The "compositional" part quantifies the differences in the cost of job loss attributable to differences in observables, where the impact of each characteristic x is estimated using the regression coefficients β_x^c of the comparison country. The "unexplained" part quantifies the importance of structural differences between the two countries (unexplained by differences in the observables, which are kept fixed at the reference coun-

[10]We choose Denmark because job loss effects are the smallest there. Choosing Sweden as an alternative reference country yields virtually identical results.

[11]We pick three years after job displacement as this permits us to maximize the set of overlapping years where we have data for all the countries without having to rely on very short-run effects.

try's average observed levels). We focus on the composition part of the cross-country differences by looking at the following characteristics measured right before job displacement: gender, tenure, age, quintiles of worker and employer AKM fixed effects, employer size, change in unemployment rate, and quadratic time trends. These characteristics thus capture potential differences in observable characteristics at the worker and employer level, and the macroeconomic conditions.

To facilitate the interpretation of each pairwise comparison, we focus on the job displacement years available for both country c and Denmark. Both individual- and worker-level fixed effects are estimated through AKM models and aggregated into country-specific quintiles based on the corresponding AKM sample that excludes displaced workers and their matched control workers.

5.1.2 Decomposition Results

The results of this decomposition exercise are reported in Table 3. The table shows that compositional differences typically explain only a small part of the total gap in earnings losses between the different countries and Denmark. For instance, out of a 16 percentage point job loss gap in earnings between Italy and Denmark, only 1 percentage points are due to compositional differences in worker- and employer characteristics. This result holds for all countries where the overall gap is largest, i.e., all Southern European countries, which are characterized by very different labor market institutions as compared to Denmark. In addition, if we focus on only the unexplained part, it still holds that Northern European countries face the lowest losses, and Southern European countries the highest.

Thus, it appears that the large cross-country heterogeneity in the job loss effects is not primarily driven by differences in observed characteristics. Figure A.3 provides further visual confirmation of this finding. This figure shows the distribution of the AKM employer-specific wage premium of displaced workers across countries. The figure confirms that the composition of employers at the moment of displacement (as captured by the AKM employer-specific wage premium) does not appear to play a major role in explaining large cross-country heterogeneity in the job loss effects on earnings.

Table 3: Decomposition of Job Loss Effect on Total Earnings (% Change from $t-3$)

	Overall gap	Composition part					Unexplained part
		Worker	Employer	Business cycle	Time trend	Total	Total
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sweden	-0.011	-0.053	-0.004	-0.000	-0.000	-0.058	0.047
Austria	-0.098	-0.029	-0.052	-0.001	-0.003	-0.085	-0.013
France	-0.009	-0.021	-0.013	0.001	0.004	-0.029	0.021
Italy	-0.166	0.023	-0.012	0.003	-0.005	0.010	-0.174
Spain	-0.207	-0.034	-0.003	-0.001	0.000	-0.038	-0.169
Portugal	-0.156	-0.035	-0.011	-0.011	0.004	-0.053	-0.104

Notes: Oaxaca-Blinder decompositions by separately comparing each country to Denmark. Column (1) reports the total gap in the job loss effect calculated three years after displacement. Columns (2)-(6) show the part of the gap explained by the following characteristics measured at displacement: worker characteristics (quintiles of worker fixed effects, gender, tenure, age); employer characteristics (quintiles of employer fixed effects, employer size); business cycle conditions (unemployment rate); and timing of separation (quadratic time trend). Column (7) shows the gap part unexplained by the average differences in the observables.

5.2 Job Loss Effects and Labor Market Institutions

The evidence reported to this point implies that observed differences of displaced workers across countries cannot explain the stark cross-country heterogeneity in earnings losses. But then why do some labor markets seemingly work better than others? This section combines almost thirty years of causal effects on the cost of job loss across countries with data on their labor market institutions to see how much variation in these institutions – both within and across nations – can account for the unequal cost of job loss displayed in Figure 1.

5.2.1 Measuring the Importance of Institutions

To study how labor market institutions are related to the cost of job loss across countries, we regress the coefficients θ_3— obtained when estimating equation (1) separately by mass layoff year and country— on institutional characteristics measured at the country–year–of–layoff level. We control for average displaced worker characteristics from the matched employer–employee data (employer size, age, tenure, gender). Moreover, we use GDP per capita, unemployment rate, the share of involuntary part-time employment, and the Gini ratio to control for additional cross-country differences in macroeconomic characteristics.

Labor market institutions are chosen according to the classification by Boeri (2011), who argues that strictness of employment protection legislation, generosity of unemployment benefits, scope of active labor market programs, and degree of centralization of collective bargaining are highly heterogeneous institutional features in Europe.

Definitions of these variables are provided in Appendix B.3.

5.2.2 The Role of Institutions in Explaining Job Loss Effects

Figure 2 shows that job displacement effects on earnings three years after job displacement are strongly positively correlated with spending on Active Labor Market Policies (ALMPs). In other words, in country-years where ALMP spending is higher (at the time of job displacement) we observe a smaller negative effect of job displacement on future earnings.

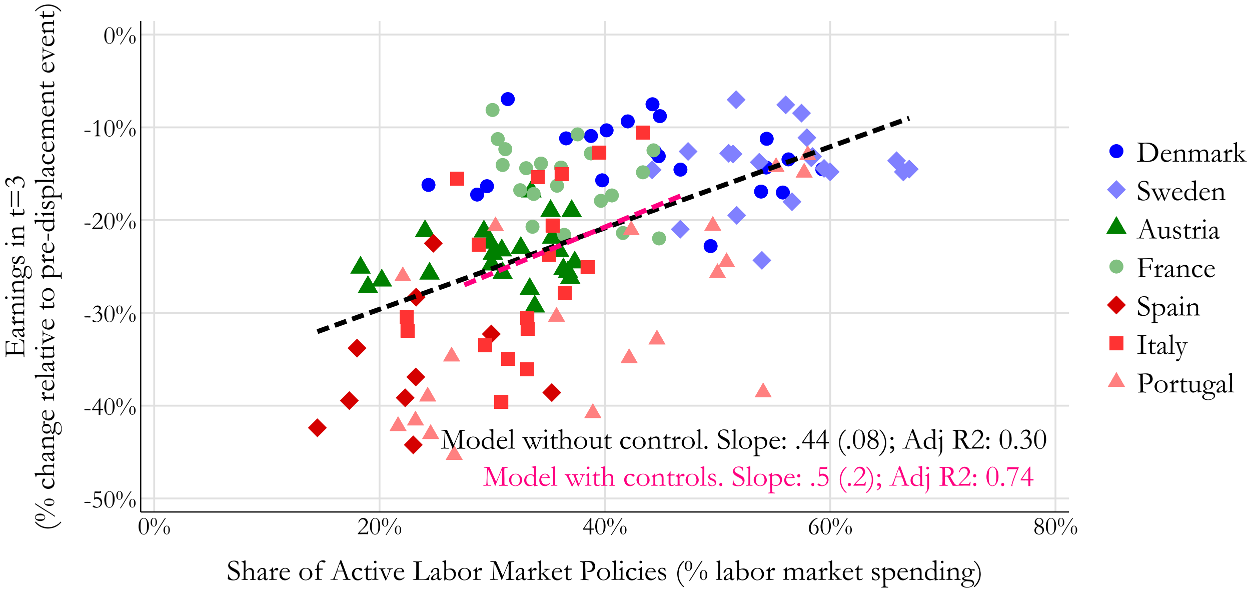
Interestingly, this relationship holds also when we look at within-country variation only. When we adjust for country and year fixed effects, as well as for additional institutional features and rich employer, worker, and macroeconomic controls, the relationship between job loss effects and ALMP spending remains positive and highly statistically significant. A 10 percentage point increase in the share in spending on active labor market policies is associated with a 5% decrease in earnings losses, see also Column 3 of Table A.5.

When using a Lasso regression to study which variables can predict earnings losses due to displacement, spending on ALMPs along with % of labor market spending are the sole institutional variables being picked up by Lasso (column 4 of Table A.5). By contrast, other measures related to labor market institutions, such as the share of workers covered by wage negotiation and the generosity of unemployment benefits, do not appear to be strong predictors of earnings losses from job displacement.

Table A.6 shows that increases in spending on ALMPs also attenuate the negative effects of job displacements on re-employment probabilities as well as on log daily wage as calculated in equation (1). Importantly, Table A.6 also shows that the relationship between spending on ALMPs and job loss effects is driven by the spending on training programs. Scaling spending on ALMPs as a percentage of GDP, instead of as a percentage of total labor market spending, leads to similar conclusions.

Overall, these results suggest that labor market institutions—specifically differences in spending on active labor market policies—have the potential to attenuate the negative consequences of job loss.

Figure 2: Earnings Losses due to Displacement and Labor Market Institutions



Notes: The figure displays the relationship between the estimated displacement effect on labor earnings 3 years after displacement—the coefficient θ_3 when estimating Equation 1 separately by country and year of mass layoff—and spending on active labor market policies (ALMPs) in a given country × year-of-mass-layoff. ALMPs include spending on public employment service, training, employment incentives, and other re-employment programs. The slope from the associated regression is printed on the figure in black. The regression coefficient obtained when also including country and year fixed effects as well as additional controls is printed in pink, see also Table A.5. Additional controls capture various average worker and employer characteristics of displaced workers (employer size, age, tenure, gender), macroeconomic controls (GDP per capita, unemployment rate, the share of involuntary part-time employment, and Gini ratio), and labor market institutions (Labor market spending as % of GDP, the OECD indicator for employment protection for temporary and permanent jobs, union coverage and density, unemployment insurance, see Appendix B.3 for further details).

6 Conclusion

Using a harmonized research design, we document striking differences in the cost of job loss across seven European countries. While earnings losses five years after job loss are around 10% in Northern European countries, they are almost 30% in Southern European countries, with Austrian and French workers facing losses in-between. Crucially, these cross-country earnings differences would not emerge from meta-analyses of existing papers due to discrepancies in associated empirical methodologies.

What explains the unequal cost of job loss observed both within and across countries? A key factor in driving wage losses following job displacement is reallocation to worse-paying employers. Specifically, the share of wage losses explained by losses in AKM employer-specific wage premiums ranges from 40% for Spain to more than 95% for Portugal. This result thus enriches a recent but still inconclusive literature that has analyzed the role of employer-specific wage policies in driving the wage losses following displacement (Lachowska et al., 2020; Schmieder et al., 2020; Gulyas and Pytka, 2020).

Wage losses as well as differences in worker characteristics, however, do little to explain the differences in earnings losses following displacement observed across countries. Motivated by this fact, we then analyze the role of labor market institutions. We find that spending on active labor market policies is significantly associated with *lower* earnings losses of displaced workers, even after controlling for country and year fixed effects, worker and employer characteristics from our harmomized matched employer-employee data. Although only descriptive, this finding does suggest that active labor market policies might have overall positive equilibrium effects. Future work should further validate this result, as the equilibrium effects of active labor market policies remain an important yet understudied topic (Crépon et al., 2013; Card et al., 2018; Katz et al., 2020).

All in all, the vastly different earnings trajectories following a job loss documented in this paper should be informative for policy makers and academics alike. Our results reveal that labor markets function better in some countries than others and that labor market institutions have the potential for mitigating these differences.

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Appendix

Table of Contents

A Additional Tables and Figures

A.1 Tables

Table A.1: Earnings Effects with Alternative Control Groups

	Earnings Effect in t=+5		Earnings Effect in t=+1	
	Baseline	Continuously employed	Baseline	Continuously employed
Austria	-0.211	-0.360	-0.389	-0.461
Denmark	-0.116	-0.253	-0.177	-0.255
France	-0.121	-0.255	-0.199	-0.253
Italy	-0.277	-0.772	-0.392	-0.635
Portugal	-0.243	-0.270	-0.344	-0.437
Spain	-0.325	-0.512	-0.457	-0.537
Sweden	-0.116	-0.171	-0.206	-0.233

Notes: Earnings losses 1 and 5 years after job displacement for different definitions of the control group. The *Continuously employed* control group is similar to that in Lachowska et al. (2020). It is defined by selecting workers who stay employed at the same establishment at which they had at least 3 years of pre-displacement tenure for the entirety of the post-period time window (up to 9 years in total). The *Baseline* control group does not impose the post-displacement restriction and is the control group that is used in our main analyses.

Table A.2: Characteristics of Data Sources by Country

	Italy	Portugal	Spain	France	Austria	Denmark	Sweden
Population of Workers and Firms							
Year of job loss	1993-2016	1992-2017	2007-2019	1994-2016	1987-2018	1983-2017	1994-2016
Individuals: % employees	6.5	100	4	8	100	100	100
Employers:							
Establishment ID and Firm ID	YES	YES	YES	YES	NO	YES	YES
Public sector employers	YES	YES	YES	YES	YES	YES	YES
Main Variables							
Earnings include income from...							
all jobs	YES	NO	YES	YES	YES	YES	YES
severance payments	NO	NO	NO	YES	NO	YES	YES
self-employment	NO	NO	NO	NO	NO	NO	YES
Days worked	YES	YES	YES	YES	YES	YES	NO
Full time/Part time	YES	YES	YES	YES	NO	YES	YES
Temporary/Permanent contract	YES	YES	YES	YES	NO	NO	NO
Reasons for job separation	YES	NO	YES	NO	NO	NO	NO

Notes: The table summarizes the main characteristics of the datasets. See Appendix C for explanations for each country. *Year of Job loss*: time range of the event-study. *% employees*: the data contains the the full population or a sample of X % workers. *Establishment ID and Firm ID*: the data contains both identifiers. "*Public sector employer*": the data records *some* jobs in the public sector. See coverage by country in Appendix C. *All jobs*: earnings include all jobs, and not a snapshot in a given month. *Severance payments*: the data contains severance pay or redundancy compensation. *Self-employed*: the data contains labor earnings from non-salaried labor earnings. "*Annual days worked*": the data contains the exact number of days covered by an employment contract. "*Full time/Part time*": the data contains an indicator to measure whether the job is full-time or part-time. *Temporary/Permanent contract*: the data contains a variable to distinguish between temporary employment contracts and permanent contracts. *Reasons for job separation*: the data contains a variable to identify separation due to a layoff.

Table A.3: Descriptive Statistics, Matched sample

	Denmark		Sweden		Italy		Spain		Austria		France		Portugal	
	treated	control	treated	control	treated	control	treated	control	treated	control	treated	control	treated	control
Panel A: Worker characteristics														
Earnings in $t^* - 2$	42.7	42.6	33.1	33.1	24.1	24.3	22.4	22.4	29.9	30.0	29.8	30.1	15.1	15.1
(EUR Th.)	(24.1)	(23.7)	(19.2)	(18.3)	(16.6)	(16.3)	(9.3)	(9.0)	(11.4)	(11.6)	(17.6)	(18.6)	(12.3)	(12.7)
Earnings in $t^* - 3$	40.3	40.2	32.8	32.8	23.1	23.3	22.2	22.1	29.3	29.3	28.6	28.8	15.0	15.0
(EUR Th.)	(23.9)	(23.7)	(15.9)	(15.8)	(16.3)	(16.2)	(9.2)	(8.9)	(11.3)	(11.6)	(17.0)	(18.1)	(12.1)	(12.6)
Age	33.7	34.2	36.6	36.7	37.7	37.7	38.2	38.0	38.2	38.1	37.3	37.5	35.8	35.8
	(9.0)	(9.0)	(7.9)	(7.9)	(7.6)	(7.8)	(6.8)	(6.9)	(7.8)	(7.8)	(7.5)	(7.6)	(7.6)	(7.7)
Female	0.37	0.37	0.35	0.35	0.40	0.40	0.41	0.41	0.42	0.42	0.36	0.36	0.48	0.48
Tenure	5.8	5.8	7.3	7.3	4.7	4.7	6.7	6.6	7.3	7.3	6.6	6.6	10.3	10.4
	(3.8)	(3.8)	(4.9)	(4.9)	(1.4)	(1.3)	(3.9)	(3.8)	(4.3)	(4.3)	(5.1)	(5.0)	(7.1)	(7.2)
Temporary contract	–	–	–	–	0.06	0.06	0.14	0.15	–	–	0.09	0.09	0.13	0.13
Full time	0.81	0.81	–	–	0.86	0.85	0.87	0.86	–	–	0.88	0.88	0.89	0.89
Panel B: Employer characteristics														
Industry:														
Manufacturing	0.38	0.38	0.42	0.42	0.36	0.36	0.26	0.26	0.47	0.47	0.44	0.44	0.53	0.53
Services	0.34	0.34	0.32	0.32	0.31	0.31	0.59	0.59	0.13	0.13	0.33	0.33	0.38	0.38
Other	0.28	0.28	0.25	0.25	0.33	0.33	0.15	0.15	0.41	0.41	0.23	0.23	0.09	0.09
Establishment size	369	344	387	382	364	359	342	361	323	308	320	342	335	321
	(603)	(635)	(651)	(849)	(284)	(291)	(789)	(812)	(372)	(510)	(434)	(540)	(490)	(591)
% Masslayoff event	2.84	2.84	1.12	1.12	3.42	3.42	1.80	1.80	2.59	2.59	0.70	0.70	1.84	1.84
No. Workers (th.)	201.91	201.91	97.36	97.36	66.28	66.28	14.71	14.71	55.89	55.89	28.66	28.66	177.26	177.26
No. Firms (th.)	7.09	10.04	6.04	15.04	22.64	28.22	13.25	13.70	1.14	5.85	8.66	19.31	8.02	46.22

Notes: Averaged worker and employer characteristics in the matched sample, with t^* denoting the year of job loss for the treated group. Earnings are measured in $t^* - 3$ and $t^* - 2$, and all other variables in $t^* - 1$. The industry groups were matched at more disaggregated country-specific level but have been re-aggregated in the table for presentation purposes. Earnings are deflated and reported in 2010 Thousand Euros. Standard errors appear in parentheses.

Table A.4: Cyclicality of Job Loss Effects on Wage and Earnings

	Sweden		Denmark		Austria		France		Italy		Spain		Portugal	
Panel A: Log-daily wage														
Δ in unempl. rate	-0.022	-0.008	-0.012	-0.005	-0.007	-0.009	-0.017	-0.010	-0.039	-0.020	-0.010	-0.005	-0.011	-0.005
	(0.004)	(0.004)	(0.003)	(0.003)	(0.005)	(0.004)	(0.007)	(0.007)	(0.020)	(0.019)	(0.004)	(0.003)	(0.002)	(0.002)
Employer FE	-0.032	0.555	-0.316	0.160	-0.500	0.051	-0.042	0.207	-0.178	0.038	-0.261	0.120	-0.121	0.142
	(0.036)	(0.036)	(0.010)	(0.011)	(0.015)	(0.015)	(0.022)	(0.022)	(0.011)	(0.011)	(0.024)	(0.024)	(0.013)	(0.012)
Worker FE	0.019	-0.040	-0.352	-0.402	-0.192	-0.326	0.030	-0.076	-0.086	-0.178	-0.081	-0.221	-0.064	-0.170
	(0.010)	(0.010)	(0.006)	(0.006)	(0.008)	(0.008)	(0.012)	(0.012)	(0.009)	(0.009)	(0.019)	(0.017)	(0.006)	(0.006)
Δ in employer FE		1.280		0.820		0.840		0.599		0.563		0.829		0.887
		(0.023)		(0.009)		(0.010)		(0.017)		(0.010)		(0.022)		(0.011)
No. of observations	52,479	52,479	73,794	73,794	26,885	26,885	13,122	13,122	25,688	25,688	5,581	5,581	47,375	47,375
Mean dep. var.	-0.058	-0.058	-0.053	-0.053	-0.127	-0.127	-0.052	-0.052	-0.056	-0.056	-0.137	-0.137	-0.035	-0.035
Panel B: Yearly earnings														
Δ in unempl. rate	-0.021	-0.010	-0.021	-0.017	-0.004	-0.006	0.000	0.007	-0.081	-0.068	-0.012	-0.007	-0.014	-0.007
	(0.004)	(0.004)	(0.003)	(0.003)	(0.007)	(0.007)	(0.008)	(0.008)	(0.026)	(0.026)	(0.005)	(0.005)	(0.007)	(0.007)
Employer FE	0.071	0.549	0.005	0.257	-0.603	-0.055	0.088	0.300	-0.149	0.009	-0.262	0.081	-0.031	0.294
	(0.033)	(0.034)	(0.008)	(0.009)	(0.022)	(0.023)	(0.026)	(0.027)	(0.015)	(0.015)	(0.031)	(0.032)	(0.036)	(0.037)
Worker FE	0.095	0.047	-0.069	-0.095	-0.167	-0.301	0.173	0.083	0.005	-0.062	-0.091	-0.218	-0.153	-0.283
	(0.009)	(0.009)	(0.005)	(0.005)	(0.012)	(0.012)	(0.014)	(0.014)	(0.012)	(0.012)	(0.024)	(0.023)	(0.018)	(0.019)
Δ in employer FE		1.041		0.432		0.834		0.509		0.412		0.746		1.096
		(0.021)		(0.007)		(0.015)		(0.021)		(0.014)		(0.029)		(0.033)
No. of observations	52,480	52,480	77,549	77,549	26,886	26,886	13,152	13,152	25,688	25,688	5,581	5,581	47,367	47,367
Mean dep. var.	-0.067	-0.067	-0.064	-0.064	-0.147	-0.147	-0.061	-0.061	-0.091	-0.091	-0.195	-0.195	-0.060	-0.060

Notes: The dependent variable is the wage loss (Panel A) and earnings loss in percent from the pre-displacement level (Panel B) 3 years after job displacement. The baseline controls are: change in unemployment rate, quadratic time trends, firm size, worker's demographics, and employer and worker fixed effects. The individual fixed effects are obtained by subtracting the employer fixed effects from the average pre-displacement wages. The change in the unemployment rate is measured in percentage points. For each country, the second column includes as additional control the change in establishment effect. Section 4 discusses the results. Standard errors in parentheses.

Table A.5: Earnings Losses due to Displacement and Labor Market Institutions

Outcome: Effect of Job Loss on Post-Displacement Earnings				
	(1)	(2)	(3)	(4)
Share of active labor market policies (% labor market spending)	0.44	0.49	0.50	0.24
	(0.08)	(0.13)	(0.20)	
Labor market spending (% GDP)		0.86	1.14	0.29
		(1.35)	(2.83)	
Employment protection index (permanent)		-3.50	-0.79	
		(2.26)	(5.55)	
Unemployment benefits (replacement rate)		-0.04	-0.81	
		(0.27)	(0.30)	
Union coverage (%)		0.40	0.07	
		(0.24)	(0.34)	
Observations	132	132	132	132
Adj. R2	0.296	0.566	0.738	
Additional Controls	No	Yes	Yes	Yes
Country FE & Year FE	No	No	Yes	Yes
Lasso	No	No	No	Yes

Notes: The table presents results from a regression where the outcome variable is the estimated displacement effect on labor earnings 3 years after displacement, i.e. the coefficient θ_3 when estimating Equation 1 separately by country and year of mass layoff. The key explanatory variables are institutional features as measured in a given country–year-of-mass-layoff. ALMPs include spending on public employment service, training, employment incentives, and other re-employment programs. Additional controls represent average worker and employer characteristics (employer size, age, tenure, gender), macroeconomic controls (GDP per capita, unemployment rate, the share of involuntary part-time employment, and Gini ratio), as well as additional labor market institutions (the OECD indicator for employment protection for temporary jobs, and fraction of workers unionized). The last column reports OLS post-Lasso estimates, i.e., applies OLS to the variables selected by the Lasso when searching over the entire set of explanatory variables. Standard errors are clustered at the country level.

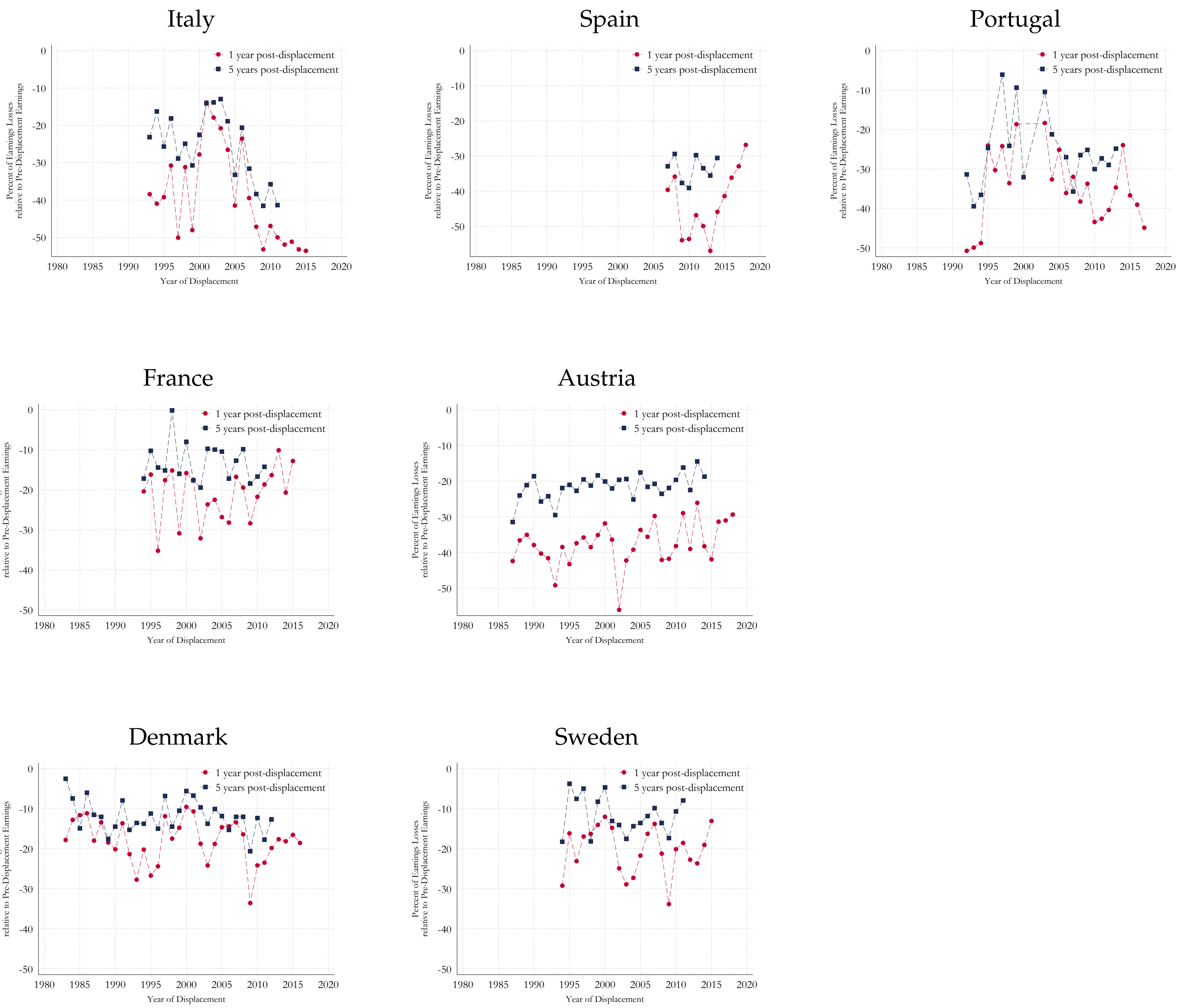
Table A.6: Labor Market Institutions and Job Loss Effects

Outcome: Earnings, Employment, and Wages in *t*=3									
	(1) Earnings			(2) Employment			(3) Wages		
	Baseline	% LM Spending	% GDP	Baseline	% LM Spending	% GDP	Baseline	% LM Spending	% GDP
Share of active labor market policies	0.50			0.29			0.22		
	(0.20)			(0.12)			(0.09)		
ALMP: Public employment services		0.45	15.57		0.52	18.25		0.54	22.38
		(0.74)	(14.23)		(0.80)	(20.45)		(0.28)	(6.40)
ALMP: Training programs		0.49	10.82		0.25	3.51		0.29	8.32
		(0.14)	(3.46)		(0.09)	(2.88)		(0.12)	(4.30)
ALMP: Employment subsidies		0.73	14.03		0.40	4.23		0.23	6.17
		(0.34)	(16.26)		(0.26)	(11.63)		(0.21)	(9.26)
ALMP: Other programs		0.22	-0.12		0.16	-1.39		-0.04	-5.24
		(0.35)	(13.09)		(0.31)	(11.23)		(0.18)	(3.69)
Passive labor market policies (% GDP)			-4.22			-3.47			-2.09
			(4.22)			(3.30)			(1.99)
Labor market spending (% GDP)	1.14	0.10		-0.71	-0.55		0.20	0.21	
	(2.83)	(3.60)		(1.64)	(2.68)		(1.87)	(2.19)	
Employment protection index (permanent)	-0.79	-1.81	0.31	1.30	-0.98	-0.61	-3.25	-4.12	-2.13
	(5.55)	(4.54)	(2.81)	(3.15)	(3.89)	(2.75)	(4.48)	(2.36)	(1.67)
Unemployment benefits (replacement rate)	-0.81	-0.80	-0.58	-0.45	-0.44	-0.35	-0.27	-0.27	-0.15
	(0.30)	(0.27)	(0.24)	(0.26)	(0.26)	(0.21)	(0.14)	(0.16)	(0.11)
Union coverage (%)	0.07	0.01	-0.13	-0.08	-0.05	-0.12	0.30	0.20	0.13
	(0.34)	(0.35)	(0.34)	(0.30)	(0.25)	(0.27)	(0.15)	(0.19)	(0.14)
Observations	132	132	132	132	132	132	132	132	132
Mean Dep. Var.	-21.5	-21.5	-21.5	-16.1	-16.1	-16.1	-8.5	-8.5	-8.5
Adj. R2	0.738	0.736	0.697	0.780	0.775	0.760	0.705	0.708	0.698

Notes: The table reports results from a regression where the outcome represents the effect of job loss on total labor earnings (Column 1), number of days worked (Column 2), and daily wages (Column 3), three years after displacement (as in Equation 1), i.e., the coefficient θ_3 after estimating equation (1) separately by mass-layoff year and country. The regression model in *Baseline* is as described in Column (3) of Table A.5. Model *% LM Spending* splits the share of active labor market policies, as % of labor market spending into four components: (i) public employment services, (ii) training programs, (iii), employment subsidies, and (iv) other programs. Model *% LM GDP* reports results when using total spending in ALMP as % of GDP (instead of % of total labor market spending) and removes GDP per capita from the set of controls. Standard errors are clustered at the country level.

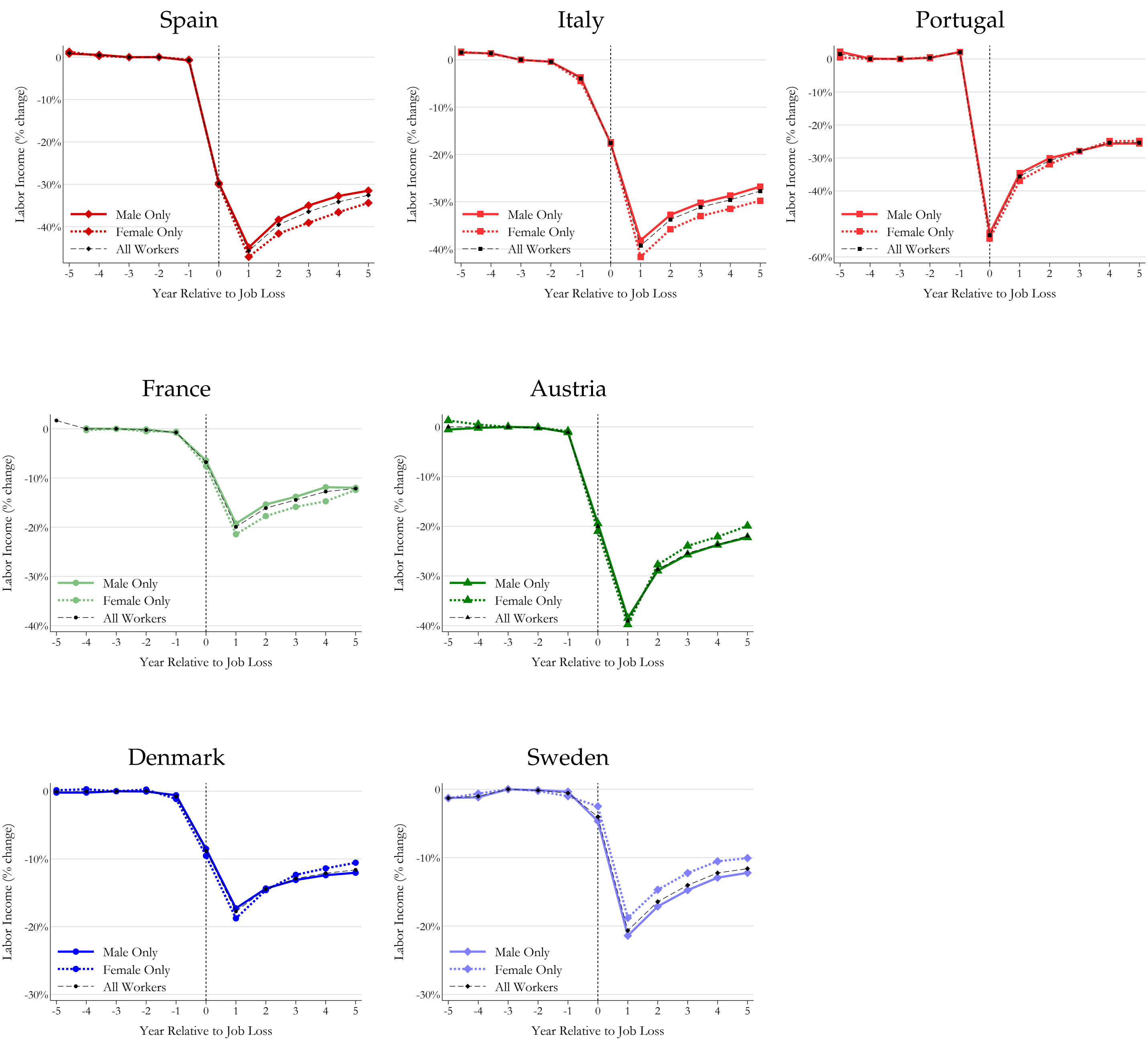
A.2 Figures

Figure A.1: The Effect of Job Loss on Earnings: Evolution for the last 25 years



Notes: The figure shows estimates of earnings losses spanning three decades (1990s-2010s) following job loss as defined in section 2. Each plot reports the point estimate – by year of job displacement – of labor earnings losses for the first and the fifth year following involuntary job loss, i.e. θ_1 and θ_5 of the difference-in-difference model (1). Section 3.2 discusses the results.

Figure A.2: Job Loss on Earnings: by Gender



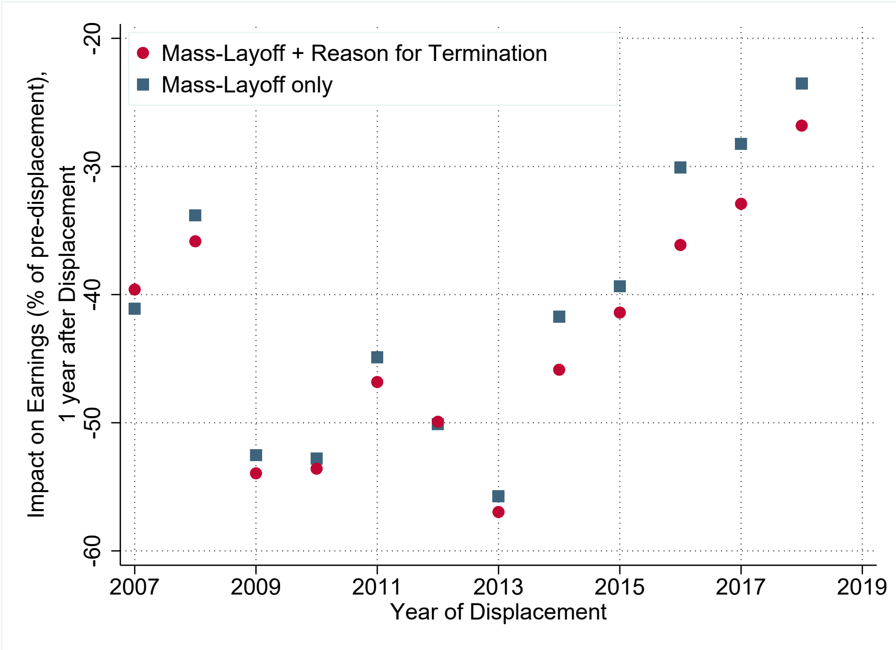
Notes: The figures shows regression coefficients for the difference between treatment and comparison groups, i.e., θ_k from the difference-in-differences model (1). The outcome variable is earnings at the end of the year. See Appendix C for a definition of the outcome variable by country. Section 3.2 discusses the results.

Figure A.3: Distribution of displaced workers across quintiles of firm effects before job displacement

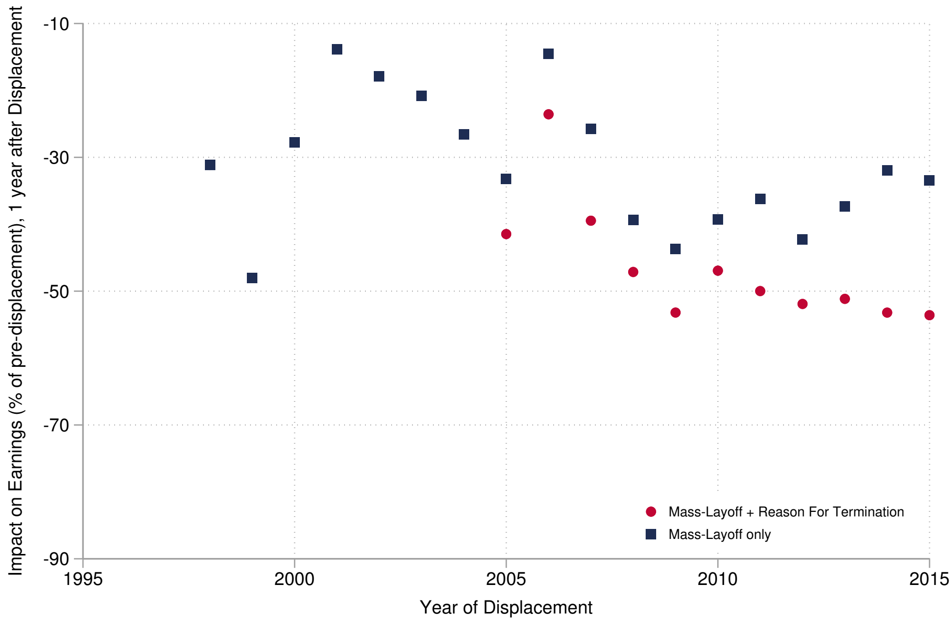
Notes: Share of workers by quintiles of wage AKM employer fixed effects measured right before displacement.

Figure A.4: Comparing Mass Layoffs Definition for Spain and Italy

(a) Spain: Loss in Earnings, 1 Year Following Layoff



(b) Italy: Loss in Earnings, 1 Year Following Layoff

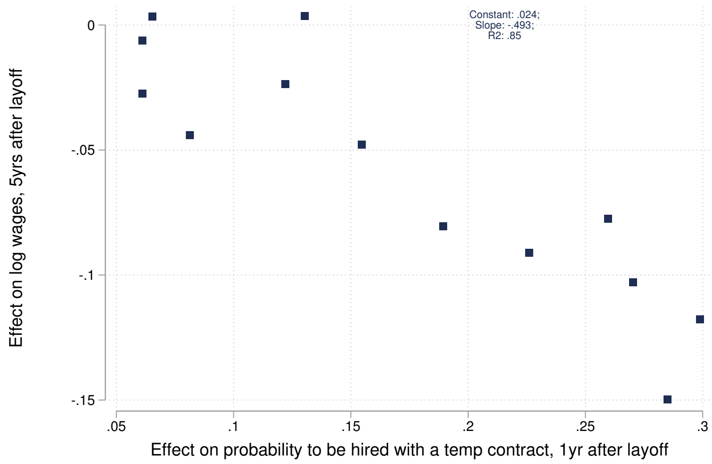


Notes: The figure displays the trends in earnings losses for Italian and Spanish displaced workers using alternative definition for a mass-layoff. See section C.4 and section C.6 for details.

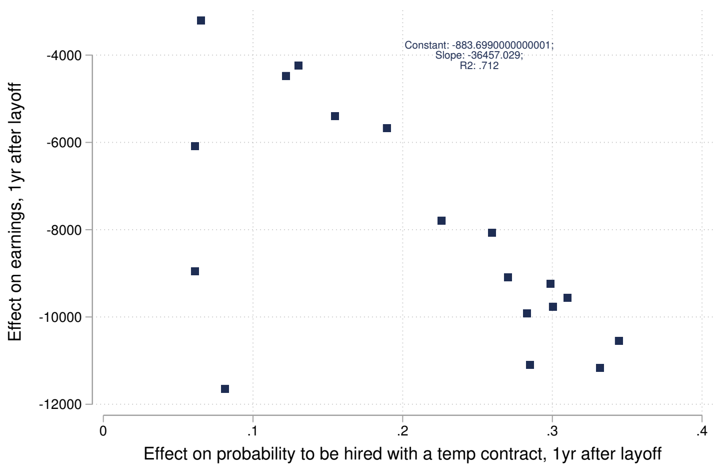
Figure A.5: Explaining Trends in Pay Losses for Italian Displaced Workers

(a) Loss in Log Wages, 1 Year Following Layoff

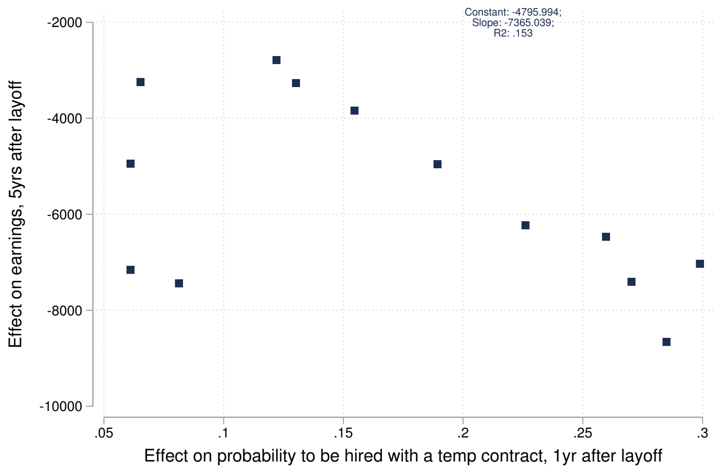
(b) Loss in Log Wages, 5 Years Following Layoff



(c) Loss in Earnings, 1 Year Following Layoff



(d) Loss in Earnings, 5 Years Following Layoff



Notes: Each panel shows the displacement effects on either log wage or earnings, 1 or 5 years following the layoff for different cohorts of displaced Italian workers. We overlay to these coefficients the estimates that we obtain on the probability that the first job after displacement is on a temporary job: Finally, we display the results from a simple linear fit for each panel, weighting each square in the scatter-plot by the number of displaced workers observed in a given year. Section C.4 provides details on the institutional Italian context.

B Sample Construction

This section provides additional information on the construction of the main sample (section 3) and sample for analyzing the role of employers (Section 4) and institutions (Section 5).

B.1 Main Sample

We do not restrict workers from the control group and the treated group to be observed from t^* onwards in order to avoid conditioning on future outcomes. We connect all employment spells at the same establishment in case workers have multiple employment spells during the year.

Treated group. We do not consider workers that find a job in the same firm to be displaced. We control for transitions that follow from change of establishment identifiers due to mergers, split-ups etc. Specifically, we do not allow more than 20 percent of the displaced workers to be reemployed together at the same establishment in the following year. Leaving workers are either non-employed or dispersed to different establishments. Mass-layoff events do not include a "stability" requirement, i.e., employment can increase before or after the drop in mass-layoff event. Treated workers can be treated only once.

Control group. Control workers are never treated, which circumvents heterogeneity issues (e.g., de Chaisemartin and D'Haultfoeuille (2020)). However, they are allowed to be coworkers of employees displaced due to a mass layoff, or can be laid off in a given year but not during a mass layoff. Control workers can be used as control only once.

B.2 The Role of Employers

B.2.1 Sample to estimate employer fixed effects

To limit the extent of noise in the fixed effects estimation, we restrict the samples to workplaces with at least three employees at least once in their histories. Also, to limit the concern that job loss itself contributes directly to the estimates of establishment effect in the AKM model, we exclude treated and control workers from the AKM estimation. Limited mobility of workers across employers can lead to imprecise estimates of establishment fixed effects. This is a first-order concern when performing variance decomposition exercises, which we do not do (see, e.g., Kline et al., 2020; Bonhomme et al., 2020). For all countries, we are able to estimate establishment fixed effects for most of the main jobs before and after the relative year of the event t^*.

B.2.2 The cyclicality of wage losses and employer quality

To further investigate the importance of employers in explaining the costs of job loss, we follow Schmieder et al. (2020). First, we compute individual-level job loss effects before and after job displacement for each treated–matched control worker pair (between $t^* - 3$ and $t^* + 3$) as follows:.

$$\Delta_{dd} y_{it} = (y_{i,T,t^*+3} - y_{i,T,t^*-3}) + (y_{i,C,t^*+3} - y_{i,C,t^*-3}),$$

where $\Delta_{dd} y_{it}$ is an estimate of the individual treatment effect from job loss.

Then, we regress the individual-level job loss effect on the unemployment rate and on additional displaced workers' controls. The set of control characteristics is: female, tenure, age, employer size, quadratic time trends, worker fixed effects, and employer fixed effects. The individual fixed effects are obtained by subtracting the employer fixed effects from the average pre-displacement wages.[12] The effect of the aggregate annual change in the unemployment rate (from $t^* - 1$ to t^*) on wage losses is captured by β. As the mean of the dependent variable, $\Delta_{dd} y_{it}$ is negative (ranging from -0.061 in France to -0.195 in Spain, see Table A.4), where a negative estimated coefficient indicates that a one percentage point increase in the unemployment rate *increases* wage losses, i.e.,

$$\Delta_{dd} w_{ic} = \beta \Delta UR_c + \gamma \hat{\psi}_{J(i,c)} + \delta \hat{\alpha}_i + X_i \theta + c\pi_1 + c^2 \pi_2 + \varepsilon_{ic} \tag{A.1}$$

Table A.4 shows that variation in unemployment rate at the time of job loss statistically and economically impacts wage losses.[13] In Italy, a 2 percentage point increase in the unemployment rate predicts wage loss increases of around 8 points, compared to an average loss of 9%. An increase of more than 50% of the wage loss is not specific to Italy, as similar magnitudes are estimated for France and Sweden. Interestingly, a similar magnitude is reported in Schmieder et al. (2020) on German data.

Once we include the change in employer fixed effects as additional control, $\xi \Delta_{dd}$, as in model A.2, the conclusion is drastically different.

$$\Delta_{dd} w_{ic} = \beta \Delta UR_c + \gamma \hat{\psi}_{J(i,c)} + \delta \hat{\alpha}_i + \xi \Delta_{dd} \hat{\psi}_J + X_i \theta + c\pi_1 + c^2 \pi_2 + \varepsilon_{ic} \tag{A.2}$$

In all countries but Austria, the magnitude of the effect decreases by 50%. And, in most cases, the effect is not statistically significant. This finding clearly indicates that across Europe the reallocation of workers to worse paying-employers in recessions explains the cyclicality of job loss. Even if post-displacement establishment characteristics are endogenous, this correlation, which is empirically verified in many European economies, provides useful information for empirical model builders that seek to understand the cyclicality of wages over the business cycle (e.g., Lise and Robin (2017)).

Additionally, we find that estimating displaced workers with higher fixed effects, calculated by subtracting the employer fixed effects from the average pre-displacement wages the employer fixed effects, increases wage losses. This result relates to the finding of Mueller (2017). It deserves and warrants additional investigation.

[12]Our construction of the worker fixed effects differs from Schmieder et al. (2020), which imply that we cannot easily compare results.

[13]We do not find that variation in the employment rate has an an effect on wage losses Austria. This result can be explained by the fact that there has been little variation in the unemployment rate, ranging from 4% to 6%, in the past 20 years.

B.3 The Role of Labor Market Institutions

We use three group of variables. First, we control for macroeconomic conditions. Then, we include a set of variables related to labor market institutions, and finally we include displaced worker characteristics from the harmonized matched employer–employee dataset.

B.3.1 Macroeconomic conditions

We include the following controls: (i) share of involuntary temporary employment, (ii) change in the unemployment rate, (iii) GDP per capita, (iv) Gini Index from the World Income Database.

B.3.2 Labor market institutions

We follow Boeri (2011) and include the main labor market institutional features: the strictness of employment protection legislation, the generosity of unemployment benefits, the scope of active labor market programs and proxy for wage setting.

Employment protection. There is large variation in terms of legislation to conduct business in general in our sample. For instance, out of 34 countries, the World Bank ranks Denmark 2 in the ease of doing business, while Italy is ranked 31.

- We use the OECD indicators of the strictness of regulation for both permanent and temporary contracts. Data range from 0 to 6, with higher scores representing stricter regulation.

Unemployment insurance. Unemployment insurance typically varies according to the duration and generosity of benefits (Schmieder and Von Wachter, 2016).

- We use the OECD gross replacement rate at 2 months for single workers, evaluated at the average worker. [14]
- We measure duration of unemployment using the Comparative Welfare Entitlements Datasets (Scruggs et al., 2017). Duration of unemployment benefits (`UEDUR`) is defined as months of benefit entitlement excluding means-tested assistance.

Active and passive labor market policies. We use public expenditure on labor market policies, which contains passive and active policies, as a percentage of GDP. We split active labor market policies (ALMP) into four different categories:

- *Public employment service and administration*: Placement and related services, and benefit administration.

[14] We use the historical gross replacement rate before 2000 and the current series. All values are calculated before taxes and social security contribution payments. Calculations exclude family benefits, social assistance, housing benefits, as well as in-work benefits.

- *Training*: Institutional training , workplace training, integrated training, special support for apprenticeship.
- *Employment incentives*: Recruitment incentives, employment maintenance incentives, job rotation and job sharing.
- *Other ALMP*: Sheltered and supported employment and rehabilitation, direct job creation, and start-up incentives.

Passive policies include: out-of-work income support and early retirement. The data source is the OECD labour Market Programs database.

Collective bargaining. We use union density and coverage to measure the prevalence of collective bargaining.

B.3.3 Displaced workers and employers' characteristics

To limit the influence of composition effects, we include: (i) age of worker, (ii) share of females, (iii) size of the previous employer, and (iv) tenure of displaced workers.

C Background: Institutional Settings and Data Sources

We harmonize the sample construction to make our cross-country variables of interests as comparable as possible. This section reports the details of data sources and key institutional features. In particular, we report the population of firms and workers, and how labor earnings, days worked, and employer size are measured.

Recall that the outcome variables are defined as follows (see 2.1). We define yearly labor earnings, deflated to 2010 EUR, as the sum of labor earnings (possibly from different employers) before taxation. Labor earnings include overtime, bonuses, and severance payments when available. We do not have information on hours worked for all countries. Wages are defined as daily earnings from the main employer, and are computed as labor earnings over days worked. The main employer is the establishment at which annual earnings is the largest. We connect all employment spells at the same establishment in case workers have multiple employment episodes during the year.

C.1 Austria

Data Sources We use the administrative records (AMDB) from the social security administration from 1984 through 2019. This data comprises daily information on all jobs and unemployment spells covered by social security (Zweimuller et al., 2009). It contains information on yearly earnings for each worker-establishment pair. The data does not contain information on hours worked. It further contains basic sociodemographic information at the worker level. Each establishment has a unique identifier that allows us to study changes in employer specific characteristics over time. The self-employed and public servants are not reported.

Definition of main variables

- *Employees:* Earnings are the sum of gross labor earnings across all yearly employers.
- *Employers:* The data only contain establishment identifiers, not firm identifiers, hence we cannot delete workers that are considered to be displaced but move to the same firm.

Institutional Settings on Layoffs Employers with more than 20 employees are obliged to notify the Austrian public employment service (AMS) if they intend to collectively dismiss more than a certain number of employees, where the exact threshold depend on firm size. Furthermore, firms and work councils must agree on a social plan, which can include voluntary severance payments, financial interim aid, reimbursement of costs for education, training or job interviews. Until 2002, long-tenured workers were eligible for severance pay. The Employees Income Provision Act in 2003 eliminated severance pay and replaced it with monthly employer contributions into pension accounts accessible during unemployment spells. See Kettemann et al. (2017).

Related studies Gulyas and Pytka (2020) is the closest paper. They use a recent machine learning method to uncover the sources behind job loss. They find that the main sources behind job losses are related to employer specific factors (AKM firm's wage premiums and the availability of well paying jobs in the local labor market).

C.2 Denmark

Data Sources Our main data source is the `IDA` dataset from 1980 to 2018, provided by Denmark Statistics. IDA contains the universe of Danish residents with establishment and firm identifiers. There is no information on job separations, nor on contract type (temporary or permanent). The data source changed in 2008, which impacts the computation of the days worked and labor earnings variables.

Definition of main variables

- *Employees:* Earnings comprise all salary-related income in a year.
- *Employers:* The number of employees in the establishment on November 28th is used as establishment size. Industry group follows the NACE classification. Public sector employers include the state and municipalities.

Institutional Setting Employers have to inform the local authorities and start negotiating with a worker representative in cases of mass layoffs. Notice periods and severance payments vary from one to six months, depending on workers´ tenure. In the event of large mass layoffs, special funding (*Varslingspulje*) is granted to local job centers. The OECD (2016a) and the European Restructuring Monitor website provide further explanations of the institutional setting.

Unemployment insurance is voluntary. Low-income members of the insurance system receive benefits worth 90% of their pre-unemployment salary, but the replacement rate is lower for middle and top income groups. For an average production worker, the replacement rate is less than 50% (see Andersen et al. (2020)). A string of reforms changed labor market policies in the mid-1990s (see Andersen and Svarer (2007)).

Related Studies Roulet (2021) finds a similar impact of job displacement using plant closure as the displacement event. In contrast, Bennett and Ouazad (2019) find larger impacts.

C.3 France

Data Source We use the dataset `DADS` that includes a sample of salaried workers from 1991 to 2018. The dataset is provided by the CASD. Until 2001, the sample corresponds to a 1/25 random sample. Starting in 2002 the sample was doubled. The dataset contains establishment and firm identifiers, and records public sector jobs. The panel does not follow workers outside salaried jobs (e.g., self-employed workers).

Definition of main variables

- *Employees:* Earnings include all payments to workers; profit-sharing schemes, employee savings schemes, severance payments and perks.
- *Employers:* The number of employees in the establishment on December 31st is the establishment size. Industry classification is based on a 5 group economic activity category.

Institutional Setting A plan that aims to reduce the numbers of layoffs is mandatory in firms with more than 50 employees, in which at least 10 employees will be laid off within 30 days. Legal severance pay comes to approximately 25% of the monthly reference wage. Severance payments can explain the increase of daily wages in t=0 reported in Figure 1.

Unemployment benefits end after 24 months for workers below 50 years old, and the net (and constant over the unemployment spell) replacement rate is 71%. Special benefits are granted to displaced workers. They can increase the replacement rate to 100% of the previous net salary for one year, with special counselling and training.

The French labor market has become segmented over the last three decades, with an increase of jobs under fixed-term contracts. Moreover, part-time unemployment (*Activité Réduite*) is increasingly used (Benghalem et al., 2021).

Related Studies Royer (2011), Frocrain (2018) and Brandily et al. (2020) evaluate the impact of establishment closures on workers. Brandily et al. (2020) identify job losses from two samples: *1.* workers that receive unemployment insurance as "laid-off for economic reasons" and *2.* workers employed in establishments that close. They document a long term reduction of 36% of earnings ($\approx$ 15 % in sample 2.) and 11% of hourly wages ($\approx$ 6 % in sample 2.). The firm (AKM) wage premium explains 84.5% (sample 1) and 95.5 % (sample 2) of the long-term hourly wage losses.

C.4 Italy

Data Sources The main data source is derived from social social security records stored by the Social Security Institute (Istituto Nazionale Previdenza Sociale, INPS). This dataset, which we label INPS-LOSAI, contains roughly 6.5% of the universe of workers present in the universe of INPS records. The panel records all employment spells in salaried-jobs. Therefore, attrition can be due to self-employment or employment in the public sector. Information on whether a job is under temporary contract and the reasons behind a job termination is available since 1998 and 2005, respectively.

Definition of main variables

- *Employees*: Earnings includes base labor earnings, regular benefits (based on seniority) and irregular benefits (e.g., profit distributions, premiums at the firm level, holiday bonuses are also included). Earnings are top coded at roughly the 99.5 percentile (Hoffmann et al., 2021).
- *Employers*: Yearly information on employer size is collected within the LOSAI dataset in various bins (0-5, 6-10, 11-15, 16-20, 21-25, 26-30, 31-40, 41-50, 51-100, 101-200, 201-300, 301-400, 401-500, 500). We take the midpoint in each bin and define that as the employer size for a given year. An employer is defined based on the employer identifier provided by INPS. As in Spain (see below), we consider an employer to be involved in a mass layoff when one of these two situations occurs: (i) when the employer experiences a reduction in the number of workers employed of more than 30% relative to the previous year or (ii) the reason of job separation given to INPS by the employer is “firing for economic reasons" which represents scenarios in which the employer is laying off part or all of its workforce because of financial difficulties. Below we show that similar earnings losses are obtained using only (i).

Institutional settings Employment legislation surrounding layoffs typically applies to firms that have more than 15 employees (Kugler and Pica, 2008). Sectoral bargaining agreements might provide specific criteria on which workers should be subject to the layoff. Prior to the layoff, it is typical to observe some workers receiving zero hours contracts (Giupponi and Landais, 2020). Following the layoff, the worker receives the so-called “trattamento di fine rapporto (TFR)" which is calculated as a full year of salary divided by 13.5 plus approximately 1.5% for each year of tenure.

Related Studies The closest paper to our study using Italian data is Mossucca (2016). She estimated job displacement effects using INPS data. However, she does not have information on firm-size and, therefore, uses worker-level information on whether workers were assigned to zero-hours contracts to proxy for mass-layoff events.

Downward Trend in Pay Losses during the 2000s Earnings losses for Italian displaced workers appear to experience a downward trend during the 2000s.

It is worth investigating the causes of this particular downward trend. One concern is that this trend is artificial: from 2005, the traditional definition of mass-layoff is combined with direct information from INPS on which jobs were terminated for economic reasons. This might change the composition of workers in our mass-layoff samples thus causing a structural break in our estimates. Therefore, we re-compute the earnings losses over the years for Italy without using information on job termination. The results are displayed in Figure A.4. We see a broadly similar trend to our baseline figure during the 2000s.

We then move into a more structural interpretation for this finding. The decade 2000-2010 is a period of profound transformations of the Italian labor market. The landmark of this process of transformation is the dualization of employment contracts. Temporary employment contracts were liberalized during this period. This liberalization was achieved while maintaining rigid levels of employment protection for permanent contract workers (Boeri, 2011; Daruich et al., 2020).

This leads to the question: Are Italian workers who were displaced in the 2000s experiencing larger earnings losses because they are more likely to have a temporary job following a job loss? Figure A.5 overlays the event study coefficients on earnings and wage losses experienced by workers displaced in different years with the event study of the probability that the first job obtained after a layoff is on a temporary employment contract. It appears that the effect on the share of displaced workers obtaining a temporary job following displacement predicts wage and earnings losses well, both in the short and long-run. The negative association between earnings losses and temp-share following displacement also suggests that these contracts did not help workers find jobs following displacement. Instead, a substitution effect appears to dominate: displaced workers are increasingly more likely to obtain a temporary job (as opposed to a permanent one) and this causes significant wage and earnings losses both in the short and in the longer run.

In conclusion: the downward trajectory in pay losses appears to be due in part to by changes to Italian institutions that facilitated the hiring of workers on a temporary basis. This finding echoes the ones in Woodcock (2020) who found that German workers displaced after the passage of the so called Hartz-reforms experienced (i) larger wage losses (ii) a substantial part of these wage losses is due to workers increasingly sorting into temporary jobs.

C.5 Portugal

Data Sources The main data source is the *Quadros de Pessoal* (hereafter QP) for the 1987-2018 period.[15] The data are gathered annually by the Portuguese Ministry of Employment through an questionnaire that every establishment is obliged by law to fill in. The dataset does not cover the public administration and non-market services, whereas it covers partially or fully state-owned firms The dataset covers virtually the entire population of firms. The dataset contains a snapshot of firms' employment in October each year. It contains information on industry (NACE 2), hiring date, the kind of job contract (fixed-term or open-ended), the effective number of hours worked, and different types of compensation. This implies that jobs (hence earnings, days worked and daily wages) are not recorded for a worker who is not employed in October. Finally, due to the fact that the year 2001 is missing from the QP at worker level, we exclude the years 2000 and 2001 as possible treatment years. We also remove from the treatment years the year 1999, due to the disproportionate and implausible amount of displaced workers who disappear from the dataset compared to other years, which

[15]We are grateful to Pedro Raposo for his help to access to the data.

makes the year a clear outlier. See Acabbi et al. (2021) for additional details about the data source.

Definition of main variables

- *Employees:* Earnings include base earnings, regular benefits (based on seniority) and irregular benefits (profit distributions and premiums). Earnings do not contain severance payments.
- *Employers:* Number of employees in establishments are measured at the end of October. The definition of a mass layoff is based on the variation in employment from October to October each year.

Related studies The closest paper to our study using Portuguese data is Raposo et al. (2021). They evaluate the sources of wage losses of workers displaced from 1988 to 2011, with different sample restrictions. They find that sorting into lower paying job titles represents the largest component of the monthly wage loss of displaced workers, accounting for 37% of the total average monthly wage loss compared to 31% for the firm and 32% for the match effects.

C.6 Spain

Date Source We use administrative data from the Continuous Sample of Working Histories (*Muestra Continua de Vidas Laborales*, MCVL) for the period 2005-2019, provided by the Spanish Social Security Administration. This sample is a 4% random draw from the universe of Social Security records, employed and unemployed workers in the reference year. This sample also offers retrospective information of the entire labor history of workers. Around one third of the public sector employees are not included in the sample (excluded from the General Regime of the Social Security).

The dataset contains monthly information on the number of days worked, the kind of job contract (open-ended or fixed-term) and the working time (whether full-time or part-time job, and the fraction of working time) for all employers. Hours worked are not available.

Definition of main variables

- *Employees*: Earnings refer to the monthly contribution to Social Security that can be top- and bottom-coded, including annual bonuses and excluding overtime hours and severance payments. The minimum and maximum limits vary by workers and over time, depending on the minimum wage and inflation. The data also provides information on total yearly earnings (i.e., not top and bottom coded) coming from tax records. As a robustness check, we have reestimated the costs of job loss in earnings and wages to assess that the results are almost identical statistically when we use information on total taxable labor earnings for the period with both income sources available. They only differ significantly in the pre-displacement year ($t^* - 1$) and in the year of mass layoff (t^*) as earnings from tax records include severance payments.

- *Employers*: The number of employees in an establishment is available for the month of April one year later. Hence, we redefine our reference year in our analysis from May to April of next year. This makes the yearly information on the number of employees in an establishment coincide with the end of the reference year (for instance, year 2018 in our analysis covers from May of the calendar year 2017 to April of 2018).

  An employer is involved in a mass layoff when one of these two situations occur: (i) the reason for job separation given to Social Security by firms is a permanent collective dismissal (*Expediente de Regulación de Empleo*, ERE) or (ii) when the establishment experiences a reduction in the number of workers employed in more than 30% with respect to the previous year. Figure A.4 shows that estimates of earnings losses are similar with or without using the condition (i) (*ERE*).

Institutional Setting Firms must ask for authorization for a collective dismissal when the number of dismissed workers exceeds a certain threshold in a three-month period depending on the initial firm size (*Expediente de Regulación de Empleo*, ERE). In collective dismissals, the legal severance payments are the salaries of 20 days per year worked with a maximum level equal to 12 months earnings. In cases of unfair dismissals of permanent workers, severance payments are the earnings of 33 days per year worked with a maximum payment of 24 months, In cases of fixed-term contracts, it is 8 days per year worked and 12 days since 2015 (see Barceló and Villanueva (2016)). The maximum duration of unemployment benefits is 24 months. The replacement rate of unemployment benefits is 70% of the contribution base in the first 6 months and 50% after. The amount of unemployment benefits vary between 527.24€ and 1,482.86€ in 2019. The use of fixed-term contracts is very high in Spain. Since 2015, the maximum length of a short-term contract is three years that can be extended one year more in some cases.

Related studies Garda (2012) finds wage drops in the long run of roughly 10% for permanent contract and 5% for fixed term contract. Garcia-Cabo (2018) also studies wage losses, but the sample restriction is different.

C.7 Sweden

Data Sources We use the RAMS matched employer–employee database from Statistics Sweden (SCB). The database contains full population-level information on the gross labor earnings paid for each employment spell (public and private sector jobs). RAMS does not provide information on the reason for layoffs nor on the nature of the contract. We complement the employment information with socioeconomic characteristics from the LOUISE dataset (SCB). RAMS is also used to compute firm size and employer in November.

Definition of main variables

- *Employees:* Earnings is the sum of gross labor earnings across all employers.

  The employment spells are used to compute the number of days employed at the primary employer (by multiplying the corresponding number of months worked by 30) and the daily earnings at the primary employer.

Institutional setting The Swedish institutional setting is similar in many respects to that of Denmark and other Nordic countries when it comes to unemployment insurance and active labor market programs. The Swedish model integrates flexibility for employers and security for employees. Workers can *voluntarily* insure against job loss, which gives them eligibility to receive unemployment benefits. The unemployment insurance system is characterized by conditionality: unemployment benefits can be subject to suspension if jobseekers do not fulfill the job search requirements (see Lombardi 2019).

Job security councils help workers who lose their jobs during mass layoffs to transition towards a new job. The transition services provided include training and start-up support to employees.

One specificity of the Swedish system in the case of mass layoffs is a set of rules that go under the name LIFO ("last-in-first-out"; see OECD, 2016b). This implies that workers with lower tenure leave the firm first, whereas longer-tenured workers are laid off at a lower priority. In practice, firm-level bargaining can imply deviations from LIFO rules. OECD (2016b) gives an overview of the institutional setting.

Permanent contracts are the main rule. Fixed-term employment contracts must be provided by law or collective agreement.

Related studies Eliason and Storrie (2006) study long-term effects of job displacements in 1987 up to 12 years later. The lack of post-displacement earnings recovery is attributed to the 1990s Swedish financial crisis. Seim (2019) studies displacement effects in Sweden for displacements in 2002–2004 by using information that allows resignations to be distinguished from actual displacements. Five years after displacement, our earnings loss effects are similar to those in Seim (2019), both in levels (around 4,000 Euros in 2010 currency) and as percentage change from the pre-displacement level (about 10% losses).

Cederlöf (2021) provides job loss estimates using a mass layoff design similar to the one we implement.

D Related Literature

This section reviews recent theoretical frameworks and empirical work. See Carrington and Fallick (2017) for a review.

D.1 Job Displacement

D.1.1 Theoretical framework

Key ideas. Some models are based on *loss of skills*. Loss of skills can be split into two categories. First, firm-specific skills are acquired over time during the employment spell and are mainly valuable in the current job (Becker, 1964; Lazear, 2009). Second, general skills can be lost over the unemployment period (Pissarides, 1992; Ljungqvist and Sargent, 1998). In the class of search models, *losses in firm rents or match components* explain earnings losses. Over the employment spell in search models, wages rise with tenure as wages are renegotiated (Cahuc et al., 2006), or simply through commitment

(Burdett and Coles, 2003). In job matching models, such as in Jovanovic (1979), workers lose a fixed component of their wage which is specific to a match. Recent models combine some of those mechanisms. For instance, see Krolikowski (2017), Jarosch (2021), Huckfeldt (2021) and Burdett et al. (2020).

D.1.2 Empirical Evidence

US evidence. Davis and Von Watcher (2011) report a range of earnings losses going from -18% to -25% depending on displacement years (see Hall (2011) for a discussion). Lachowska et al. (2020) study displacement events from 2008-2010 for Washington State. They find a reduction of 15% in earnings, 2.7% in hours worked and 4.9% in hourly wages up to five years after the event. Match effects, as in Woodcock (2015), explain 57% of the job loss, while AKM firm fixed effects explain 17%. In their sample, the AKM firm fixed effect is not important as 70% of workers move to a better or same AKM quintile firm. Using Ohio data, Moore and Scott-Clayton (2019) report that between 16 and 24% of long-run earnings losses is explained by firm rents.

European evidence. Schmieder et al. (2020) study job displacement in 1980-2009 in Germany and find a 10% decrease in earnings up to 10 years after displacement. In contrast to evidence based on U.S data, they conclude that a large part of wage losses and a substantial degree of their cyclicality can be explained by the reduction of average wage levels of new employers. Schmieder et al. (2020) find that, going from peak to trough of the business cycle in Germany raises short-term earnings losses from -13% to -25%, similar in magnitude to Davis and Von Watcher (2011). Fackler et al. (2021) shows that wage losses for plant closures in Germany depend on pre-displacement plant size. Raposo et al. (2021) study job loss in 1988-2014 in Portugal. In their sample, 46% of the wage loss is due to sorting into lower paying jobs, 27% of the loss due to match effects, and the remaining 27% is accounted for the drop in employer fixed effects. OECD (2018) reports earnings losses using a mix of survey and administrative data over the period 2000 to 2005 for several OECD countries.

Comparing existing evidence. It is not possible to compare the above-mentioned results because they apply different econometric models and impose different sample restrictions. This point is illustrated in Table 1. In terms of methods, Raposo et al. (2021) estimate an AKM model, but include job titles, that blend skill requirements of the worker and the bargaining power of the workers' organizations. Sample selection also greatly differs across the papers mentioned above. For instance, the set of comparison workers are different across studies. Schmieder et al. (2020) build their control as workers that do not leave the firm up to $t = 0$, while Lachowska et al. (2020) restrict to at least $t = 4$. Previous research shows that different comparison groups lead to different earnings losses (Krolikowski, 2018; Cederlöf, 2021).

D.2 Labor market Institutions

Labor market institutions. Boeri (2011) and Bentolila et al. (2019) review the literature on institutional reforms and labor market performance. The impact of institutions has been evaluated using aggregate data across countries (Lazear, 1990)[16], and within-country quasi-experimental variation at the firm-level and at the worker-level (Autor et al., 2007; Daruich et al., 2020). Garcia-Cabo (2018) quantifies the impact of the job loss in dual labor markets.

International comparison of wage dynamics. Card et al. (1996) is one of the first studies to use micro data in a cross-country design. Kuhn and et al (2002) compare wage dynamics following job loss using matched employer-employee datasets. Criscuolo et al. (2020) quantify the role of firms in explaining wage inequality.

Passive and active labor market policies. Andersen and Svarer (2007) argue that that active labour programs are key for a high-performing labor market. Card et al. (2018) examine the impact of 207 ALMP studies, and find a long run (2+ years) impact on employment probability of between 5 and 12 percentage points. Using survey data in 13 European countries, Andrews and Saia (2017) find that higher spending on ALMPs can improve the re-employment prospects of displaced workers.

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