Online Appendix

The Unequal Consequences of Job Loss across Countries

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A Additional Tables and Figures

A. Tables

Table A.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, Schmieder and Weber (2020)	Austria	1990-2007	1	Mass layoff	10	Male	No	-20%
Bennett and Ouazad (2020)	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, Hémet and Malgouyres (2020)	France	2002-2012	2	Reason for Separation	–	Both	No	-36%
Schmieder, Von Wachter and Heining (2023)	Germany	1975-2005	3	Mass layoff $\geq$ 30%	50	Male	No	-20%
Fackler, Müller and Stegmaier (2021)	Germany	2002-2014	3	Reason for Separation	–	Male	No	-12%
Leombruni, Razzolini and Serti (2013)	Italy	1989-1994	3	Plant closure	–	Both	No	-9%
Mossucca (2016)	Italy	2005-2010	6	Mass layoff	–	Both	Yes	-9%
Carneiro and Portugal (2006)	Portugal	1991-1998	3	Plant closure	–	Both	Yes	-6%
Raposo, Portugal and Carneiro (2021)	Portugal	1988-2014	2	Plant closure	20	Both	No	-27%
Garcia-Cabo (2018)	Spain	2005-2015	1.5	Reason for separation	–	Both	Yes	-32%
Garda (2012)	Spain	1999-2004	3	Reason for separation	5	Male	No	-25 %
Eliason and Storrie (2006)	Sweden	1987-1988	–	Plant closure	10	Both	No	-11%
Seim (2019)	Sweden	2002-2004	1.5	Reason for separation	5	Male	No	-15%
Jacobson, LaLonde and Sullivan (1993)	USA	1974-1986	6	Mass layoff $\geq$ 30%	50	Both	Yes	-25%
Lachowska, Mas and Woodbury (2020)	USA	2002-2014	6	Mass layoff $\geq$ 30%	50	Both	Yes	-17%

Notes: Selection of papers studying the labor market consequences 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 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.

Table A.2: Earnings Effects with Alternative Control Groups

	Baseline		Alternative	
Denmark				
$k = 1$	-17.85	(0.155)	-25.47	(0.140)
$k = 5$	-11.52	(0.196)	-25.29	(0.171)
Sweden				
$k = 1$	-19.61	(0.240)	-24.73	(0.220)
$k = 5$	-11.40	(0.329)	-19.83	(0.311)
Austria				
$k = 1$	-39.00	(0.247)	-45.78	(0.277)
$k = 5$	-21.96	(0.297)	-36.00	(0.296)
France				
$k = 1$	-19.56	(0.431)	-25.33	(0.390)
$k = 5$	-12.25	(0.626)	-25.32	(0.542)
Italy				
$k = 1$	-39.58	(0.386)	-63.44	(0.496)
$k = 5$	-27.86	(0.507)	-77.22	(0.537)
Spain				
$k = 1$	-45.71	(0.551)	-53.71	(0.503)
$k = 5$	-32.56	(0.672)	-51.21	(0.556)
Portugal				
$k = 1$	-35.45	(0.286)	-44.49	(0.273)
$k = 5$	-24.45	(0.332)	-27.38	(0.328)

Notes: Earnings losses 1 and 5 years after job displacement for different definitions of the control group (expressed in proportions with respect to the average pre-displacement labor earnings). t^* denotes year of job displacement. The *Continuously employed* control group is similar to that in Lachowska, Mas and Woodbury (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 used in our main analyses.

Table A.3: Decomposition of Job Loss Effect on Total Earnings

	Overall gap	Composition part					Unexplained part
		Worker	Employer	Business cycle	Time trend	Total	Total
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sweden	-0.006	-0.025	0.003	0.000	-0.000	-0.023	0.016
Austria	-0.099	-0.056	-0.044	0.001	-0.004	-0.104	0.005
France	-0.006	-0.012	-0.011	0.002	0.002	-0.020	0.014
Italy	-0.166	-0.063	-0.007	0.003	-0.006	-0.073	-0.092
Spain	-0.210	-0.023	0.020	-0.000	-0.001	-0.004	-0.205
Portugal	-0.148	-0.034	-0.003	-0.010	0.001	-0.045	-0.103

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, industry); 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.

Table A.4: 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 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.5: 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	-0.026	-0.011	-0.007	-0.007	-0.003	-0.005	-0.016	-0.008	-0.060	-0.038	-0.011	-0.006	-0.008	-0.002
	(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	-0.054	0.530	-0.279	-0.263	-0.502	0.048	-0.059	0.212	-0.175	0.056	-0.241	0.094	-0.135	0.139
	(0.033)	(0.033)	(0.007)	(0.008)	(0.015)	(0.015)	(0.022)	(0.023)	(0.011)	(0.011)	(0.022)	(0.022)	(0.013)	(0.012)
Worker FE	0.013	-0.047	-0.332	-0.332	-0.202	-0.337	0.039	-0.061	-0.080	-0.190	-0.092	-0.228	-0.073	-0.178
	(0.009)	(0.009)	(0.005)	(0.005)	(0.008)	(0.008)	(0.012)	(0.012)	(0.009)	(0.009)	(0.019)	(0.017)	(0.006)	(0.006)
Δ in employer FE		1.274		0.015		0.847		0.600		0.583		0.761		0.919
		(0.022)		(0.004)		(0.010)		(0.018)		(0.010)		(0.020)		(0.011)
No. of observations	59,583	59,583	80,946	80,946	26,960	26,960	13,241	13,241	25,635	25,635	5,638	5,638	47,311	47,311
Mean dep. var.	-0.057	-0.057	-0.056	-0.056	-0.125	-0.125	-0.047	-0.047	-0.059	-0.059	-0.135	-0.135	-0.034	-0.034
Panel B: Yearly earnings														
Δ in unempl. rate	-0.021	-0.008	-0.013	-0.013	0.005	0.003	-0.009	-0.003	-0.102	-0.086	-0.014	-0.010	-0.007	0.000
	(0.003)	(0.003)	(0.003)	(0.003)	(0.007)	(0.007)	(0.008)	(0.008)	(0.027)	(0.026)	(0.005)	(0.005)	(0.006)	(0.006)
Employer FE	0.048	0.535	-0.049	-0.036	-0.604	-0.057	0.084	0.297	-0.149	0.022	-0.268	0.029	-0.090	0.248
	(0.028)	(0.029)	(0.006)	(0.007)	(0.023)	(0.024)	(0.026)	(0.027)	(0.015)	(0.016)	(0.029)	(0.030)	(0.033)	(0.034)
Worker FE	0.057	0.007	-0.062	-0.062	-0.186	-0.321	0.189	0.110	0.001	-0.081	-0.106	-0.226	-0.129	-0.259
	(0.008)	(0.008)	(0.004)	(0.004)	(0.012)	(0.012)	(0.014)	(0.014)	(0.012)	(0.012)	(0.024)	(0.023)	(0.017)	(0.017)
Δ in employer FE		1.062		0.014		0.842		0.473		0.431		0.675		1.134
		(0.019)		(0.004)		(0.015)		(0.021)		(0.014)		(0.027)		(0.030)
No. of observations	59,583	59,583	85,218	85,218	26,966	26,966	13,276	13,276	25,635	25,635	5,638	5,638	47,303	47,303
Mean dep. var.	-0.064	-0.064	-0.067	-0.067	-0.145	-0.145	-0.053	-0.053	-0.094	-0.094	-0.191	-0.191	-0.058	-0.058

Notes: The dependent variable is the wage loss (Panel A) and earnings loss 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 B. discusses the results. Standard errors in parentheses.

Table A.6: Effects of Job Loss on Earnings by Country and Gender

	Men		Women	
Denmark				
$k = 1$	-17.41	(0.191)	-18.86	(0.260)
$k = 5$	-11.90	(0.243)	-10.56	(0.324)
Sweden				
$k = 1$	-20.32	(0.290)	-17.85	(0.417)
$k = 5$	-11.70	(0.402)	-10.62	(0.555)
Austria				
$k = 1$	-38.58	(0.293)	-39.67	(0.440)
$k = 5$	-22.64	(0.347)	-20.07	(0.549)
France				
$k = 1$	-18.77	(0.525)	-21.30	(0.752)
$k = 5$	-12.16	(0.782)	-12.38	(1.019)
Italy				
$k = 1$	-38.32	(0.472)	-42.14	(0.659)
$k = 5$	-26.99	(0.632)	-29.62	(0.823)
Spain				
$k = 1$	-44.90	(0.671)	-47.12	(0.954)
$k = 5$	-31.50	(0.813)	-34.38	(1.178)
Portugal				
$k = 1$	-34.16	(0.382)	-37.45	(0.417)
$k = 5$	-24.47	(0.449)	-24.39	(0.473)
Germany				
$k = 1$	-22.24	(0.19)	-35.49	(0.35)
$k = 5$	-16.25	(0.42)	-22.35	(0.70)

Notes: The table shows the coefficients θ_1 and θ_5 from equation (1) for earnings separately estimated by gender within each country. Point-estimates are re-scaled by the average earnings measured in the pre-displacement years and multiplied by 100. Standard errors reported in parentheses and clustered at the individual level. Results from Germany are taken from Schmieder, Von Wachter and Heining (2023) and in particular from Figure 1(b) (men), and Figure A27(b) (women).

Table A.7: Share of displaced workers who are still unemployed after displacement

	Years since displacement				
	$k=1$	$k=2$	$k=3$	$k=4$	$k=5$
Panel A: All displaced workers					
Denmark	0.251	0.181	0.136	0.108	0.089
Sweden	0.186	0.079	0.057	0.042	0.032
Austria	0.244	0.134	0.102	0.083	0.056
France	0.174	0.091	0.069	0.055	0.046
Spain	0.404	0.263	0.205	0.173	0.148
Italy	0.325	0.278	0.253	0.239	0.201
Portugal	0.597	0.478	0.398	0.328	0.236
Panel B: Displaced workers who eventually find a job					
Denmark	0.177	0.100	0.050	0.020	0.000
Sweden	0.159	0.049	0.025	0.010	0.000
Austria	0.197	0.081	0.047	0.026	0.000
France	0.134	0.047	0.023	0.009	0.000
Spain	0.297	0.131	0.062	0.024	0.000
Italy	0.147	0.087	0.056	0.037	0.000
Portugal	0.455	0.294	0.186	0.092	0.000

Notes: Share of workers displaced in 2010 who are still non-employed, by years since displacement (k). Panel A reports numbers for all displaced workers; in Panel B the displaced workers are conditioned to those who eventually find a job within five years from the displacement event.

Table A.8: Comparing displaced workers who eventually find a job within five years of displacement to those who don't

	Denmark		Sweden		Austria		France		Spain		Italy		Portugal	
Permanently displaced	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Panel A: Worker characteristics														
Earnings in $t^* - 2$	42,166	42,711	33,745	33,203	28,433	30,069	27,634	29,932	23,233	22,241	25,318	23,696	14,700	14,571
Earnings in $t^* - 3$	39,352	40,317	35,665	32,781	27,927	29,435	26,658	28,685	23,280	22,049	24,704	22,635	15,530	14,496
Age	31.82	33.78	38.38	36.58	40.28	37.99	34.58	37.39	39.71	38.01	39.26	37.27	37.13	35.31
Female	0.39	0.37	0.37	0.34	0.45	0.42	0.42	0.36	0.46	0.40	0.47	0.37	0.53	0.46
Tenure	5.74	5.80	7.58	7.20	7.08	7.32	7.17	6.60	6.47	6.75	4.66	4.66	11.73	9.87
Panel B: Employer characteristics														
Establishment size	376	369	368	384	314	323	262	322	383	337	437	340	335	338
Manufacturing	0.38	0.38	0.43	0.41	0.45	0.47	0.55	0.43	0.27	0.25	0.30	0.38	0.57	0.51
Services	0.34	0.34	0.36	0.33	0.18	0.12	0.25	0.34	0.58	0.59	0.47	0.25	0.34	0.40
No. Workers (th.)	5.79	196.12	5.27	103.31	5.03	50.79	1.15	27.48	1.62	13.09	16.18	49.88	45.71	125.43

Notes: This table compares the characteristics of displaced who eventually find a job within five years from displacement (not permanently displaced workers) to those workers who instead are unable to job within five years from displacement (permanently displaced workers).

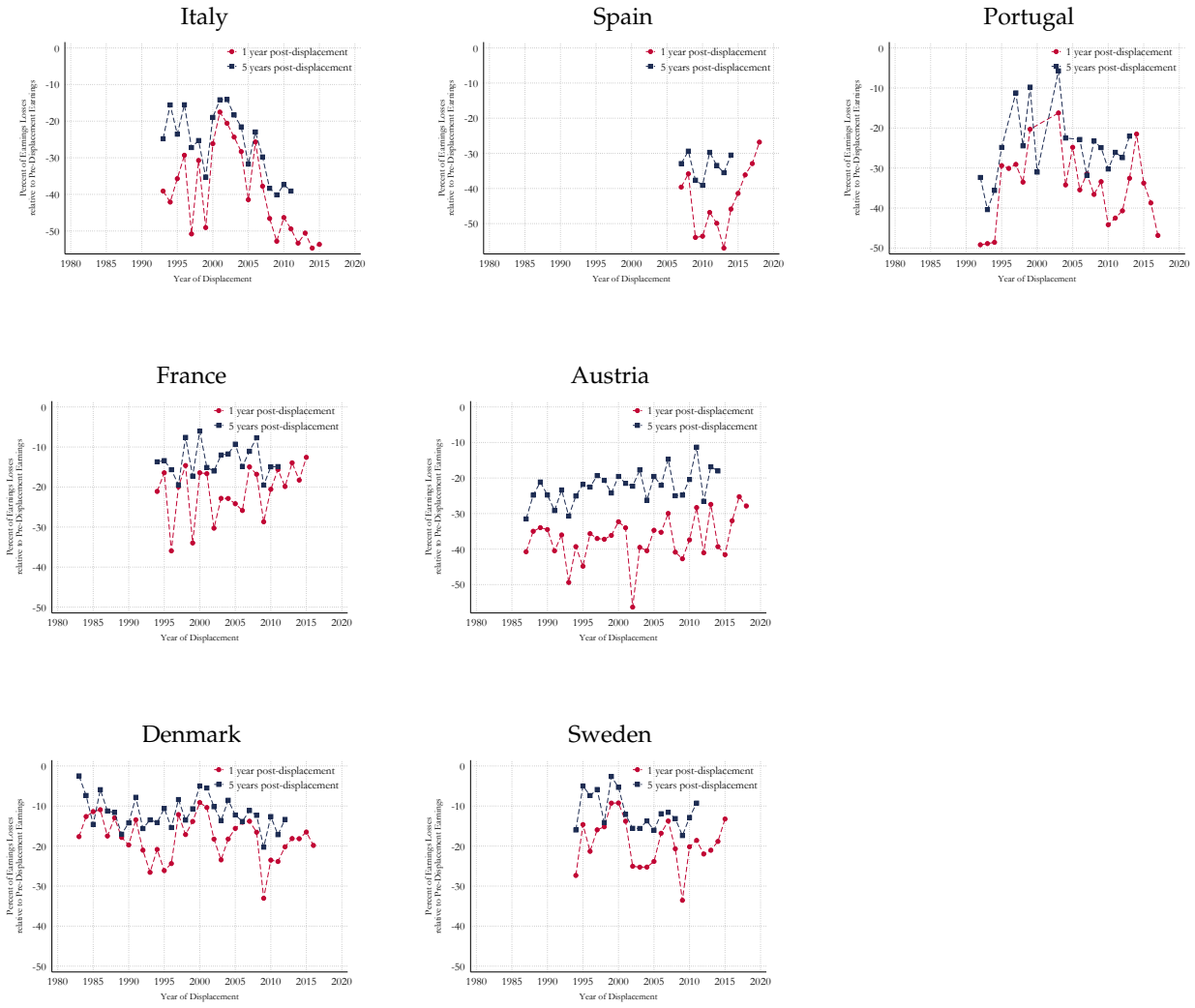
Table A.9: Bounds on wage losses 5 years after displacement

	Employment effect	Share compliers among employed control workers	Mean wage treated	Mean wage control, excluding compliers	Bound on wage effect
	(1)	(2)	(3)	(4)	(5)
Denmark	-0.036	4%	4.761	4.878	-0.116
Sweden	-0.041	4%	4.407	4.581	-0.174
Austria	-0.091	10%	4.323	4.534	-0.211
France	-0.057	6%	4.342	4.473	-0.131
Spain	-0.156	18%	3.909	4.248	-0.339
Italy	-0.176	23%	4.354	4.616	-0.262
Portugal	-0.173	25%	3.880	4.156	-0.276

Notes: Column 1 displays the employment effects due to displacement observed 5 years following displacement. Column 2 uses the estimates from Column 1 to estimate the share of compliers among the control group, that is, workers that in the presence of displacement would be non-employed five years from displacement. Column 4 then displays the mean wage among control workers assuming that these compliers all belong to the left-tail of the wage distribution observed among control workers. This monotone selection pattern provides therefore an upper bound on the wage effects, computed as the difference between Column 3 and Column 4 and displayed in Column 5, as originally suggested by Lee (2009). See Appendix E for additional details.

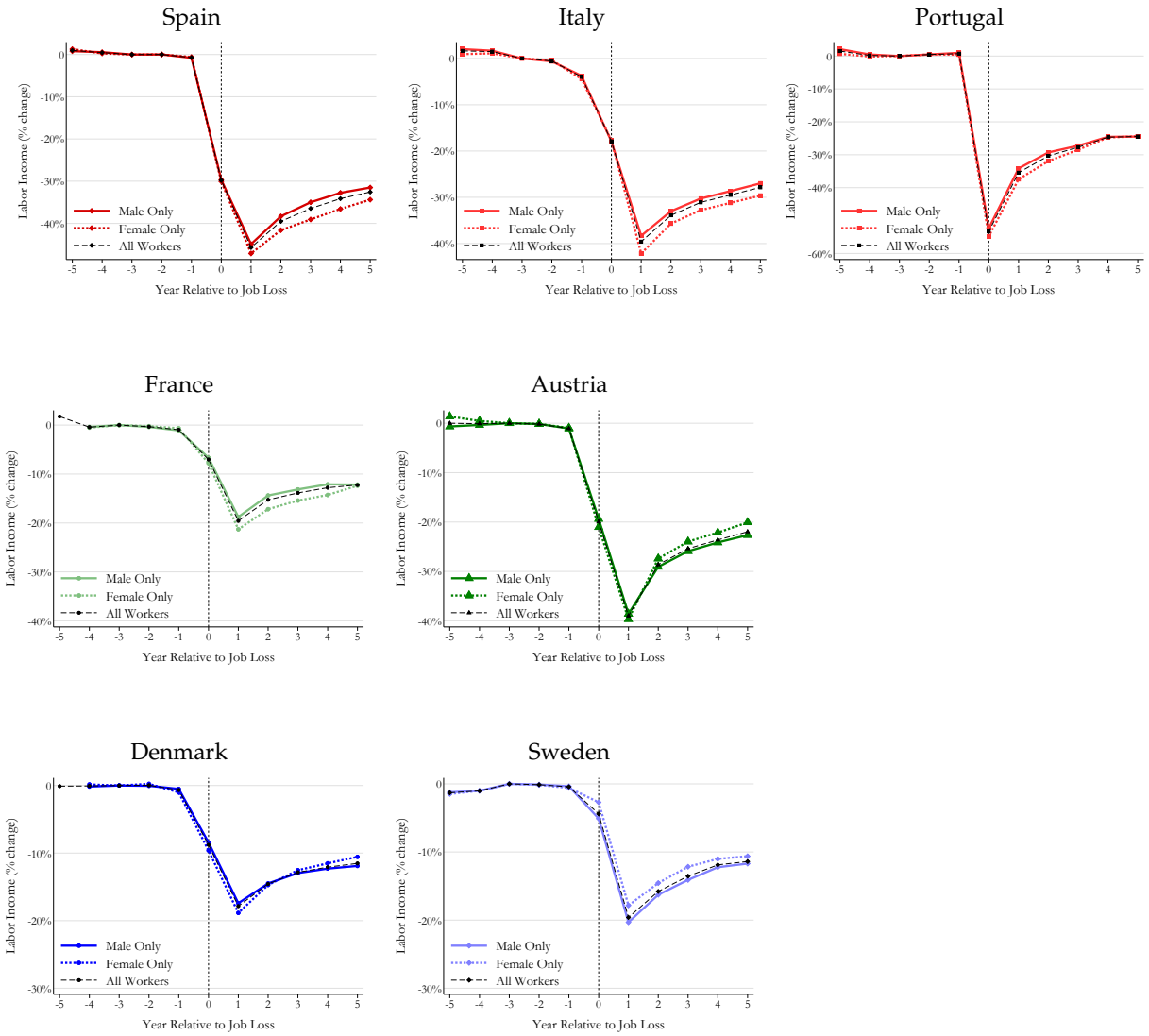
B. Figures

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



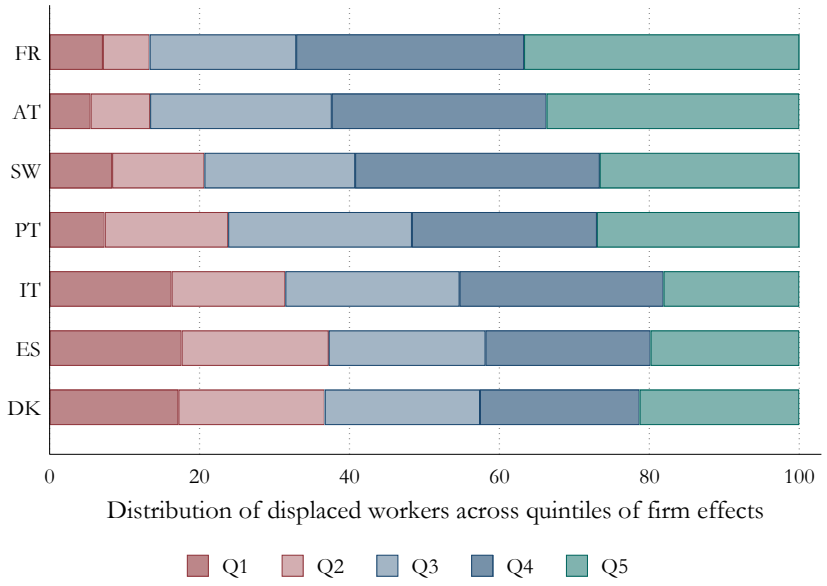
Notes: The figure shows estimates of earnings losses spanning three decades (1990s-2010s) following job loss as defined in section I. Each plot reports the point estimate – by year of job displacement – of labor earnings losses for the first and the fifth year following involuntary job loss, i.e. θ_1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

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



Notes: The figures shows the event-study coefficients θ_k after fitting equation (1) separately by country and gender. The outcome variable is total earnings within the year (rescaled by pre-displacement earnings). Standard errors along with point estimates at $k = 1$ and $k = 5$ years from displacement are reported in Table A.6.

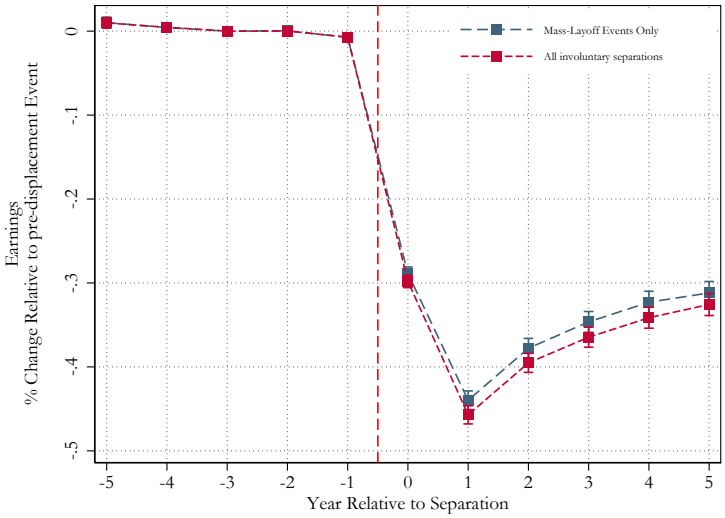
Figure A.3: Distribution of displaced workers across quintiles of firm effects before job displacement



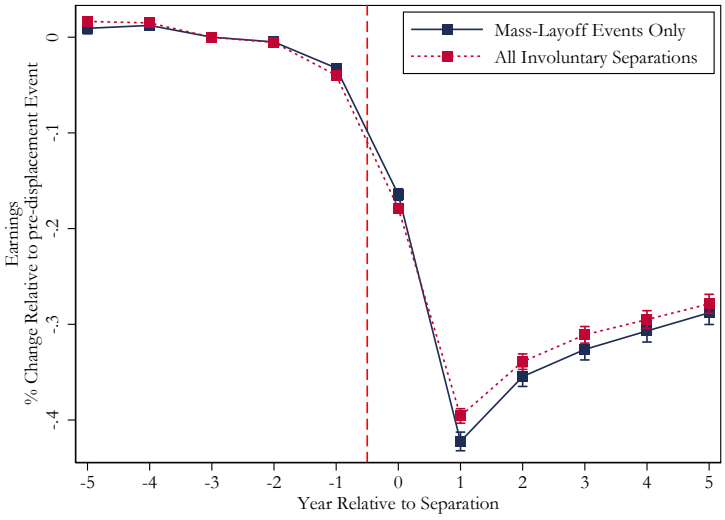
Notes: Share of workers by quintiles of wage AKM employer fixed effects measured right before displacement.

Figure A.4: Representativeness of Mass Layoffs Workers for Spain and Italy

(a) Spain

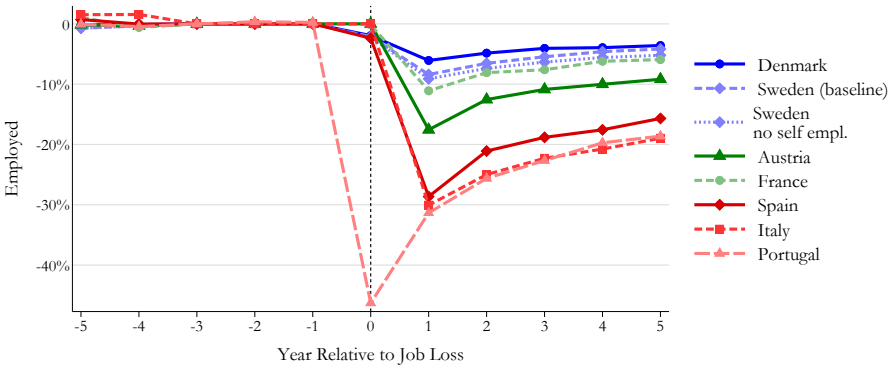


(b) Italy



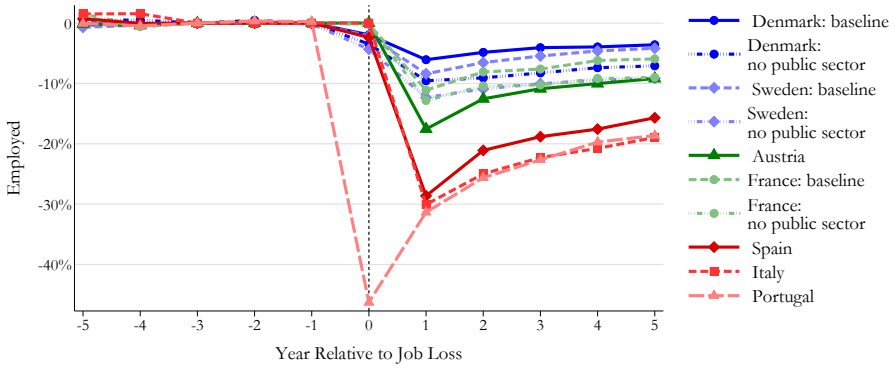
Notes: In Spain and Italy, matched employer-employee data provide a reason behind a job separation, see section D. and section F. for details. We use this information to contrast the effects of job displacement on earnings that one would obtain when defining displaced workers to be only those involved in mass-layoff events captured in administrative data— see label "Mass-Layoff Events Only" — to the ones obtained when using the entire set of involuntary separations due to economic reasons that one could measure in the Spanish and Italian context. Specifically, "involuntary separations" due to economic reasons represent all job separations that occurred as a result of the employer facing some economic distress. 95% confidence intervals based on standard errors clustered at the individual level are displayed in the figure.

Figure A.5: Classifying self-employment as non-employment in Sweden

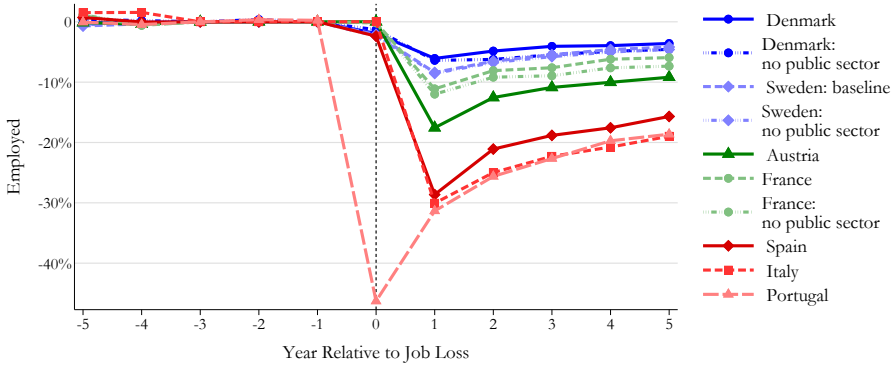


Notes: This figure computes our baseline event-study estimates from equation (1) on employment while setting self-employed jobs recorded in Sweden as non-employment spells. See Appendix D. for details.

Figure A.6: Classifying public sector jobs as non-employment in Denmark, Sweden and France



(a) Classifying as non-employment all public sector jobs

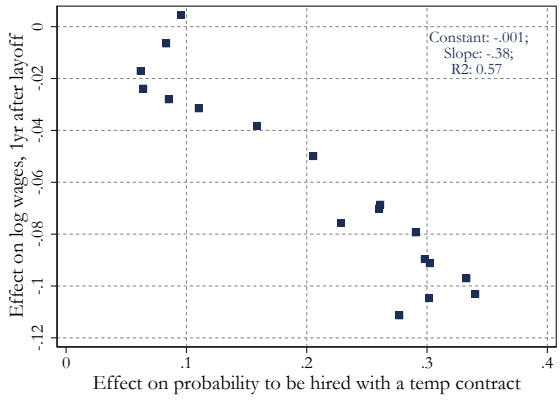


(b) Classifying as non-employment a selection of public sector jobs not covered in Southern European countries.

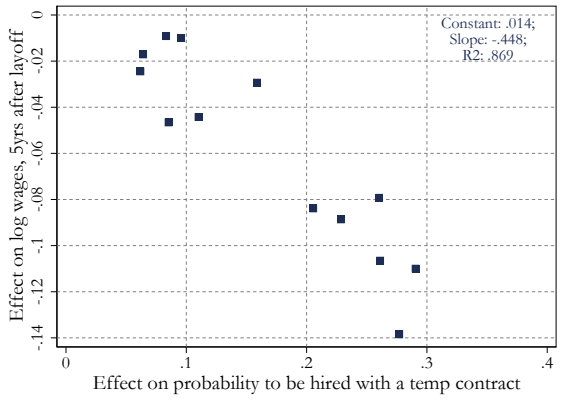
Notes: Panel (a) computes our baseline event-study estimates from equation (1) on employment while setting *all* jobs in the public sector Denmark, France and Sweden as non-employment spells. Panel (b) is similar but records as non-employment spells only a subset of public jobs from Denmark, France and Sweden that are particularly unlikely to be recorded in administrative registries from Southern European countries. See Appendix D. for details.

Figure A.7: Explaining Trends in Pay Losses for Italian Displaced Workers

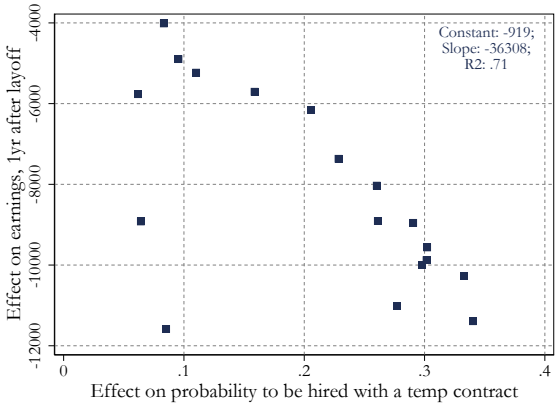
(a) Loss in Log Wages, 1 Year Following Layoff



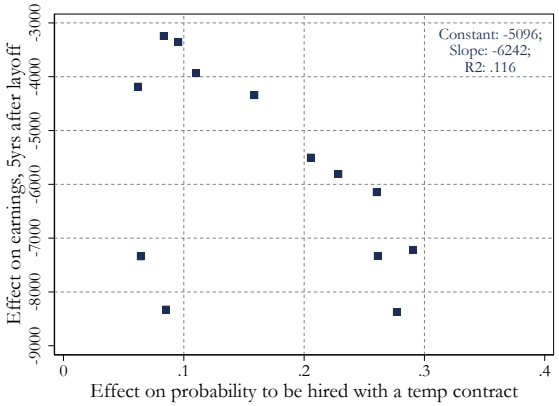
(b) Loss in Log Wages, 5 Years Following Layoff



(c) Loss in Earnings, 1 Year Following Layoff

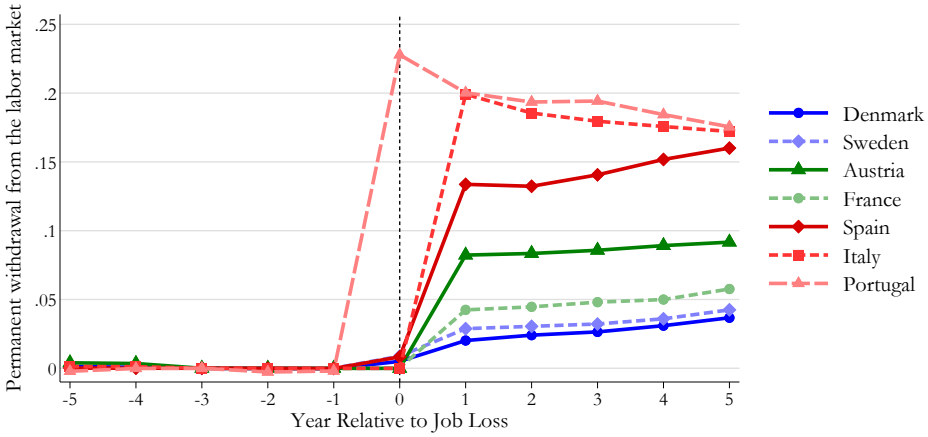


(d) Loss in Earnings, 5 Years Following Layoff



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 D. provides details on the institutional Italian context.

Figure A.8: Permanent withdrawal from the labor market



Notes: The figure reports the event-study coefficients from equation (1). The outcome in the regression is a dummy equal to 1 if worker i in period t is non-employed in t and all the subsequent periods up to year $t+5$. Thus, the event-study coefficients captures changes in the probability of displaced workers to permanently withdraw from the labor market relative to their matched control group across countries. The resulting effects displayed in the figure are not necessarily monotonically increasing over time since workers in the comparison group are also allowed to withdraw from the labor market.

B Sample Construction and Analyses

This section provides additional information on the construction of the main sample (Section II) and on the analyses aimed at understanding the heterogeneous job loss effects across countries (Section III).

A. 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. In order to focus on permanent job separations, treated workers who return to their firm up to $t^* + 5$ are dropped from the sample (from both the treated and the comparison group). To avoid classifying mergers and domestic outsourcing as mass layoffs, we create a cross flow matrix of worker flows across firms each year, and exclude mass layoffs from our sample where we observe more than 20 percent of workers jointly moving to another firm.

Control group. Control workers are never treated, to avoid bias induced by control units treated later (see, 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. Differences in Observed Characteristics across Countries

According to Table 1, the composition of displaced workers differs somewhat across countries. To quantify the role of different observable characteristics of displaced workers in driving the heterogeneous effects of job displacement across countries shown in Figure 1, we perform pairwise Oaxaca–Blinder decompositions between

each country c and a reference country r (Denmark).[13] 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.[14] Individual-level job loss effects are individual-level difference-in-differences effects computed for each treated-matched control worker pair, see Schmieder, Von Wachter and Heining (2023) for a similar approach and Appendix C..2. 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:

$$\Delta_c = \sum_{x \in X} \underbrace{(E[x_{i,c}] - E[x_{i,r}])\beta_x^c}_{\text{Composition}} + \sum_{x \in X} \underbrace{E[x_{i,r}](\beta_x^c - \beta_x^r)}_{\text{Unexplained}} \tag{A.1}$$

The "compositional" part quantifies the differences on the impact 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 country's average observed levels).

We focus on the composition part of the cross-country differences by measuring the following characteristics measured right before job displacement: gender, tenure, age, quintiles of worker and employer AKM fixed effects, employer size, economic sector, change in unemployment rate, and quadratic time trends. [15] 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.

Table A.3 reports the results of this decomposition exercise.[16] 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. Figure A.3 provides

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

[14] 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.

[15] The worker fixed effects are obtained by subtracting the employer fixed effects from the average pre-displacement wages.

[16] The sample is restricted until 2015, which is the last year with available information on the OECD indicators of interest (generosity of unemployment benefits, employment protection legislation, active labor market policies, among others).

further visual confirmation of this finding by showing the distribution of the AKM employer-specific wage premium of displaced workers across countries.

C. The Role of Employers

C..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, Saggio and Sølvsten, 2020; Bonhomme et al., 2023). We estimate establishment fixed effects for most of the main jobs before and after the relative year of the event t^*.[17]

C..2 The cyclicality of wage losses and employer quality

To further investigate the importance of employers in explaining the consequences of job loss, we follow Schmieder, Von Wachter and Heining (2023). 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 difference in 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. The impact 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 -0.034 in Portugal to -0.135 in Spain, see Table A.5), a negative estimated coefficient indicates that a one percentage point increase in the unemployment rate *increases* wage losses, i.e.:

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

[17] For Spain, due to the relatively small sample size, we estimate firm fixed effects.

Table A.5 shows that a positive variation in unemployment rate is strongly associated with the size of wage losses. This result holds for all countries with the exception of Austria, and is in line with Schmieder, Von Wachter and Heining (2023) for Germany.[18]

Once we include the change in employer fixed effects as additional control, $\Delta_{dd}\hat{\psi}_J$, as in model A.3, the conclusion is drastically different.

$$\Delta_{dd} w_{it^*} = \beta \Delta UR_{t^*} + \gamma \hat{\psi}_{J(i,t^*)} + \delta \hat{\alpha}_i + \xi \Delta_{dd} \hat{\psi}_J + X_i \theta + t^* \pi_1 + t^{*2} \pi_2 + \varepsilon_{it^*} \tag{A.3}$$

In all countries but Austria, the coefficient on the unemployment rate shrinks considerably. And, in most cases, the effect is not statistically significant anymore. 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 to understand the cyclicality of wages over the business cycle.

D. Employment Coverage

Figure 1 displays remarkably different employment and earnings trajectories across countries following a job displacement event. A potential concern is that this finding is driven by differences in employment coverage across countries. For instance, as displayed in Table A.4, in Sweden self-employed jobs are covered by the data whereas in all the other countries this does not happen to be the case. Yet, this discrepancy does not appear to drive our results. Re-estimating our baseline effects on employment treating self-employed job spells in Sweden as non-employment spells—as it would occur in all the other countries, returns virtually identical results, see Figure A.5.

Another potential source of discrepancy is due to different coverages in public jobs. All our datasets record *some* public jobs. However, coverage of public jobs tends to vary. Denmark, France and Sweden are for instance countries where all public jobs are recorded in their corresponding administrative registers whereas this does not occur in countries like Italy, Portugal and Spain where most jobs in public administration (e.g. teachers) are usually not present. To understand the importance of these discrepancies on public jobs for our employment results, we take our data from France, Denmark and Sweden—which cover 100% of all public jobs present in each of these countries—

[18] We do not find that variation in the employment rate affects wage losses in 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.

and assign all employment spells in public jobs as *de facto* non-employment spells, similarly to what we did above when looking at self-employed jobs in Sweden.

Notice that this clearly represents an extreme or "worst-case" type of scenario as we are implicitly setting *all* public jobs from Denmark, France and Sweden as not-employed, even those types of public jobs that would still instead show up in administrative data from countries like Italy, Portugal or Spain.[19] However, even setting all public jobs as non-employment spells in Denmark, France and Sweden (while maintaining employment spells in the public sector observed in the other countries) does not change the qualitative conclusions. As shown in Figure A.6a, employment effects due to displacement remain about twice as large in Italy, France and Spain compared to what we observe in the remaining countries.

We also produced a more nuanced analysis where we tried to identify public jobs that, to the best of our knowledge, would not be recorded in Italy, Portugal and Spain but that instead would show up in the registers of Denmark, France or Sweden. Treating these jobs as non-employment spells returns virtually identical results as our baseline case displayed in Figure 1, see Figure A.6b.[20]

All in all, while lack of detailed occupational data from Southern European countries does not permit us to provide a formal cross-walk of public jobs consistently measured across European datasets, the evidence presented in Figures A.6a and A.6b suggests that discrepancies in the coverage of public jobs broadly defined do not appear to drive our employment effects. Dropping public jobs from Denmark, Sweden and France that to the best of our knowledge are unlikely to be covered in Italy, Portugal and Spain barely change our point-estimates. Even in a worst case scenario where all public jobs in Denmark, Sweden and France are set as non-employed spells leaves unaltered our main conclusions that displaced workers in Spain, Portugal and Italy are systematically less likely to find a post-displacement job compared to workers from Sweden, France, Austria and Denmark.

These results are consistent with the fact that many public sector jobs in Europe require some form of occupational licensing thus making it difficult for displaced workers – who were all displaced from the private sector – to re-allocate to one of these public jobs (Checchi, Fenizia and Lucifora, 2021). As a result, the potential discrepancies in the coverage of public employment jobs do not appear to drive our baseline employment effects.

[19] Employment in companies that are entirely or in part controlled by the national government (e.g. jobs in the national post-office) tend to be present in Southern-European countries.

[20] For Sweden and Denmark we classify as non-employment the following occupations: teachers, public sector clerks, legislators, and government officials. For France, which adopts an occupation classification not immediately mapped to ISCO codes present in Denmark and Sweden, we set as non-employment the following occupations: administrative and technical executives of the public service; intermediate professions in the public service (administration, security); administrative employees of the public service (service agents and health auxiliaries).

E. Lee Bounds for Effects on Wages

This appendix discusses computation of "Lee Bounds" for the wage effects reported in Figure 1. Let $i = 1,\ldots,n$ index the sample of displaced workers along with their matched counterfactual, control workers. Let $D_i = \mathbf{1}\{\text{worker } i \text{ is a displaced worker}\}$; $E_{ik} = \mathbf{1}\{\text{worker } i \text{ is employed } k \text{ years following displacement}\}$ and W_{ik} is wages k years following displacement. The selection model is assumed to be the following

$$W_{ik} = \alpha + \theta_k D_i + \epsilon_{ik}, \tag{A.4}$$

$$E^*_{ik} = \beta + \gamma_k D_i + v_{ik}, \qquad \gamma_k<0 \tag{A.5}$$

$$E_{ik} = \mathbf{1}\{E^*_{ik}>0\} \tag{A.6}$$

Among displaced workers, we observe only the "Always Takers" individuals, i.e. those that would have a job in period k regardless of whether they were displaced k years before. These individuals have $v_{ik} > -\beta-\gamma_k$. However, within the control group, we see both "Always Employed" individuals as well as "Compliers": workers that, if subject to displacement, would actually not be employed in period k. Compliers have $-\beta-\gamma_k > v_{ik} > -\beta$. Therefore, the fraction of compliers among employed control workers is given by

$$p_k = \Pr(v_{ik} < -\beta-\gamma_k | v_{ik} > -\beta) \tag{A.7}$$

Under a monotone selection model that assumes that these compliers all belong to the left tail of the wage distribution, we can therefore compute an estimate of the wage effects due to displacement "controlling" for selection following the insights from Lee (2009). First, note that we can identify p_k from

$$p_k = -\frac{E[E_{ik}|D_i=1] - E[E_{ik}|D_i=0]}{E[E_{ik}|D_i=0]} \tag{A.8}$$

Given an estimate of p_k, one can then assume that all compliers lie in the left part of the distribution of wages, i.e. their wage must be bounded above by w^{p_k}, where w^{p_k} is the p_k centile of the wage distribution among control workers. Therefore, one can construct an estimate of the wage losses due to displacement under a monotone selection model of the type describe above simply by computing:

$$\bar{\mu}_k \equiv E[W_{ik}|E_{ik}=1, D_i=1] - E[W_{ik}|E_{ik}=1, D_i=0, W_{ik}>w^{p_k}] \tag{A.9}$$

We stress that this corresponds to a valid estimate of the treatment effect of displacement on wages under the extreme monotone selection model described above, where

only highly-productive displaced workers can enter the labor market following the displacement event. In case the latter model does not hold, then $\bar{\mu}_k$ should be viewed as an upper bound on the wage losses due to displacement (with a lower bound that can be constructed simply by computing $E[W_{ik}|E_{ik}=1, D_i=1] - E[W_{ik}|E_{ik}=1, D_i=0, W_{ik}<w^{p_k}]$).

Computation: To compute p_k we simply scale our employment effects from equation (1) at $k=5$ by the fraction of control workers employed at $k=5$. We use this quantity to construct w^{p_k} and therefore $\bar{\mu}_k$ as displayed in equation (A.9). Results are displayed in Table A.9. The bound is particularly large in Italy, Portugal, and Spain, with a magnitude of almost 30 log points. Therefore, after accounting for re-employment selectivity the cross-country heterogeneity in wage losses are aligned with that found in our main results.

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 Section A.). 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.

The main data sources used are in the following table. The citation in the table provides the distributor in each country. In the replication package we provide all data sources for each country. Below we describe in detail the data used for each country. To control for macroeconomic indicator across countries, we use the hamonized unemployment rate constructed by the OECD (2020).

Table A.10: Data sources

Country	Databases reference
Austria	Arbeitsmarktdatenbank (2022)
France	CASD (2018)
Denmark	Statistics Denmark (2019)

Italy	INPS (2020)
Portugal	INE (2020)
Spain	Seguridad Social (2022)
Sweden	IFAU (2018)
Cross-country	OECD (2020)

Notes: Data sources used for each country.

A. 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 socio-demographic information at the worker level. Each establishment has a unique identifier that allows us to study changes in employer specific characteristics over time. Most public sector employees are subject to social security and are hence in the data. But there exist public sector employees which are not covered by social security, most prominently the police force, teachers, judges, are not covered by the dataset. The self-employed 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 depends 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 Andreas Kettemann, Francis Kramarz and Josef Zweimüller (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).

B. Denmark

Data Sources Our main data source is the `IDA` dataset from 1980 to 2018, provided by Denmark Statistics (`IDAN`,`IDAS`,`IDAP`). 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. We also use the dataset `IND` for information on earnings.

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 (2016*a*) 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. (Forthcoming)). 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 (2020) find larger impacts.

C. France

Data Source We use the dataset DADS-Panel (2018) that includes a sample of salaried workers from 1991 to 2018. The dataset is provided by the CASD.[21] 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).[22] Furtermore, we also use the datasets DADS-Poste (2018), DADS-Etablissement (2015), and the dataset MMO (2018).

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. The replacement rate can be up 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, Cahuc and Villedieu, 2021).

[21] We use the dataset `"DADS panel tous salariés 2018"`, starting in 1976. This dataset is constructed by the French national statistical office (INSEE) from social security records 1) for private sector that establishments must filled once a year for each employee (*DADS, Déclarations Administratives de Données Sociales*) and 2) for central government public employees (*FPE, fichiers de paye des agents de l'état*). We start our sample in 1991 for several reasons. The years 1981, 1983 and 1990 are not available. Public servants were gradually recorded in the 1980s. Hospital public servants (fonctionnaires de la fonction publique hospitalière) are integated in 1984. Regional public servants (fonctionnaires des collectivités territoriales) and state level public servants (fonctionnaires de la fonction publique d'État) are integrated in 1988. Earnings, is estimated before 1993. The quality of the worker identifier is poorer in the 1980s (Kramarz and Perez-Duarte, 2009).

[22] We are grateful to Pauline Carry, Bérengère Patault, and Elio Nimier-David for their help on the French data.

Related Studies Royer (2011), Frocrain (2018) and Brandily, Hémet and Malgouyres (2020) evaluate the impact of establishment closures on workers. Brandily, Hémet and Malgouyres (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.

D. Italy

Data Sources The main data source is derived from 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 private-sector salaried-jobs. However, jobs under employers that are controlled in part or entirely by the government (e.g. job in the national post office) tend to also be included. Attrition can be due to unemployment, self-employment or employment in public administration (e.g. teacher). 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, Malacrino and Pistaferri, 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, 2023). 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. 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, Di Addario and Saggio, 2023).

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.7 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 (2023) 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.

E. Portugal

Data Sources The main data source is the *Quadros de Pessoal* (hereafter QP) for the 1987-2018 period.[23] 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 each year (the reference month being March before 1994 and October from then on). 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 makes the year a clear outlier. See Acabbi, Panetti and Sforza (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 Pedro Raposo, Pedro Portugal and Anabela Carneiro (2021). They evaluate the sources of wage losses of workers displaced from 1988 to 2011, with different sample restrictions.

[23] We are grateful to Pedro Raposo for his help to access to the data. The INE project number associated with our data request is PED-452199310.

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.

F. Spain

Date Sources 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 and retired people 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 consequences of job loss in earnings and wages to assess that the results are almost statistically identical 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 the analysis from May to April of next year. This makes the yearly information on the number of employees in the 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% afterwards. The amount of unemployment benefits varies 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, which 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 finds wage losses of 15% on average, but the sample restriction is different.

G. 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, 2016*b*).

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 (2016*b*) 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.

A. Job Displacement

A..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, Postel-Vinay and Robin, 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 (2023), Huckfeldt (2022), Kenneth Burdett, Carlos Carrillo-Tudela and Melvyn Coles (2020), Acabbi, Alati and Mazzone (2022).

A..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, Mas and Woodbury (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% to 24% of long-run earnings losses is explained by firm rents.

European evidence. Schmieder, Von Wachter and Heining (2023) 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, Von Wachter and Heining (2023) 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, Müller and Stegmaier (2021) shows that wage losses for plant closures in Germany depend on pre-displacement plant size.

Raposo, Portugal and Carneiro (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 A.1. In terms of methods, Raposo, Portugal and Carneiro (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, Von Wachter and Heining (2023) build their control as workers that do not leave the firm up to $t = 0$, while Lachowska, Mas and Woodbury (2020) restrict to at least $t = 4$. Previous research shows that different comparison groups lead to different earnings losses (Krolikowski, 2018; Cederlöf, 2021).

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