The Costs of Job Displacement over the Business Cycle and Its Sources: Evidence from Germany*

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Abstract

We document the costs of job loss to displaced workers over the business cycle and its sources using administrative data from Germany. Losses in annual earnings in Germany after displacement are large, persistent, and highly cyclical, nearly doubling in size during economic downturns. We show that part of these losses and their cyclicality is driven partly by unemployment. As a result, unemployment insurance (UI) plays an important role in buffering the effect of job displacements. However, the longer-tem earnings losses we find are mainly driven by declines in wages, and hence UI benefits do little to offset life-time losses in earnings. Further analysis suggests that an important factor behind the long-lasting declines in wages and their cyclicality are changes in employer characteristics, as workers switch to smallerand lower-paying firms after job displacement, in particular in recessions.

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1 Introduction

A sizable body of research has documented the high costs of job loss and ensuing unemployment on the side of workers. In particular, several papers suggest that workers displaced during mass layoffs experience large losses in annual earnings lasting over 15 to 20 years (Jacobson, Lalonde and Sullivan 1993, Couch and Plazcek 2010, von Wachter, Song, and Manchester 2011). The existing literature has also shown that earnings losses after job displacement have an important cyclical component. Using U.S. data, Davis and von Wachter (2011) show that although life-time earnings losses after job displacements occurring in booms are substantial, the earnings loss due to job displacements occurring in recessions is about twice as high. With displacement rates[1] reaching ten to fifteen percent of employment in large recessions, this implies that a substantial fraction of workers suffers large permanent reductions in their life-time earnings.

The finding of large and persistent effects of job displacement and their cyclicality has potentially important implications for understanding the functioning of the labor market and how it responds and contributes to recessions. However, several important open questions remain that are difficult to answer with currently used data sources. For example, does the cyclicality of earnings losses arise mainly from an increase in the incidence and duration of unemployment and nonemployment in recessions? If so, then cyclical earnings losses can be understood as a byproduct of unemployment, and the focus on unemployment insurance as main policy response to assist affected workers is appropriate. However, a presence of a strong cyclical component in wage losses is more difficult to explain, and poses greater challenges for policy approaches heavily focused on unemployment. For example, changes in the composition of displaced workers, changes in available job types, and wage declines within worker and job categories may all be at play. Yet, an understanding of these dynamics would provide valuable insights in both labor market dynamics in recessions and appropriate policy responses.

In this paper we fill several gaps in the empirical understanding of the costs of job loss using social security data from Germany, covering three decades of job displacements with a detail

[1] As measured for example in the CPS Displaced Worker Survey.

on wages and employment, and job and worker characteristics not curently available elsewhere. Using this data, we provide an analysis of the long-term earnings losses of displaced workers in Germany, carefully ensuring comparability of our results to recent estimates using similar data from the U.S. Second, going beyond existing estimates from the U.S. we decompose the earnings losses into wage and employment losses in terms of days worked over the short and long-run after jobloss. Furthermore we estimate how much of the earnings losses are replaced by the relatively generous German UI benefit system. Third, we analyze how the patterns of wage and employment losses and the role of unemployment insurance varies over the business cycle. Finally, we analyze the sources of cyclical movement in wages, focusing on changes in firm characteristics over the business cycle.

As comparable studies in the U.S., we find that workers in stable jobs separating from their main employer in the course of a mass-layoff during recessions suffer reductions in annual earnings of about 15% lasting at least 15 years. This suggests that job displacement has highly detrimental effects on earnings even in a labor market with a tighter safety net and lower earnings inequality. Exploiting features unique to the German data we also find that although temporary reductions in time worked explain part of the reductions in earnings, the majority of the long-term effect is driven by a lasting decline in daily wages. This suggests that some of the loss and recovery in earnings in the U.S. may be driven by reductions in time worked, information not readily available in the administrative data there. This is despite the fact that unemployment insurance is more generous in Germany and non-employment durations are typically longer. We also find that there is a very high degree of cyclicality in earnings losses in Germany, with losses in recessions more than doubling the losses in booms, mirroring closely comparable findings in the United States. We find this cyclicality is partly explained by longer unemployment durations of job losers during recessions, with the remainder explained by a cyclical pattern in losses of daily wages.

We also show that payments from the generous German unemployment insurance system only replace about 25 percent of displaced workers' lost earnings. This effect is likely to be even smaller in the American labor market, where unemployment insurance is shorter lived

and covers a smaller fraction of the unemployed. However since UI benefits are contingent on not working while not insuring against wage losses, income from UI benefits is also highly cyclical, thus playing a larger role in making up for earnings losses during recessions. In fact when we look at income losses (earnings plus UI income) over the business cycle, we find that income losses are less cyclical than earnings losses, suggesting an important role for UI benefits to smooth income during particularly difficult economic times.

Fluctuations in employment can explain earnings losses and their cyclicality only in the short term. We find that the pattern of longer-term earnings losses after job displacement are entirely explained by cyclical wage losses. In preliminary work, we find that displaced workers experience substantial reductions in firm size and firm wages, and that these reductions are larger in recessions. Simple accounting regressions suggest that about half of wage losses and a large part of their cyclicality could be driven by changes in firm characteristics alone. Hence both changes in job composition over the business cycle and wage losses withing broad job categories appear to play a role in explaining persistent and cyclical declines in wages upon job displacement.

The rest of the paper is organized as follows. Section 2 gives an overview of our definitions of job displacement and describes the data. In Section 3, we first provide basic descriptive estimates of the effect of job displacement on earnings, wages, and time worked. We then present results from a regression-based comparison of displaced workers' earnings with the evolution of earnings of a control group of non-displaced workers over the business cycle. We also discuss the role of unemployment insurance receipt as a means to smooth long-term displacement-related earnings losses. In Section 4, we analyze how employer characteristics of displaced workers change over the business cycle, and assess to what extent these changes can explain the large and cyclical wage losses we find. The last section concludes.

2 Data and Methods

2.1 German Administrative Data

We use data from the social security system in Germany, which is generated from employer submitted employment records. This data consists of complete day-to-day information on earnings and time worked in each employment spell occurring in employment covered by social security. The data also contains basic demographic characteristics including education, as well as information on occupation and industry. This data has been complemented with information on receipt of unemployment (from the Leistungsempfängerdatei). In addition, the worker-level data has been merged with information on employers (obtained from the Betriebshistorikdatei).

2.2 Measuring Job Displacement at Mass-Layoffs

The goal of our empirical approach is to remain as comparable as possible to state-of-the-art studies from the U.S. literature, while exploiting advantages specific to the German data we use. In particular, availability of daily information on both earnings and unemployment insurance receipt will allow us to better date job separations and analyze time worked and other sources of income as additional outcomes.

To study the long-term effects of job displacement, we exploit a large administrative data base containing longitudinal information on workers and firms since 1975. This data base has high-quality information on earnings, employment transitions, and firm characteristics. However, as for comparable data sources in the U.S. and other countries, there is no direct information regarding the reason of a job separation.

We follow the existing U.S. literature and define a job displacement as the event that a worker with three years of tenure leaves his main employer in the course of a mass-layoff event. The analysis of workers leaving stable jobs has several advantages. It focuses on workers who in all likelihood expected to remain in their job in the absence of a mass-layoff, and thus were likely to be surprised by being displaced. Moreover, given the steep reduction in job

mobility with even a few years of job tenure in Germany, very few of these workers were likely to have moved voluntarily. This reduces the potential measurement error in the definition of job displacement.

We work with two definitions of a mass-layoff event. First, we define a mass-layoff to occur either when the firm's employment permanently declines by thirty or more percent over a short period of time. Second, we also consider the case when firms permanently close. To make these definitions meaningful, we consider only workers whose employers had at least 50 employees in the year prior to the employment drop and did not have large employment fluctuations in the years before. This definition allows us to replicate findings in the U.S. literature. Smaller firms are subject to larger percentage fluctuations, such that these measures of mass-layoff are less meaningful.

A key step in measuring mass-layoff events is to distinguish between actual permanent reductions in firms' employment and events such as mergers, takeovers, outsourcing, or changes in firm identification numbers. Since such events occur frequently in administrative data, we have constructed a complete cross-flow matrix of worker flows between establishments. Using this flow matrix, we only consider a reduction an employment a mass-layoff event, if the majority of laid-off workers is dispersed among new employer (i.e., if there is no large flow of workers to a different establishment). This is a common methodology used, say, by the U.S. Census to adjust longitudinal firm-level employment information. Not adjusting our mass-layoff data in this way would imply potentially serious measurement-error, likely biasing our results towards finding no effect of displacement on earnings.

By focusing on job separations of high-tenured workers during mass-layoffs at medium-sized to large employers we obtain a very clean measure of job displacement that is comparable with the existing literature. A common criticism is that this may focus on workers that are more likely to have larger earnings losses at displacement. Von Wachter et al. (2011) and Hildreth et al. (2009) have shown that this is not the case for the restriction on higher-tenured workers. However, it is well known that larger firms pay more, and loss in a wage premium associated with firm size may be one explanation of the larger earnings losses we find (von Wachter and

Bender 2006).

2.3 Constructing sample of displaced workers and control group

Baseline restrictions We construct our analysis sample using a two step method. First we choose for each year t all workers that satisfy the following baseline restrictions on June 30th for that year: the individual works fulltime at an establishment with at least 50 employees, is between age 24 and 50, and has at least 3 years of tenure.[2] Furthermore we exclude individuals employed in the following sectors: mining, public administration, defense, activities of private households and extra-territorial organizations.[3]

Within this sample, we define an individual as displaced (between year t and $t+1$) if a) the individual leaves the establishment between t and $t+1$ and is not employed at the year t establishment in any of the years $t+1$, $t+2$, ..., $t+10$ and b) the establishment has a mass-layoff (or plant closing) between year t and $t+1$.

Propensity Score Matching Displaced and non-outsourced workers may differ in many ways that will make them difficult to compare. In order to obtain a comparison group for the displaced workers in our design, we use propensity score matching. We first take all workers who satisfy our baseline restrictions in a given year and are therefore at risk of being displaced in a mass layoff or plant closing.

We then use a step matching estimator where we match within 1 digit industries based on a number of matching variables. Specifically for each 1 digit industry, we estimate the propensity of being displaced using establishment size in year t, the log wage in year $t-1$ and $t-2$, as well as education, tenure and age in year t as predictors. For each displaced worker we assign a single comparison worker, using the non-displaced worker with the closest propensity score (without replacement).

This yields a group of displaced workers and very comparable non-displaced workers work-

[2]These restrictions follow largely the existing literature, with a few additional restrictions. Most notably, we drop workers younger than age 24, since they may not have fully entered the labor force. We also drop workers older than age 50, who had access to partial retirement programs in Germany during that period.

[3]Specifically we exclude sectors C, L, P, and Q of ISIC Rev. 3.1.

ing at similar firms (same industry and size). Note that there is no restriction that workers in the comparison group have to stay at the same establishment between year t and $t+1$, nor that they cannot be displaced in future years. Observable characteristics between displaced and non-displaced workers prior to displacement are very similar and the two groups exhibit almost identical pre-displacement trends in wages, earnings and employment.[4]

2.4 Outcome Variables

The data only covers employment in social security liable jobs and receipt of unemployment insurance and assistance. There are a number of reasons why individuals may drop out of the data over time, they could drop out of the labor force, work in self-employment, work in a government job, move abroad, go into early retirement or die. Over time a sizable fraction of individuals do disappear from the coverage of our data. Treating all year-person observations where individuals are fully missing from the data as years with zero earnings would likely overestimate the earnings losses of displaced workers, since certainly some of them have earnings either abroad or in self employment. There is no perfect solution to this, but as a compromise we only use information on individuals that work in covered employment or receive unemployment benefits for at least one day in a given year, since otherwise we have little information on individuals' activities. This is likely to understate our wage losses, since some workers may exit the labor force for more than a year in response to earnings losses. Here, we depart from von Wachter et al. (2011), whose study of U.S. earnings losses includes zero earnings even if an individual drops out of the labor force for multiple years.

From this data, the main outcomes we consider in this study are total annual earnings, total annual income (consisting of earnings plus payments form unemployment insurance), the daily wage on June 30th of year year, whether or not an individual is working on June 30th, as well as days worked or in unemployment per year. All earnings, income, and wage measures have been deflated using the Consumer Price Index and represent Euros in 2000 prices. Our main outcome variable, total annual earnings, is comparable to similar measures

[4]We also estimated the main results using alternative matching algorithms, such as not matching on industry, matching within counties, or matching on fewer variables and found almost identical results.

available in administrative U.S. data. Detailed information on unemployment insurance and days worked is typically not available in comparable U.S. data sources.

3 Preliminary Results

3.1 Mass layoff and plant closing rates by year

Figure 1 shows plant closing and mass layoff rates in Germany from 1975 to 2008. Since we are looking at large stable establishments, plant closings are relatively rare events of about 0.5 percent of establishments closing down each year. Mass layoffs are more than twice as common occurring at a rate of 1 to 2 percent per year.[5] Both are highly cyclical and in particular the mass lay-off rate follows almost one to one the year over year change in the unemployment rate. [6]

3.2 Average labor market outcomes of displaced workers

Figure 2 shows average labor market outcomes in the two groups of workers (displaced and non-displaced). We are here pooling workers who were displaced in any year between 1980 and 2007 as well as their respective non-displaced comparison workers. Due to the propensity score matching method, this yields readily interpretable results even without controlling for any variables (such as worker characteristics, calendar year, or displacement year effects). It is particularly noteworthy that in all 4 sub-figures, the pre-displacement trends up to year -2 are virtually identical suggesting that our matching procedure has outlined a very comparable control group (we are matching based on characteristics in year -2, in order to allow for displaced worker to have diverging pre-displacement trends in year -1, e.g. due to the fact that they are in declining establishments).

Figure 2 (a) shows total yearly earnings in the two groups. The figure reveals stark earnings losses in the year of displacement, earnings are almost 10,000 Euro lower in year 0

[5]The importance of using worker flows for defining mass lay-offs is by now well understood. For example in this context, Hethey-Maier and Schmieder (2013) show that not controlling for spurious establishment identifier changes can lead to severe bias.

[6]As a point of comparison, the 3-year rate of worker displacement in the U.S. Displaced Worker Survey is about 8-9% in expansions and about 12% in recessions

for the displaced workers or slightly less than 30 percent. While subsequent years show some recovery, this is slow and even after 10 years, displaced workers still have about 5,000 Euro lower earnings then non-displaced workers. Note that the control group earnings are increasing up to year -1, but show a change in slopes from then onwards. This is explained by the fact that workers in both groups are by definition employed in the years prior to displacement but there is not restriction after year 0. Thus people dropping out of social security liable jobs (e.g. due to unemployment, paternity leave, moving out of Germany, moving into self-employment, ...) reduce average earnings after year 0. To avoid attributing this earnings reduction to job loss, below we will compare earnings trends of displaced workers directly to non-displaced workers in order to get causal estimates of the displacement effects.

Figure 2 (b) and (c) show how these losses are explained by employment and wage losses respectively. Employment drops very sharply initially - only about 50 percent of displaced worker are employed on June 30th of the displacement year, but also recovers faster than earnings. Nevertheless, only after 10 years have most of the differences in employment probabilities have disappeared. Wages on the other hand drop by about 8-9 percent initially with the gap actually widening slightly over time to 10 percent. Thus almost all of the long-term losses in earnings are explained by lower wages among the displaced workers, rather than by employment losses.

Figure 2 (d) shows income from UI benefits in the 2 groups. UI income increases sharply at the time of displacement and appears to replace about 25 percent of the earnings losses in the first year among the full sample of displaced workers. However, it then declines quickly and the difference between the two groups disappears after around 5 years, showing - not surprisingly given the short-term nature of UI benefits - that UI benefits do little to compensate long-term earnings losses for displaced workers.

3.3 Regression analysis of labor market outcomes of displaced workers

In order to obtain results of the effects of displacement that can control for other characteristics, we estimated regression models of the form:

$$y_{it} = \gamma_0 + \gamma_1 I(disp) + \sum_{j=-4}^{10} \delta_j I(t = t^* + j) I(disp) + \alpha_t + x_{it}\beta + \varepsilon_{it} \quad (1)$$

where $I(disp)$ is an indicator for whether the person is a displaced worker, t^* is now the displacement year and t is the current year. The α_t are year fixed effects that capture the evolution of earnings for the control group. Given the other variables in the model, the coefficient on the displacement dummy measures the average difference in earnings between treatment and control groups in a baseline year $(t^* - 5)$. The main coefficients of interest are δ_j, which measure the the change in earnings of displaced workers with respect to the baseline year $(t^* - 5)$*, relative* to the evolution of earnings of non-displaced workers.[7] , The regression also includes time-varying control variables (x_{it}), chiefly worker age. It is important to note that since our matching procedure implies that worker characteristics in the treatment and control groups are similar at baseline, γ_1 is close to zero and the α_{tc} effectively control for worker-specific trends. Hence, the inclusion of x_{it} should make little difference to the estimates.

Figure 3 shows estimates of this regression for different left hand side variables. The pattern were foreshadowed in our the descriptive findings in Figure 2 for the same four variables. The figures imply that there is a strong initial effect of job loss on earnings, an ensuing recovery lasting 5-10 years, and a substantial long-term effect still visible 15 years at job loss.[8] From an analysis of employment and wages, it is clear that the large short-term effect and the initial recovery is chiefly driven by a persistent but ultimately temporary decline in

[7] I.e., the specification omitts δ_{t^*-5} and one of the year dummies to avoid collinearity. Essentially these are absorbed in the constant (γ_0). This means the δ_j can be interpreted as the difference between the two groups after taking out the initial difference in year $t^* - 5$.

[8] As found in other studies, there is a small pre-displacement dip in earnings, which can partly arise because the timing of the firm-level shock and the worker separation may deviate. Hence, workers leaving in the year after the firm-level shock may have experienced a decline in earnings on the job. It may also be that there already is a reduction in days or hours worked at the firm in the year before a separation.

employment. In a separate analysis we have found that job displacement has a a similar effect on days worked, suggesting that the employment effect occurs through within-year changes in employment.[9] The effect on wages shows a large immediate effect and exhibits little in terms of recovery. It it important to note that since this figure is conditional on having found employment, it *understates* the wage decline if high-wage workers are more likely to self-select into employment. Finally, the causal effect of job displacement on UI income shown in the final panel confirms that, consistent with the nature of the program and our findings on employment spells, UI plays an important role in buffering the earnings loss. However, given an important part of the loss is in hourly wages, UI falls far short in replacing the average amount of los income.

These findings are striking, since they resemble very closely in shape and magnitude comparable estimates for the U.S. (e.g, JLS, Couch and Placzek 2009, von Wachter, Manchester, and Song 2011). On the one hand, this may not be surprising, since we deliberately structured our anlaysis to replicate these studies in the way we defined displacements, our sample, and our estimation approach. On the other hand, much has been speculated about how the U.S., with more dynamic job creation, higher levels of job mobility, and less generous unemployment insurance may imply a faster recovery rate than a continental European labor market such as Germany. Our estimates suggest that high UI and social benefits alone do not seem to lead to a substantially different path of recovery than in the U.S. (e.g., Sargent and Ljungqvist 1998, 2008), despite the fact that UI benefits have been shown to raise unemployment and lower wages (Schmieder, von Wachter, and Bender 2015). Clearly, the composition of displaced workers and the type of shocks they effectively suffer may be different in the two labor markets, and so the close correspondence should be interpreted with caution. But the congruence we observe in Figure 3 is nevertheless telling about how labor market shocks can have very detrimental and long lasting effects on workers in very different institutional settings.

[9]Note that in the current analysis, we do not distinguish between full- and part-time workers, but plan to do so in the future to assess changes in the intensive margin of employment. The data does not contain a measure of hours worked.

3.4 Outcomes over the business cycle

Figure 4 shows earnings losses of displaced workers separately by year of displacement obtained by replication the regression in equation (1) separately by displacement year. Vertical bars indicate recession years in Germany (defined as a year of negative GDP growth). The figure reveals a strong cyclical pattern in the earnings loss from job displacement. While losses were only about 5000 Euro in the displacement year in 1979-1980, they were more than 10,000 Euros for workers displaced in the 1982 recession. After 1982 losses became smaller until they increased again during the 1993 recession. In the mid 1990s Germany entered a period of prolonged high unemployment rates and sluggish growth (eurosclerosis) and during this time period earnings losses of displaced workers stayed very high, only to come down briefly before the 2003 recession. After 2003 recession (and the Hartz labor market reforms) earnings losses fell again as the economy and the labor market recovered.

Turning to decomposing the earnings losses into employment and wage losses, Figure 5 shows a highly cyclical pattern for number of days worked of displaced workers, with the largest losses for workers who lose their jobs during recessions or in the following year. The cyclicality is similar or even more pronounced than for yearly earnings. This indicates that an important part of the earnings losses at displacement are driven by employment losses. However, Figure 6 shows that wage losses are still cyclica, though somewhat less cyclical than earnings losses, especially during the early 1980s.

Figure 8 and Table 3 explore the cylicality of the effects of job loss further. Figure 8 plots the short-term effects of job loss on annual earnings and log daily wages for each displacement year directly against the prevailing national unemployment rate. The coefficients from a univariate regression corresponding to the displayed fitted lines in the two panels of Figure 8 are shown in Table 3 (rows 1 and 3 of column 1, respectively). To better compare the cyclicality of earnings and log wages, row 2 of column 1 also displays the same regression of the percentage loss in earnings.[10] Column 5 of Table 3 displays the predicted change in the

[10]Note that the two estimates are not strictly comparable, since the percent loss for earnings is obtained by dividing the estimated loss in levels by pre-displacement average earnings, whereas the effect on wages is based on a log specification.

effect of job loss from raising the rate of unemployment by 5 points from 4 to 9 percent (the corresponding levels are shown columns 3 and 4).

The results in Figure 8 and Table 3 confirm that both earnings and wages losses are strongly countercyclical. For each point inrease in the unemployment rate, the earnings loss rises by 2.4% (row 2), whereas wages are reduced by 0.9% (row 3). It is clear from the Figure 8 that the relationships are very precisely estimated. The strong cyclicality of employment losses shown in Figure 5 and row 4 of Table 3 imply that he cyclicality of earnings losses arises from employment reductions. We return to the source of cyclicality of wage losses in Section 4.

Using the unique features of our data, we can explore to what extent the relatively generous German UI system is able to dampen the cyclicality of earnings losses. Since UI benefits only insure against earnings losses stemming from employment, we would expect that UI benefits may have some impact on the cyclicality of total income. Indeed, Figure 7 shows that the of UI benefits received in the first years after jobloss rises sharply in recessions, which is confirmed in row 5 of Table 3. In rows 6-7 of Table 3, we directly analyzed the cyclicality loss in total income at job displacement (defined as total annual earnings plus receipt of UI). The finding is that despite the large swings in benefit receipt, the cyclicality of the losses in annual earnings (row 2, column 1) change little once UI income is added (row 4, column 1). This partly reflects the fact that in Germany, in contrast to the U.S., neither the duration nor the level of UI benefits is extended in recession. It also implies that other factors affecting the overall role of UI, such as the benefit take-up rate, do not vary substantially with the cycle.

Nevertheless, a comparison of the total predicted earnings loss with and without UI – shown in rows 1 and 6 of columns 3 and 4 – imply that the total earnings loss is reduced by 15-20% due to the presence of UI. Hence, UI still provides an important buffer against the effect of job loss. Given that UI benefits only offer a replacement rate of around 63 - 68 percent over this time period and given that wage losses are not insured, it is not surprising that UI benefits can only reduce earnings losses up to a certain amount.

4 Role of Employer Charachteristics in Explaining Costs of Job Loss

A key question in the literature on job displacement is what explains the long-lasting and cyclical wage losses we find in Figures 3, 6 and 8. It is generally difficult to distinguish between the core hypotheses in the existing literature. Yet, the high-quality information on workers' employers before and after job displacement available in our data allows us to make inference about one such core hypothesis, namely that displaced workers lose quasi-rents provided by the firm. We cannot measure such rents directly, but we have access to several measures that have been associated with such rents in the labor literature. First, it has long been speculated that larger firms pay higher wages and provide more pleasant work environments generally. Second, it is usually thought that systematic wage differences across firms reflect rent sharing between workers and firms.

Hence, we proceed in two steps. In a first step, we analyze whether the incidence of job displacement differs by job type, and whether a job displacement changes the "quality" of a worker's employer. For the latter exercise, we simply estimate the same regression in equation (1) with three measures of firm characteristics as outcome variables – log employment size of the establishment, average daily wages at the establishment, and the establishment fixed effects – i.e., average differences in wage levels between firms not explained by worker characteristics. In a second step, we assess directly whether such changes in firm charachteristics can help to explain the effect of job displacement on wages and its cyclicality. That is, we reestimate equation (1) with log wages as dependent variable, but include characteristics of the employer as control variable.

There are two important caveats to bear in mind. First, clearly firm characteristics may be endogenous, and hence care has to be taken in interpreting these estimates as causal effect of changes on employer characteristics on earnings losses. Yet, the correlation is informative, and if workers are positively selected into firms with higher wages, the estimates serve as a lower bound of the remaining cost of job displacement. In addition, we replicate the main result using purely annual variation in average changes in earnings and firm characteristics, which are not affected of selective entry into firm characteristics. Second, systematic wage differences across

firms may in principle not only capture rents, but other components of the wage strucure, such as compensating differentials. While no conclusive evidence is available, several findings in the literature point to firm effects as being as signifying desireable employers.[11]

Clearly, firm characteristics only have the potential to explain the cyclicality of wage losses if the incidence of job displacement by firm type varies over the business cycle. It is well known that firms of different size and different average wages experience different net employment growth over the business cycle in the U.S. (e.g., Kahn and McEntarfer 2014). For Germany, we obtain a similar finding when we split firms by high and low firm fixed effects. Figure 9 shows the fraction of establishments with at least 50 employees that experience a plant closing or mass layoff in each year, depending on whether they are a high or low establishment fixed effect employer. Figure 9 a) shows that the mass layoff rate higher and much more cyclical for establishments with fixed effects above the median, while panel b) shows that the same is true for plant closings. This suggests that one reason for wage losses to be larger during recessions is that during economic downturns, more workers are displaced from high paying establishments and these workers tend to experience larger wage losses.

We also find that changes in establishments characteristics are more pronounced during recessions. Figure 10 shows changes in the (a) log employment size and (b) average wage of the employing establishment relative to non-displaced workers over time. There is clearly a very large decline in both establishment size and the average wage of the employer relative to non-displaced workers: establishment size goes down by about a full 100 log points, while average establishment daily wages are reduced by about 5 to 10 Euros. Figure 11 and Table 3, Panel B show that both of these effects correlate systematically with the unemployment rate at job loss, particularly the reduction in mean establishment wages.

These findings suggest that the large wage losses at job loss and their cyclicality documented in Sections 3.3 and 3.4 could be partly explained by losses in firm characteristics. To

[11]To estimate firm effects, we follow the procedure in Card, Heining, and Kline (2013), with one important exception. To avoid dealing with the fact that firm effects are normalized to an omitted firm, we do not estiamte firm effects separately for different periods. Instead, we estimate one set of firm effects for each firms, using all available workers in the entire sample for that firm. Hence, firm effects are by definition stable over time, and the only way a worker can experience a change in firm effects over time is by moving employers.

assess this question, Panel (a) of Figure 12 shows a series of estimates for the effect of job loss on log daily wages pooling all displacement years, in which we control for changes in several job characteristics at displacement; these include industry and occupation dummies, log establishment size and mean establishment wages, and establishment fixed effects. It is clear that changes in industry and occupation has a small effect (compare to Panel (b) of Figure 3 – the levels do not match exactly because of differences in sample). In contrast, including firm characteristics leads to a reduction of the wage loss of about 50%.

The last row of Panel B of Table 3 shows the effect of controlling for firm characteristics on the cyclicality of short-term wage losses. Clearly, once we control for the fact the decline in employer characteristics at job loss is much larger in recessions that in booms, the cyclicality of the wage loss is gone. This is clearly shown in Panel (b) of Figure 12, which shows the corresponding scatter plot – the clear correlation with the unemployment rate present in Panel b of Figure 8 is eliminated. While the reduction in firm characteristics can explain the entire cyclicality, columns 3 and 4 of the last row of Table 3 show that about 4% earnings loss remains, consistent with the wage loss estimates in Panel a of Figure 12.

Overall, the important role of firm characteristics we find for explaining about 50% of the level of wage losses, and all of the cyclical variability points to an important role of losses in rents from a job displacement. Clearly, workers from high-wage firms are more likely to lose their jobs, and particularly so in recessions, and they see a strong reduction in the quality of their employer. These findings underscore an important role of luck in the labor market, and in the business cycle shaping worker career outcome by changing the firm-composition of employment opportunities. However, they do not preclude a role of factors such as losses in specific skills or other forms of human capital for explaining the remainder of wage losses.

5 Conclusion

[TO BE WRITTEN]

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Table 1: Establishment characteristics by Mass-layoff / Plant closing status the following year – 1978-2008

	(1) All establishments	(2) Mass lay-off	(3) Plant closing	(4) Mass lay-off or plant closing
Panel A: Establishment Characteristics				
Number of employees	196.3	152.1	133.6	145.7
	[604.0]	[259.5]	[233.2]	[250.8]
Number of fulltime employees	172.9	135.6	120.3	130.3
	[576.0]	[244.2]	[202.5]	[230.6]
Fraction fulltime workers	0.9	0.9	0.9	0.9
	[0.2]	[0.2]	[0.2]	[0.2]
Mean years of education	10.9	11.0	10.8	10.9
	[1.2]	[1.3]	[1.0]	[1.2]
Fraction university degree	0.1	0.1	0.1	0.1
	[0.2]	[0.2]	[0.1]	[0.2]
Mean log real wage	4.2	4.1	4.1	4.1
	[0.3]	[0.4]	[0.3]	[0.4]
Establishment effect	2.0	1.9	2.0	2.0
	[0.2]	[0.2]	[0.2]	[0.2]
Establishment effect above median	0.5	0.4	0.5	0.5
	[0.5]	[0.5]	[0.5]	[0.5]
West Germany	0.9	0.8	0.8	0.8
	[0.3]	[0.4]	[0.4]	[0.4]
Panel B: Industry (percent)				
A Agriculture, hunting and forestry	0.6	1.3	0.8	1.1
	[7.6]	[11.4]	[8.8]	[10.6]
B Fishing	0.007	0.04	0.03	0.03
	[0.8]	[1.9]	[1.7]	[1.8]
C Mining and quarrying	0.5	0.7	0.4	0.6
	[7.2]	[8.2]	[6.5]	[7.7]
D Manufacturing	34.7	36.0	44.7	39.0
	[47.6]	[48.0]	[49.7]	[48.8]
E Electricity, gas and water supply	1.3	0.4	0.7	0.5
	[11.4]	[6.5]	[8.3]	[7.2]
F Construction	8.3	13.0	15.9	14.0
	[27.6]	[33.6]	[36.6]	[34.7]
G Wholesale and retail trade;	16.2	12.5	14.8	13.3
	[36.9]	[33.1]	[35.6]	[34.0]
H Hotels and restaurants	1.3	1.3	1.0	1.1
	[11.3]	[11.1]	[9.7]	[10.6]
I Transport, storage and communications	5.9	5.8	5.1	5.6
	[23.6]	[23.5]	[22.0]	[23.0]
J Financial intermediation	4.7	1.6	1.8	1.6
	[21.2]	[12.5]	[13.2]	[12.7]
K Real estate, renting and business activities	9.6	16.9	8.3	13.9
	[29.4]	[37.4]	[27.6]	[34.6]
M Education	2.7	3.1	1.2	2.4
	[16.3]	[17.3]	[10.8]	[15.4]
N Health and social work	10.0	3.4	3.2	3.4
	[30.0]	[18.2]	[17.7]	[18.0]
O Other community, social and personal service activities	4.0	4.0	2.0	3.3
	[19.6]	[19.6]	[14.0]	[17.8]
Number of Spells	1848058	20035	10738	30773

Notes: Average characteristics of establishments with at least 50 employees depending on whether they have a PCL or MLF the following year. Data 1978 to 2008, West Germany. Standard deviations in brackets. Industry codes are ISIC Rev 3.1 codes.

Table 2: Worker characteristics by displacement status the following year – 1980-2007

	(1) Non-displaced workers	(2) Displaced mass lay-off	(3) Displaced plant closing	(4) Displaced mass lay-off or plant closing
Panel A: Individual Characteristics				
Non-German	0.09	0.1	0.1	0.1
	[0.3]	[0.3]	[0.3]	[0.3]
Real wage	84.5	84.1	82.3	83.1
	[27.3]	[28.2]	[27.1]	[27.6]
Parttime	0	0	0	0
	[0]	[0]	[0]	[0]
Female	0.3	0.3	0.3	0.3
	[0.5]	[0.5]	[0.4]	[0.5]
West Germany	0.9	0.8	0.8	0.8
	[0.3]	[0.4]	[0.4]	[0.4]
Years of education	10.9	11.1	10.8	10.9
	[2.3]	[2.4]	[2.1]	[2.2]
Potential experience	21.1	20.7	21.4	21.1
	[7.6]	[7.5]	[7.5]	[7.5]
Tenure with current Employer	8.9	8.5	9.0	8.8
	[4.7]	[4.8]	[5.0]	[4.9]
Actual experience, but censored 1975	12.1	11.7	12.1	11.9
	[6.0]	[5.9]	[6.1]	[6.0]
Total yearly earnings	30725.0	29610.1	28998.5	29275.0
	[10080.3]	[10769.5]	[10379.2]	[10561.8]
Total yearly income	30739.7	29891.6	29351.2	29595.6
	[10068.3]	[10559.7]	[10145.8]	[10338.4]
Days per year working fulltime	363.3	350.0	350.7	350.4
	[18.3]	[39.7]	[38.1]	[38.8]
Wage on June 30th of year	84.5	84.1	82.3	83.1
	[27.3]	[28.2]	[27.1]	[27.6]
Log of wage in June	4.4	4.4	4.4	4.4
	[0.3]	[0.3]	[0.3]	[0.3]
Panel B: Establishment Characteristics				
Number of employees	506.4	519.8	512.2	515.6
	[1408.2]	[870.7]	[1460.2]	[1229.2]
Share of fulltime employees	0.9	0.9	0.9	0.9
	[0.1]	[0.1]	[0.1]	[0.1]
Establishment effect	2.0	2.0	2.0	2.0
	[0.1]	[0.1]	[0.1]	[0.1]
Avg. years of education in estab.	10.9	11.0	10.8	10.9
	[1.1]	[1.2]	[1.0]	[1.1]
Number of Spells	171619	77598	94021	171619

Notes: Characteristics of displaced and non-displaced workers in year prior to displacement year. Workers satisfy the following restrictions: age 24 to 50, working fulltime in pre-displacement year, have at least 3 years of tenure and establishment has at least 50 employees. Non-displaced workers are matched to displaced workers using propensity score matching algorithm.

Figure 1: Mass Layoff and Plant Closing Rates by Year

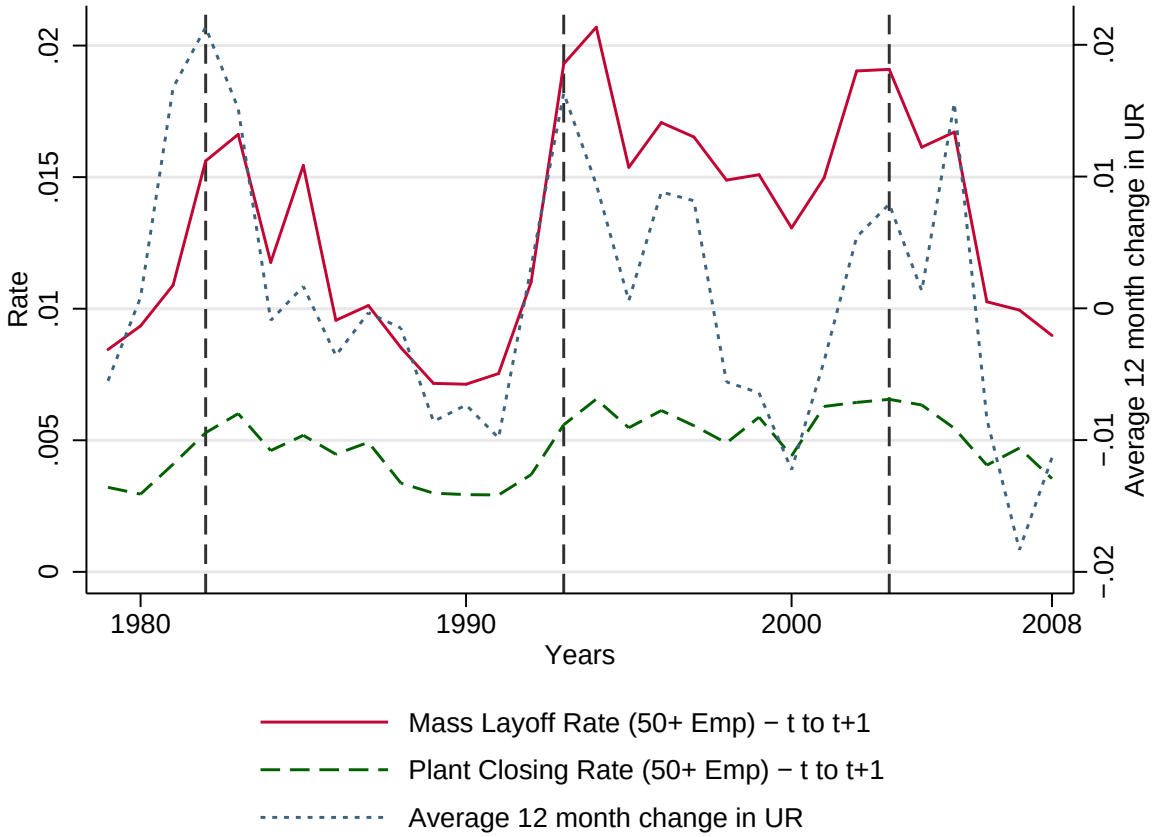
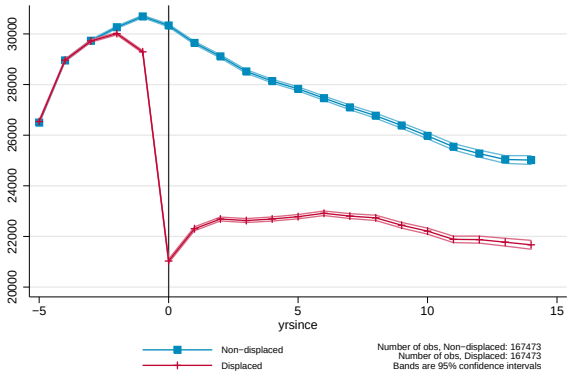
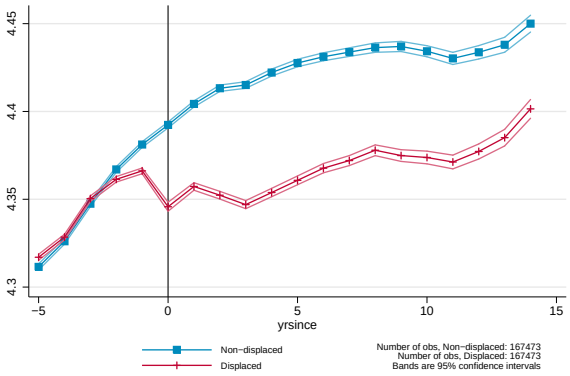


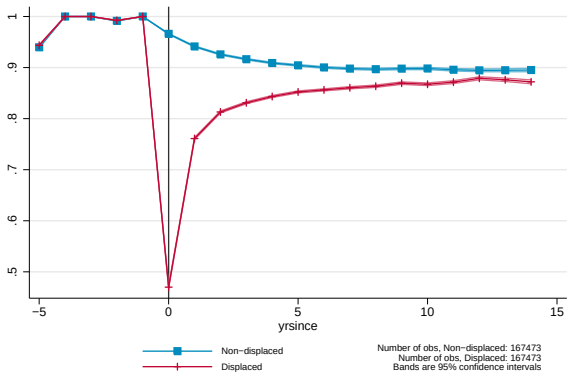
Figure 2: Labor Market Outcomes of Displaced Workers before and after Job Loss - Comparing Raw Means of Displaced Workers and Control Group



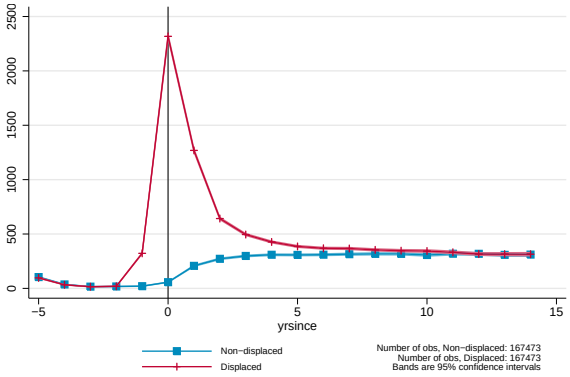
(a) Total Earnings in Year



(b) Log Wage



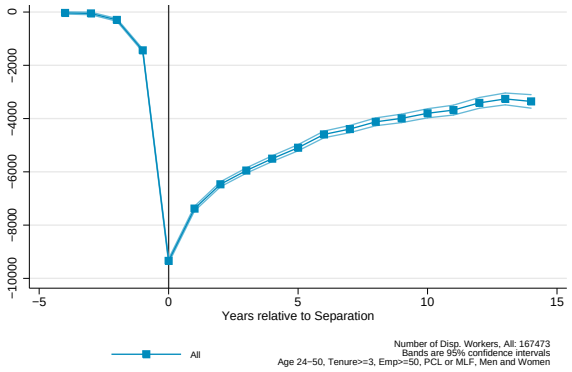
(c) Employed on June 30th of Year



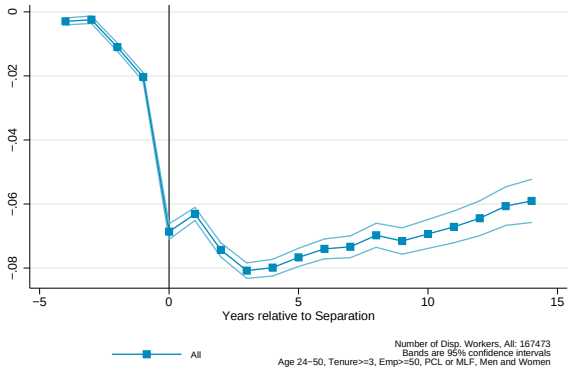
(d) Income from Unemployment Insurance Benefits

Notes: The figures shows labor market outcomes for displaced and non-displaced workers. The red line corresponds to workers who are displaced from year -1 to 0, while the blue line corresponds to the matched control group that is constructed of non-displaced workers via propensity score matching. Each point represents the average value in the respective worker group. The figure is constructed pooling workers displaced between 1979 and 2008, while the outcome data spans 1975-2009.

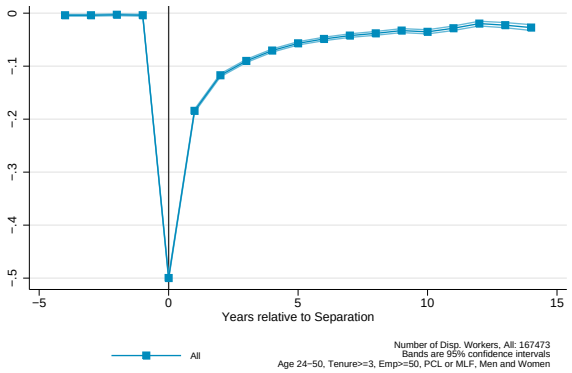
Figure 3: Labor Market Outcomes of Displaced Workers before and after Job Loss - Eventstudy Regression Estimates



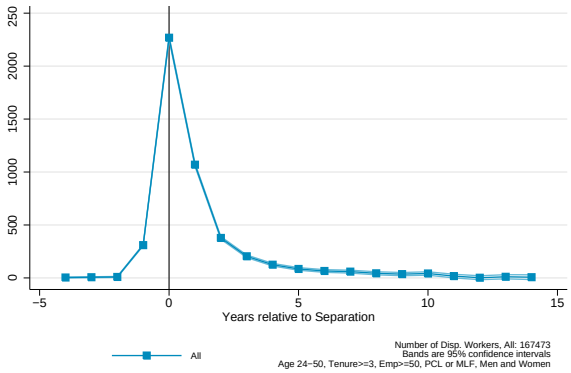
(a) Total Earnings in Year



(b) Log Wage



(c) Employed on June 30th of Year



(d) Income from Unemployment Insurance Benefits

Notes: The figures shows labor market outcomes for displaced and non-displaced workers. The red line corresponds to workers who are displaced from year -1 to 0, while the blue line corresponds to the matched control group that is constructed of non-displaced workers via propensity score matching. Each point represents the average value in the respective worker group. The figure is constructed pooling workers displaced between 1979 and 2008, while the outcome data spans 1975-2009.

Figure 4: Earnings Losses of Displaced Workers by Year of Job Loss

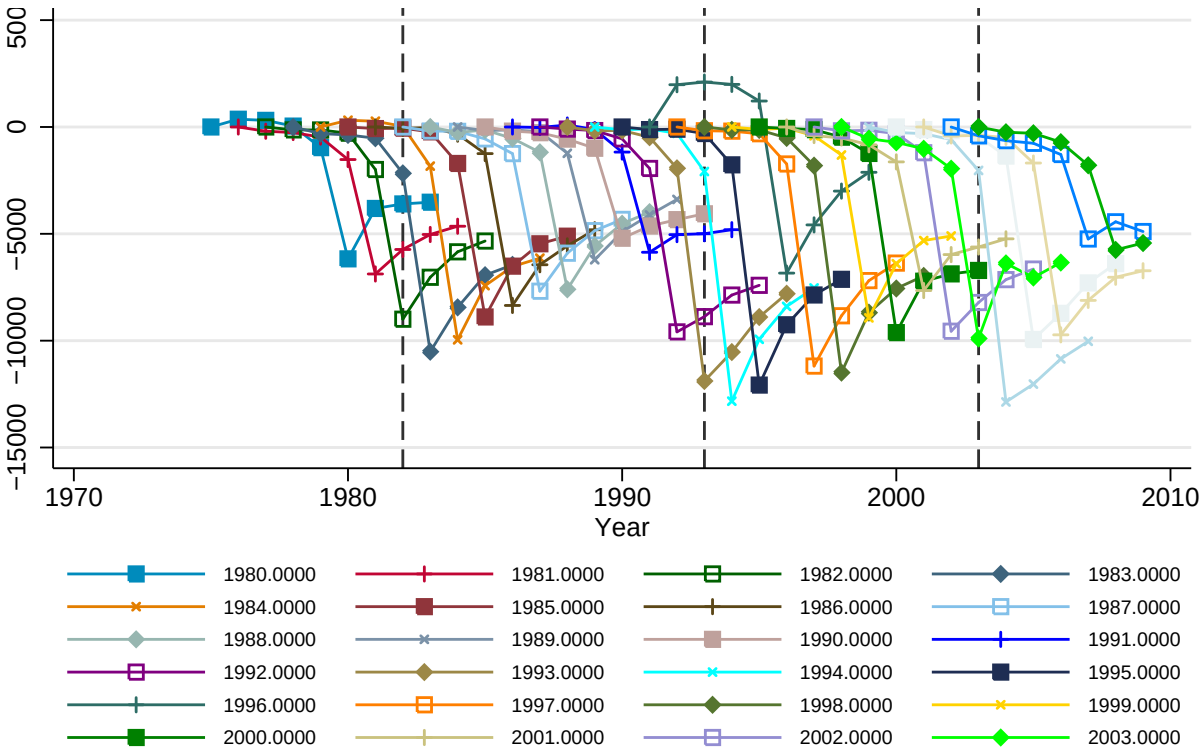


Figure 5: Probability of working on June 30th of Displaced Workers by Year of Job Loss

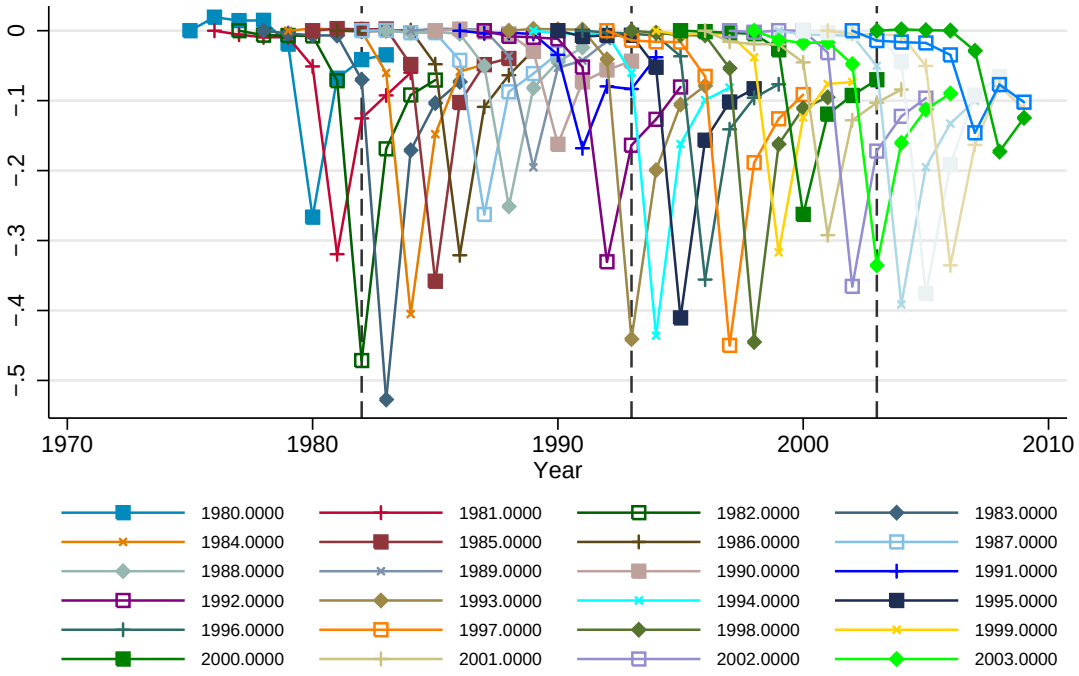


Figure 6: Wages of Displaced Workers by Year of Job Loss

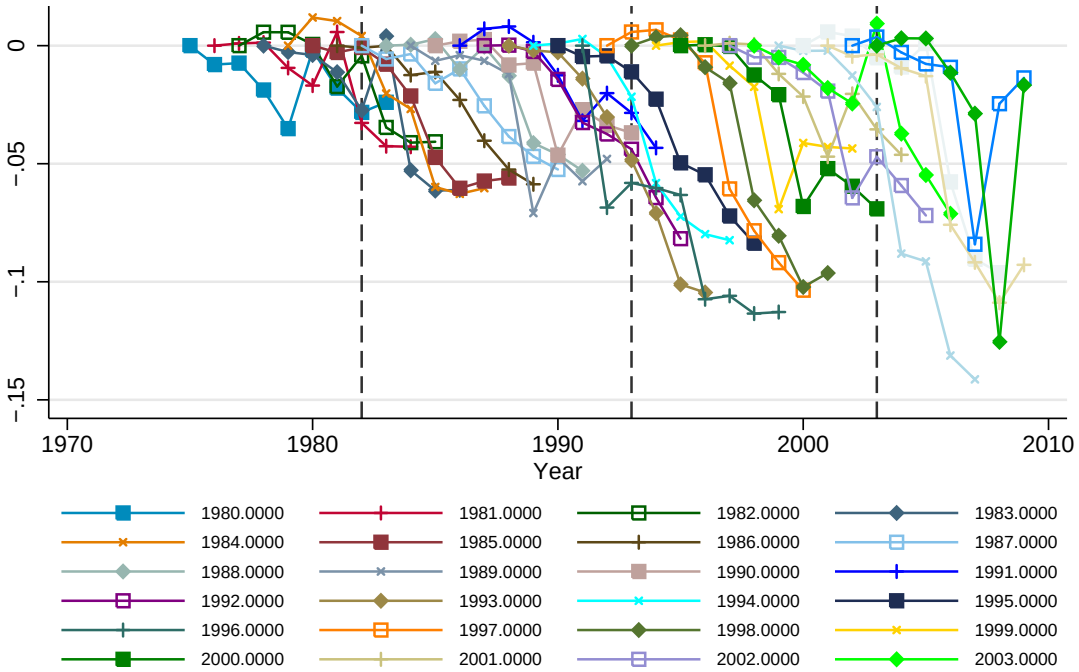


Figure 7: Unemployment Insurance Benefits Receipt

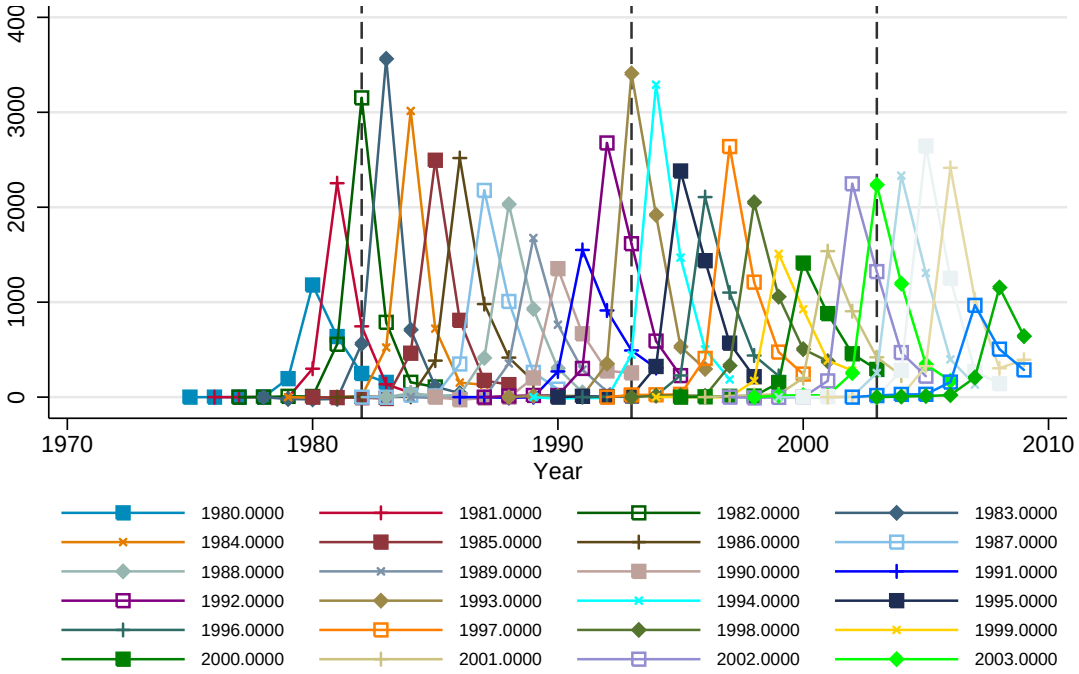
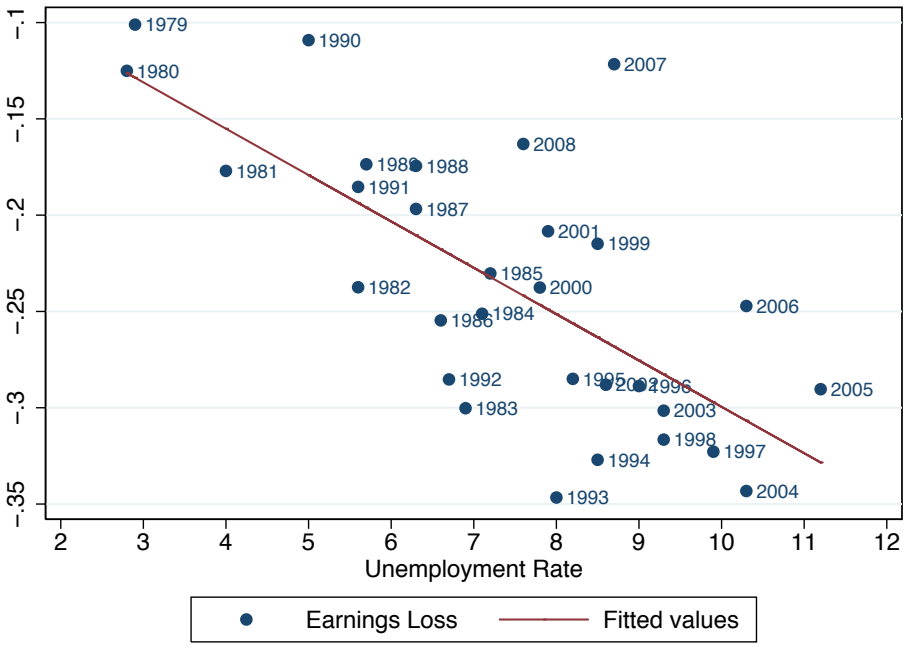
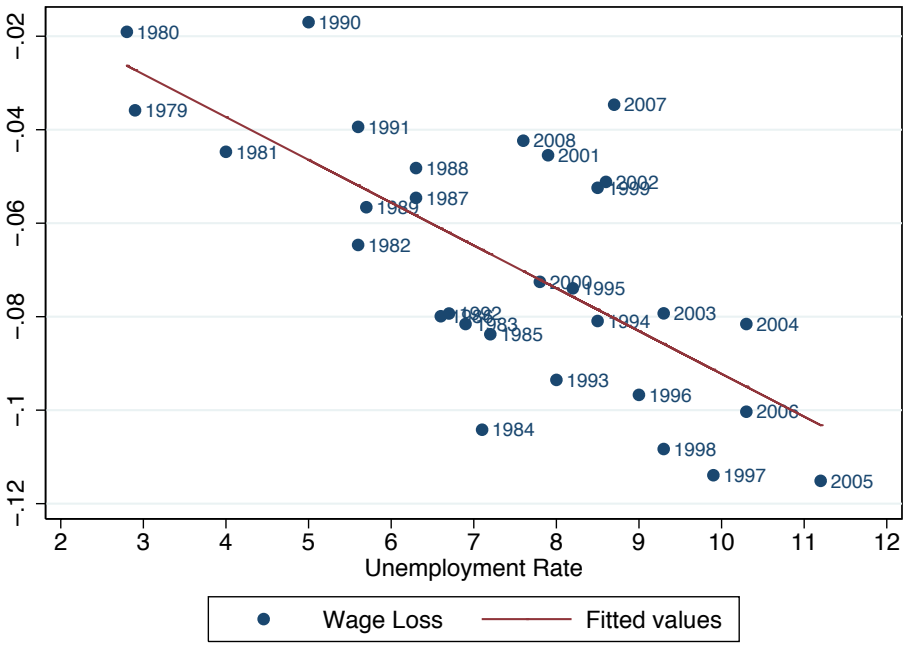


Figure 8: Effect of Job Loss on Annual Earnings and Log Daily Wages 3 Years After Displacement by Year of Job Loss vis-a-vis National Unemployment Rate at Job Loss

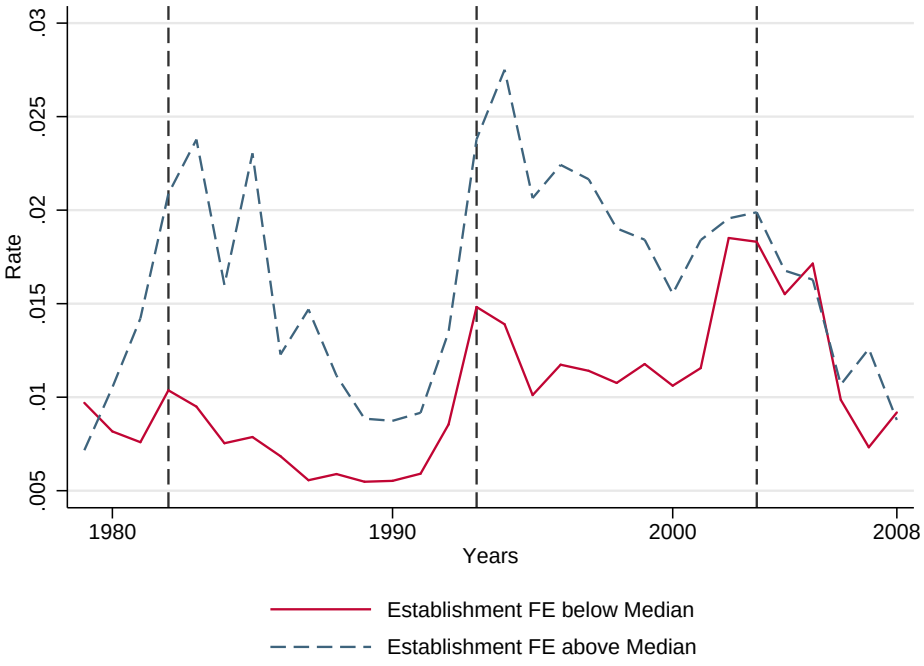


(a) Annual Earnings

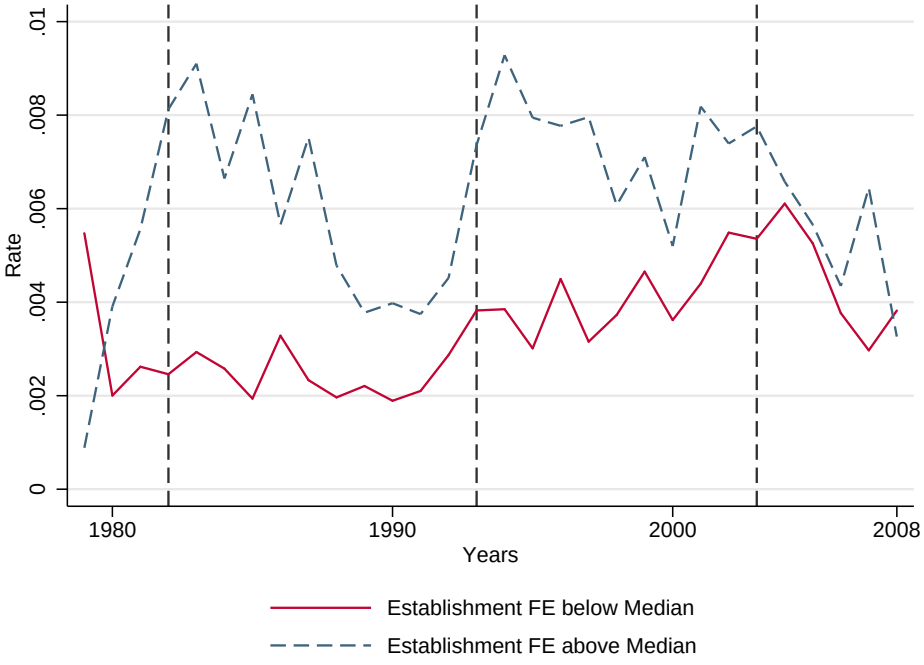


(b) Log Daily Wage

Figure 9: Incidence of Job Loss by Establishment Fixed Effect

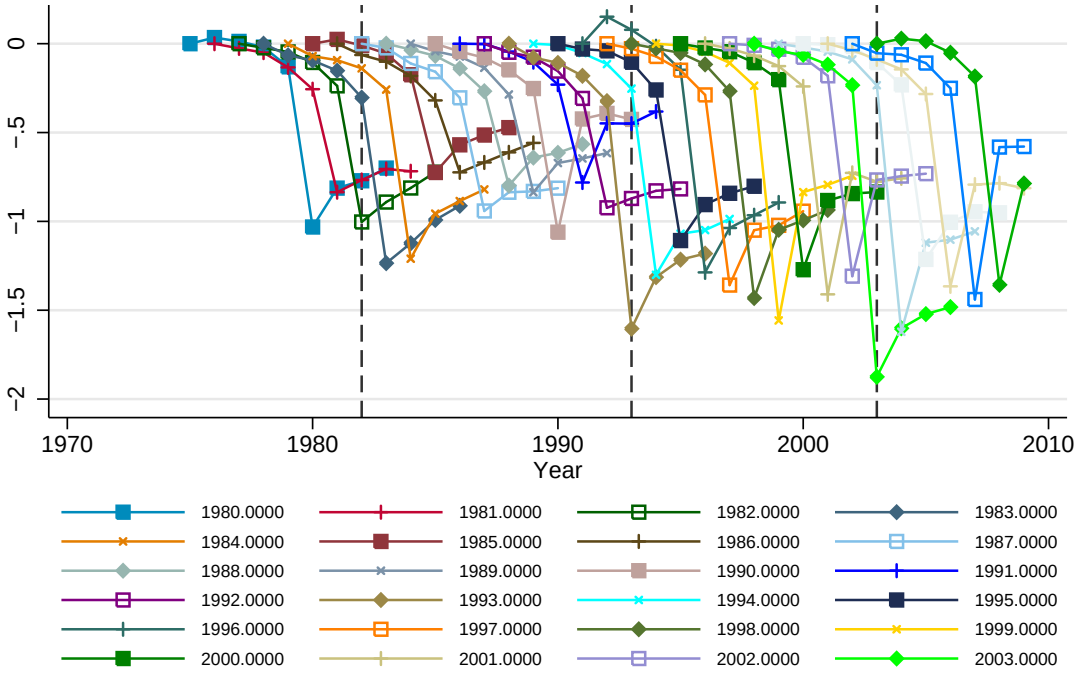


(a) Mass Layoff Rate by Year

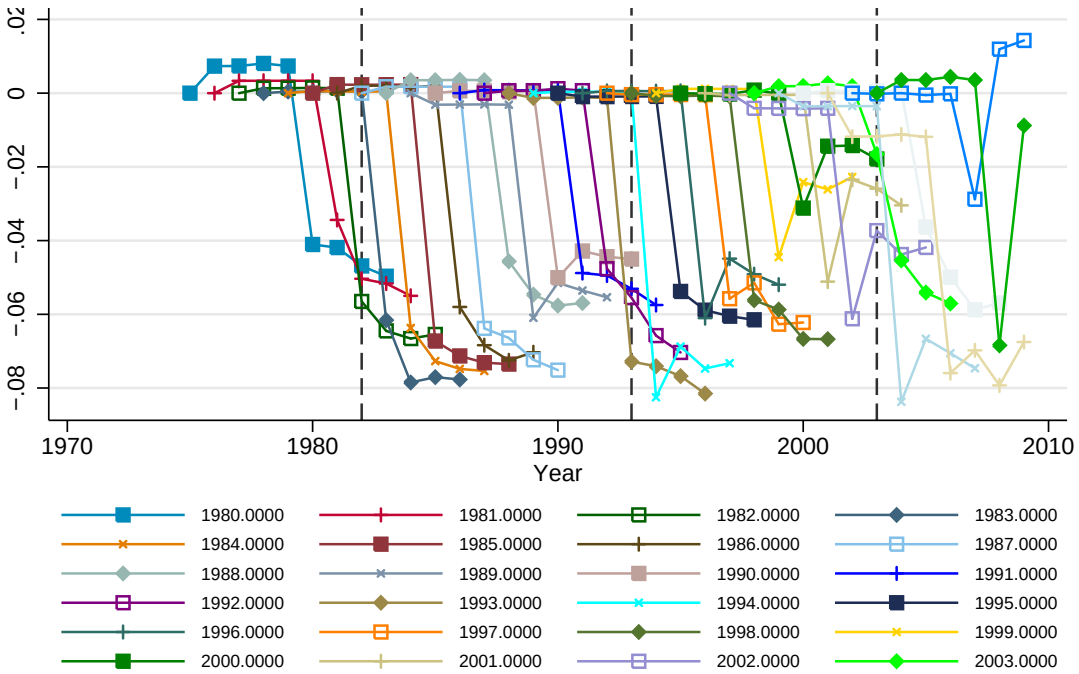


(b) Plant Closing Rate by Year

Figure 10: Employer Characteristics (Number of Employees and Establishment Effect of Displaced Workers by Year of Job Loss

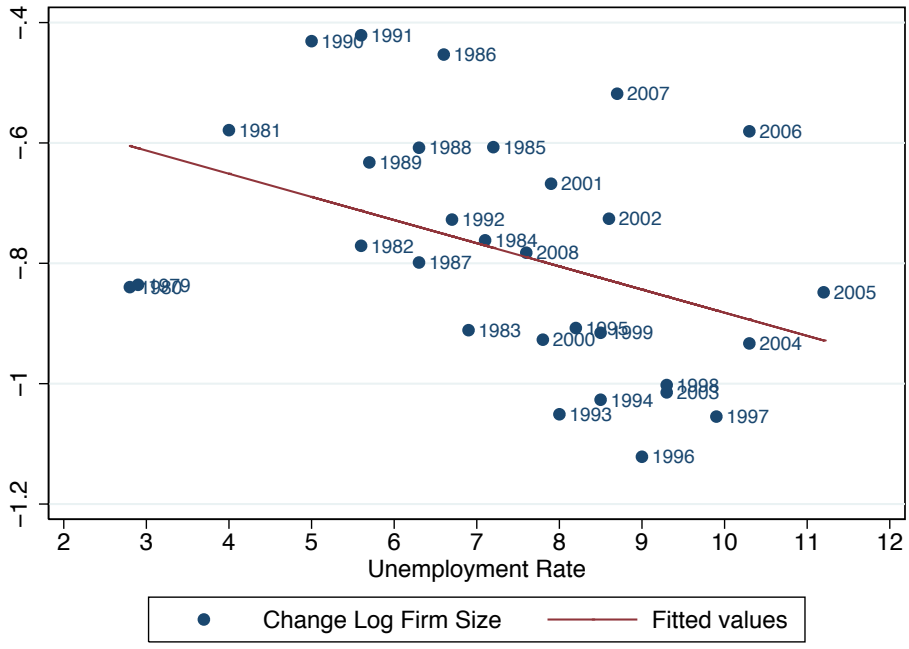


(a) Log Number of Employees at Establishment

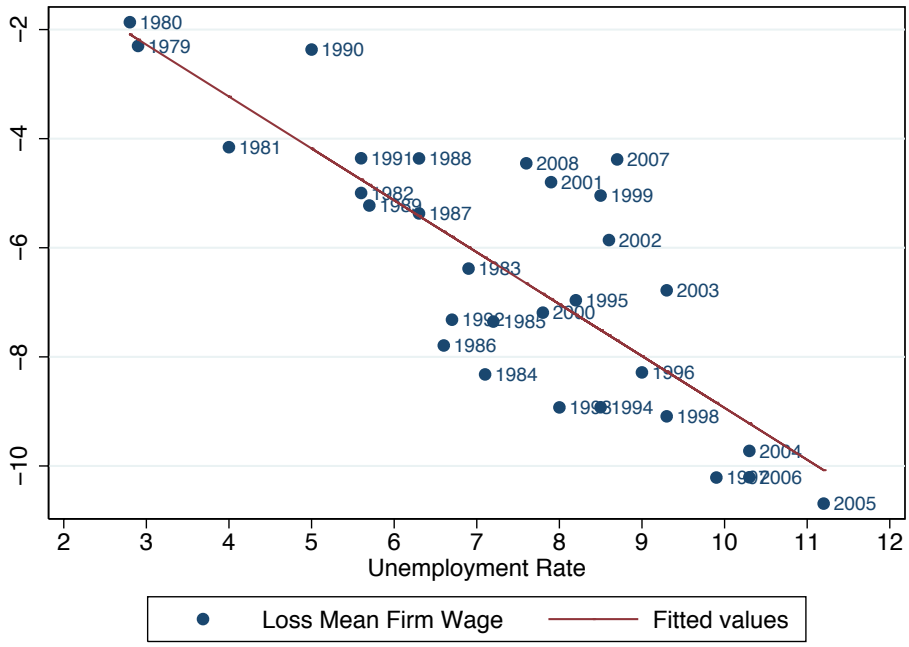


(b) Average Wage at Establishment in Euro

Figure 11: Effect of Job Loss on Employer Characteristics 3 Years After Displacement by Year of Job Loss vis-a-vis National Unemployment Rate at Job Loss

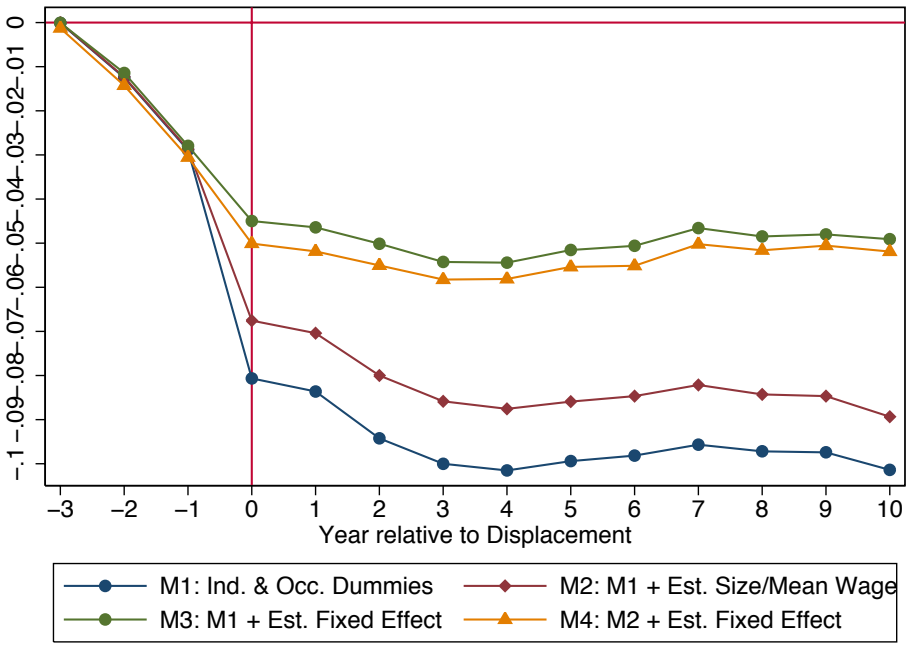


(a) Log Number of Employees at Establishment

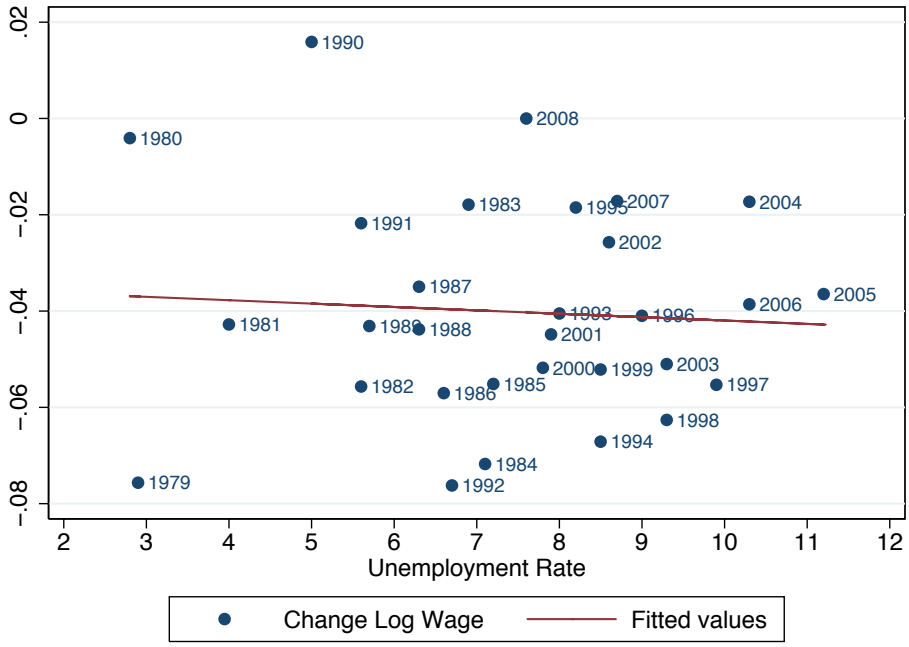


(b) Average Wage at Establishment in Euro

Figure 12: Effect of Job Loss on Log Daily Wages 3 Years After Displacement With Controls for Employer Characteristics – All Job Losses and by Year of Job Loss



(a) Average Over All Displacement Years



(b) By Year of Job Loss vis-a-vis Rate of Unemployment

Appendix

In order to identify mass-layoffs and plant closings in the German administrative data we used the following approach. After merging the establishment history panel with information on all year to year cross establishment worker flows, we defined mass layoffs as a drop in employment from one year to the next of at least 30 percent in an establishment with at least 50 employees in the year before the employment drop. To assure that these establishments were relatively stable prior to the drop and that the drop did not constitute just temporary fluctuations, we also required that employment did not increase by more than 30 percent in either of the two years before the employment drop and did not re-bounce in the two years after the drop. Furthermore to avoid identifying restructuring of the firm (such as outsourcing of larger parts) as a mass-layoff, we required that not more than 20 percent of the leaving workers were re-employed together at a single establishment in the following year (thus the leaving workers are either unemployed or dispersed over many different establishments). Similarly we defined a plant-closing as a drop in employment of at least 80 percent, again requiring that not more than 20 percent of the leaving workers were re-employed together in the following year.

The establishment history panel and the flow data provide information on the workforce of the establishments on June 30th of each year. We thus consider a mass-layoff as happening in 1982 if a plant loses 30 percent of its workforce between 1981 and 1982. We consider a worker as displaced in 1982 if he permanently left an establishment in 1982 and this establishment had a mass-layoff either in 1982 or 1983.

In order to get precise estimates we use a 20 percent random sample of all male workers in the German administrative data who we follow over the entire time period 1975 to 2009. In order to be in our main analysis sample of displaced workers and the control group, workers had to be continuously employed for at least 3 years at an establishment that was at risk of a mass-layoff. Furthermore we only selected male workers age 24 to 50 in the displacement year.

Yearly earnings were calculated as the sum of all wages during that year measured Euro and deflated to prices of 2000. For these calculations we only used workers who in a given year had at least one observation (either because they were employed for at least one day or they received unemployment benefits