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Article — Published Version

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Applied Economics

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Suggested Citation: Fackler, Daniel; Müller, Steffen; Stegmaier, Jens (2018) : Plant-level employment development before collective displacements: comparing mass layoffs, plant closures and bankruptcies, Applied Economics, ISSN 0003-6846, Taylor & Francis, London, Vol. 50, Iss. 50, pp. 5416-5435,
<https://doi.org/10.1080/00036846.2018.1486994>

This Version is available at:

<https://hdl.handle.net/10419/184751>

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Plant-level employment development before collective displacements: comparing mass layoffs, plant closures and bankruptcies

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ABSTRACT

This article analyzes the development of employment levels and worker flows before bankruptcies, plant closure without bankruptcies and mass layoffs. Utilizing administrative plant-level data for Germany, we find no systematic employment reductions prior to mass layoffs, a strong and long-lasting reduction prior to closures, and a much shorter shadow of death preceding bankruptcies. Employment reductions in closing plants, in contrast to bankruptcies and mass layoffs, do not come along with increased worker flows. These patterns point to an intended and controlled shrinking strategy for closures without bankruptcy and to an unintended collapse for bankruptcies and mass layoffs.

KEYWORDS

Job displacement; shadow of death; plant closure; bankruptcy; mass layoff



JEL CLASSIFICATION

L2; D22; J65

1. Introduction

This article analyzes firms' employment patterns prior to collective job displacement events, that is mass layoffs and firm exits with and without bankruptcy, in order to assess whether these events occur suddenly and unexpectedly or whether one can observe employment developments that point to an upcoming displacement event. A sudden and unanticipated shock precludes not only workers but also creditors and the managers of suppliers, and customers from taking preventive actions. A systematic and long-lasting plant-level employment reduction prior to exit constitutes a 'shadow of death',¹ which opens up the opportunity to predict upcoming closures, to react strategically and makes it easier for affected employees to find new jobs and for local labour markets as well as employment agencies to adjust to these job-reallocation processes. What is more, if the number of workers is reduced over a long time span before ultimate shut down, the consequences of closures might be heavily underestimated in the public debate as it is often concerned with the final employment levels.

Regarding the shadow of death, a growing body of literature has found that employment and productivity usually decrease already several years before a firm's ultimate shutdown (e.g. Griliches and Regev 1995 for Israel; Troske 1996 for the United States; Bellone et al. 2006; Blanchard, Huiban, and Mathieu 2014 for France; Carreira and Teixeira 2011 for Portugal; Almus 2004; Fackler, Schnabel, and Wagner 2014 for Germany). However, these studies were not able to distinguish between business failure and voluntary shutdown, the latter being driven, for example by the presence of more profitable alternatives. Recognizing this gap, the literature calls for an analysis of involuntary closures (e.g. Carreira and Teixeira 2011, 338). Firm exits due to bankruptcies can unambiguously be regarded as failure whereas closures may occur due to very different reasons that are not necessarily related to a firm's profitability (Müller and Stegmaier 2015). Addressing this issue empirically, Bates (2005) and Headd (2003) find that about one-third of closed firms were evaluated as successful by their owners. This suggests that previous studies on the shadow of death may have mixed up very different phenomena.

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¹The term "shadow of death" was introduced by Griliches and Regev (1995) to describe the phenomenon that productivity declines already several years before closure. Other studies (e.g. Almus 2004) used this term with respect to declining employment before closure.

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Against this background, the main contribution of our study is to compare pre-exit employment patterns before closures with and without bankruptcy thereby analyzing the shadow of death prior to involuntary exit for the first time. We further contribute to the literature by analyzing worker flow patterns prior to a collective displacement event. Examining an employer's hiring behaviour as well as separations sheds light on whether firms exit the market after an intended reduction of economic activity or struggle against a negative development and try to continue their operations. In the former case, one would argue that an upcoming closure is foreseeable for the workforce (and stakeholders outside the firm) whereas in the latter case, there is no reason for workers to expect their employers shutting down the plant.

These insights obtained from the analysis of employment patterns before collective displacements have important implications regarding the literature on job displacement (e.g. Jacobson, LaLonde, and Sullivan 1993), that is to what extent collective job displacements can be regarded as unanticipated exogenous shocks for affected employees. The literature on job displacement, which analyzes the fortunes of workers who unexpectedly lost their job due to events outside of their individual control, has long been aware of the fact that a shadow of death may obscure analyses that utilize plant closures (or mass layoffs) as an exogenous shock in order to determine wage or employment effects for affected workers among others. The reason for these concerns is that a shadow of death opens up the opportunity for strategic behaviour, for example selective worker attrition, which is particularly crucial for the interpretation of the frequently reported negative labour market outcomes of displaced workers (Von Wachter 2010).

As stated earlier, we are not the first to observe that pre-exit mobility coming along with the shadow of death threatens the proper estimation of the causal effect of job loss. Pfann and Hamermesh (2008), for example, explicitly argue that an upcoming shut down may be anticipated by workers and managers and report that workers staying until the end possess a particular high amount of firm-specific human

capital. Lengermann and Vilhuber (2002) discuss strategic pre-exit behaviour of workers and firms and report changes in the skill content of job and worker flows prior to displacement. Fackler, Schnabel, and Wagner (2014) find that employment reductions prior to plant closures come along with changes in the workforce composition. In particular, they report that the shares of high-skilled and female employees and the median age of the workforce increase before closure. Schwerdt (2011) finds selective attrition and recommends including separations up to two quarters before plant closure in the treatment group. He additionally reports better labour market outcomes of early leavers, something that has also been found by Von Wachter and Bender (2006) and Couch and Placzek (2010). Eliason and Storrie (2006, 848), however, find that early leavers may have worse outcomes. Taken together, the results of previous studies are ambiguous regarding the question whether early leavers are those who leave first because they have better outside options in the labour market or whether they are less skilled and dispensable workers who are laid off first. At the same time, most of these studies agree that there is selective worker attrition going on before firm closures. Against this background, our study aims at detecting pre-displacement periods that are likely to be affected by selective worker attrition and analyzes whether the magnitude of the shadow of death, and therefore the scope for anticipation and strategic reactions, differs between the three event types.

The remainder of the article is organized as follows: Section 2 describes the data and the construction of the sample that is used for our analyses and Section 3 provides descriptive evidence. The multivariate analysis follows in Section 4. Section 5 concludes.

II. Data

We make use of the German Establishment History Panel (BHP) provided by the Institute of Employment Research (IAB) of the German Federal Employment Agency (BA). The BHP contains the entire population of German establishments employing at least one worker subject to social security since 1975.² The data aggregate

²The publicly available version of the BHP is, for example described in Gruhl, Schmucker, and Seth (2012). Our version differs only in that it contains all plants rather than a 50 per cent sample.

employers' compulsory worker-level social security notifications at the plant level and refer to the 30th of June of each year. It includes information on plant age and size, workforce composition, worker in- and outflows, regional and sectoral information, and a unique plant identifier.

Plant exit is associated with a plant ID vanishing from the data. However, the disappearance of a plant ID can be due to very different reasons, including takeovers and changes of ownership or legal form. To better proxy true closures, extension files based on the work of Hethey-Maier and Schmieder (2013) are available. Hethey-Maier and Schmieder (2013) use worker flows between plant IDs and, intuitively, consider only those vanishing plant IDs as true closures where, after the ID disappeared, workers are dispersed over a number of different plants. Contrary, if the largest part of a vanishing plant ID's workforce ends up in the same successor ID, one would conclude that the plant did not cease to exist.

Bankruptcies are mainly identified using administrative data on *Insolvenzgeld*. These data are collected by the 610 local branches of the Federal Employment Agency (BA) and have the same unique plant ID that identifies plants in the BHP. One major advantage of these data is that the BA staff is required to actively monitor local bankruptcy processes and to store information on (upcoming) bankruptcies even if there are no applications for *Insolvenzgeld*. We additionally make use of social security announcements, that are legally required if a firm dismisses employees due to its bankruptcy, and of publicly available bankruptcy announcements made by the local courts, but this adds only marginally to the *Insolvenzgeld* data.³

We now clarify the exact definition of what we treat as a closure, a bankruptcy, or a mass layoff. A closure is a vanishing plant ID *without bankruptcy information* where the maximum clustered worker outflow⁴ of the closing plant makes up less than 30% of the

workforce of the closing plant (i.e. we use 'atomized deaths' as defined in Hethey-Maier and Schmieder 2013). For plants having less than four workers when observed the last time, the concept of clustered worker flows is not meaningful. As the bulk of vanishing plant ID's refers to such plants, dropping them seems, however, inappropriate. We decided to treat small exits as true exits if either the workforce splits up into different successor plants (which is impossible for one-worker plants and quite restrictive for two-worker plants) or if the successor is larger than the closing firm. This definition makes it unlikely that we treat continuations under different IDs as small exits.⁵ A bankruptcy is a plant for which we have bankruptcy information *and* for which the plant ID vanishes from the data. Flow measures are not needed. Finally, our definition of mass layoffs follows the bulk of the job displacement literature (e.g. Jacobson, LaLonde, and Sullivan 1993; Schmieder, Von Wachter, and Bender 2010), that is an employment reduction of between 30 and 80 per cent within 1 year in plants that had at least 50 employees at the time of the mass layoff. As in Schmieder, von Wachter, and Bender (2010) we computed a complete cross-flow matrix of employees and, for the definition of mass layoffs, require that less than 20 per cent of displaced workers end up under the same new plant ID. We also require that the plant is not experiencing employment increases of more than 30 per cent in the year prior and after the mass layoff.⁶

In the empirical analysis, we will compare plants subject to one of the three mutually exclusive events (closure, bankruptcy, mass layoff) with a control group defined later.⁷ We look at plants having the last pre-event observation in the year 2007. Strictly speaking, the event takes place at some point between June 30th of 2007 and June 29th of 2008. We chose 2007 as this is the earliest year for which we have reliable bankruptcy information and because 2007 should be the least affected by the global

³More detailed information on the identification of bankruptcies are provided by Müller and Stegmaier (2015).

⁴A clustered worker flow denotes workers moving from the same predecessor plant to the same successor plant between two consecutive years. The largest cluster of all clustered outflows from a predecessor is its maximum clustered outflow.

⁵Our robustness checks show that using all small deaths (as in Fackler, Schnabel, and Wagner 2014) makes little difference.

⁶We are grateful to Johannes Schmieder for providing us with the necessary codes.

⁷The events are mutually exclusive with respect to a specific year. Mass layoffs may, however, precede closure or bankruptcy in future years. As this may be interesting for the evaluation of within-plant selectivity in closures and bankruptcies, we checked the importance of this phenomenon. Less than 1 per cent of all closures and bankruptcies of the event-cohort 2007 are preceded by mass layoffs occurring in the period of observation between 2002 and 2006.

economic crisis reaching Germany around the third quarter of 2008. Our main insights are, however, unchanged if we replicate our analyses for plants with the last pre-event observation in 2008.⁸ We study the employment patterns during the last 5 years before the displacement event, that is we restrict our analysis to plants that are at least 5 years old in 2007 and therefore already existed in 2002. The same restriction applies to the control group.⁹ Our analysis refers to the western German private sector without agriculture and mining (both sectors are heavily influenced by national or European legislation). In the event cohort of the year 2007, our sample comprises 36,276 closures, 4767 bankruptcies, and 317 mass layoffs.

We compare the pre-event employment development of plants facing one of the three displacement events in 2007 with a control group of plants that did not experience any of the three events in 2007. The control group may thus contain both plants with the same and other displacement events occurring earlier or later. We also conducted a robustness test restricting the control group to plants that never experienced any of the three events until 2010, which did not alter our insights.

The outcome variables of main interest in the following empirical analysis are a plant's number of employees as well as the accession-, separation- and churning-rate in order to investigate the worker flows behind the employment changes. We additionally analyze changes in the workforce composition. Accessions are defined as all workers that were employed in a given plant on June 30th (the reference date in the BHP) of a given year but not on June 30th of the previous year. Analogously, separations are defined as all workers that were not employed in a given plant on June 30th of a given year but on June

30th of the previous year.¹⁰ Following previous studies on worker flows, for example Davis and Haltiwanger (1999), churning (or excess worker flows) is defined as the sum of accessions and separations minus the change in total employment between two reference dates and describes the amount of worker flows that goes beyond net employment adjustment thereby representing simultaneous job creation and destruction (Davis and Haltiwanger 1999, 2717). Following Davis and Haltiwanger (1999, 2718f), we calculated symmetric accession-, separation- and churning rates between two periods t and $t-1$, thus dividing each of the three measures by average employment in t and $t-1$.

III. Descriptive evidence

Table 1 shows some descriptive statistics for the four groups of plants that are included in our analysis (bankruptcies, closures, mass layoffs and the control group) in the base year 2002. With respect to plant size, it can be seen that bankruptcies are about 60 per cent larger than plants in the control group. Closures are smaller than the other three groups of plants whereas plants facing mass layoffs are by far largest, which is not surprising given the definition of mass layoffs described above. Regarding plant age, there are no substantial differences between the four groups of plants.¹¹ A similar picture applies to the sectoral composition. Between 11 (closures) and 21 per cent (mass layoffs) of the plants belong to the manufacturing sector. The share of plants belonging to the construction sector is highest for bankruptcies (20 per cent) whereas it is very low for mass layoffs with only 3 per cent. The share of plants in the service sector is lowest for bankruptcies (62 per cent) and between 75 and 77 per cent for the other three groups. Worker flow measures are depicted in Table 2.¹² It can be seen that accession, separation

⁸Fackler, Schnabel, and Wagner (2013) argue that it is difficult to reliably identify closures close to the current edge of the data. As the current version of the BHP ends in 2010, we therefore do not consider closures later than 2008.

⁹The observation period of five years is in line with a previous study on the shadow of death for Germany by Fackler, Schnabel, and Wagner (2014). Restricting the shadow to even shorter periods obviously makes little sense as a shadow of death for a, say, 3-year-old plant is not a really meaningful measure.

¹⁰Unfortunately, it is not possible to distinguish between voluntary quits and layoffs.

¹¹Plant age is censored at 27 years. The reason is that for those plants that already existed in 1975, it is not clear whether they were founded in 1975 or earlier. The figures reported in Table 1 might therefore underestimate true plant age.

¹²Note that the base year for the worker flows is 2003 (and not 2002) because these measures refer to the period between two reference dates (i.e. 30 June 2002 and 30 June 2003). To make sure that we use the same sample of plants for both employment levels and worker flows, that is plants that already existed in 2002 but not necessarily in 2001, we have to skip 1 year at the beginning of the observation period when considering worker flows. The number of plants in Table 2 is slightly lower than in Table 1 because the calculation of the worker flow measures requires that plants are observed in both 2002 and 2003. Plants that do not report having employees on June 30th of a given year cannot be included in our flow sample in that year and the following year.

Table 1. Plant characteristics in 2002 (means).

	Bankruptcies	Closures	Mass layoffs	Control group
Log no. of employees	1.8282 (1.2706)	0.9962 (0.9537)	4.3656 (1.0016)	1.3283 (1.2371)
Plant age (years)	10.9432 (9.7525)	11.6708 (9.6805)	12.4953 (10.0981)	11.3869 (9.8102)
Manufacturing (dummy)	0.1771 (0.3817)	0.1093 (0.3120)	0.2082 (0.4067)	0.1342 (0.3408)
Construction (dummy)	0.1995 (0.3997)	0.1168 (0.3212)	0.0252 (0.1571)	0.1168 (0.3212)
Services (dummy)	0.6235 (0.4846)	0.7739 (0.4183)	0.7666 (0.4237)	0.7490 (0.4336)
No. of plants	4,767	36,276	317	1,471,359

Notes: BHP, West Germany, private sector, w/o agriculture, forestry, hunting and mining; standard deviations in parentheses.

Table 2. Worker flow measures in 2003 (means).

	Bankruptcies	Closures	Mass layoffs	Control group
Accession rate	0.3145 (0.3459)	0.2340 (0.3333)	0.4493 (0.3390)	0.2311 (0.3114)
Separation rate	0.2964 (0.3134)	0.2459 (0.3369)	0.3484 (0.2228)	0.2313 (0.3079)
Churning rate	0.3444 (0.4281)	0.2487 (0.4473)	0.5812 (0.3955)	0.2553 (0.4195)
No. of plants	4,576	34,437	316	1,272,271

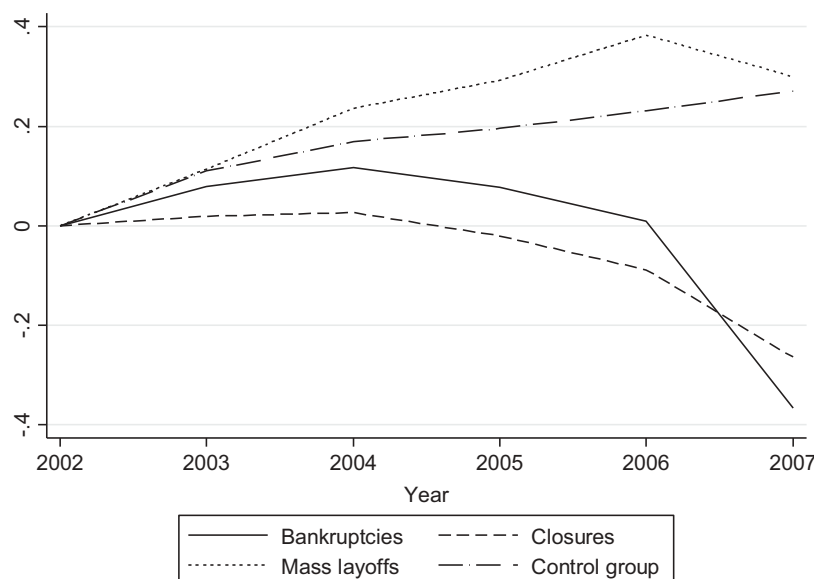
Notes: BHP, West Germany, private sector, w/o agriculture, forestry, hunting and mining; standard deviations in parentheses.

and churning rates are highest for mass layoffs followed by bankruptcies whereas both closures and plants in the control group have comparably low worker flow rates.

Figure 1 depicts the development of plant size relative to the base year. It can be seen that plants in the control group grew continuously during the

whole period of observation. One can further see that compared to the reference year 2002, bankrupt plants grew until 2004, had the same employment level as in the base year in 2006, and a strong employment reduction only in the last year. Closures, by contrast, had a rather constant employment level from 2002 to 2004 and reduced their employment level continuously between 2004 and 2007. These employment reductions become increasingly larger as exit approaches, which is in line with previous evidence by Fackler, Schnabel, and Wagner (2014). For mass layoffs, one can see a comparably strong employment increase until 2006, followed by a reduction in the year prior to the event. Note that this drop is likely to be driven by the definition of mass layoffs requiring that there is no employment increase of more than 30 per cent prior to the mass layoff (and after it). These figures indicate that there is a substantial and long-lasting shadow of death for closures, a moderate shadow of death for bankruptcies (since employment declines substantially only in the last year), and no shadow of death preceding mass layoffs.

The developments of the worker flow rates relative to the base year are depicted in Figure 2–4. In Figure 2, one can see that accession rates decreased by about 20–30 per cent for all groups of plants during the period of observation.

**Figure 1.** Log number of employees, difference to the base year 2002.

Notes: BHP years 2002–2007, West Germany, private sector, w/o agriculture, forestry, hunting and mining; plants that already existed in 2002.

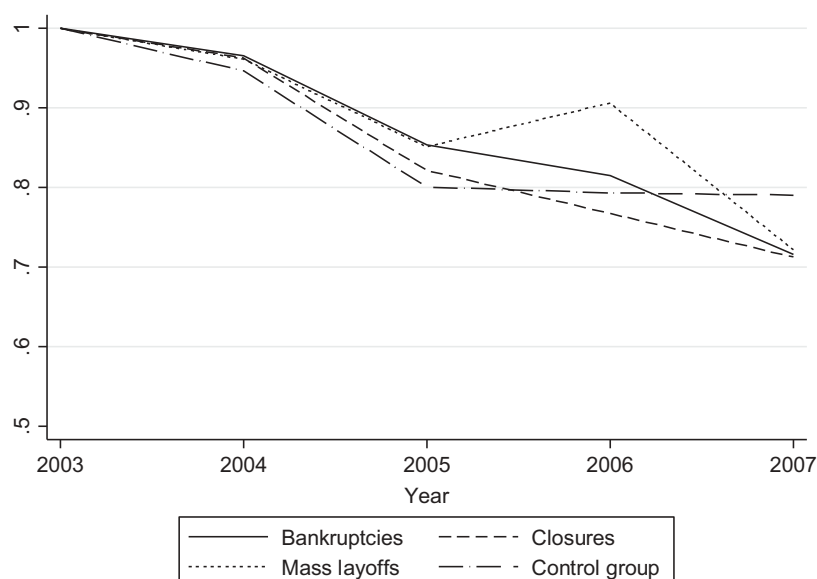


Figure 2. Accession rate relative to the base year 2003.

Notes: BHP years 2003–2007, West Germany, private sector, w/o agriculture, forestry, hunting and mining; plants that already existed in 2002.

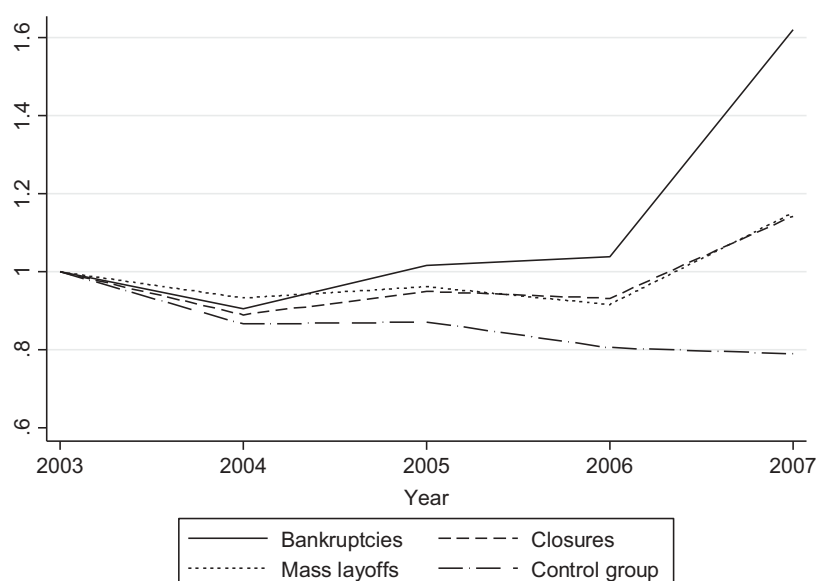


Figure 3. Separation rate relative to the base year 2003.

Notes: BHP years 2003–2007, West Germany, private sector, w/o agriculture, forestry, hunting and mining; plants that already existed in 2002.

For the control group, the accession rate remains rather constant from 2005 onwards and it further decreases slightly for closures and bankruptcies. For mass layoffs, there is a small peak in 2006 and a drop in the last year.

Looking at the separation rates relative to the base year (Figure 3), one can see a continuous decline only for the control group. The separation rate for closures is slightly lower than in the base

year until 2006 and increases moderately in the last year. The same pattern applies to mass layoffs. For bankruptcies, the separation rate does not differ substantially from the base year until 2006 and in the last year, it rises strongly by about 60 per cent.

The churning rates relative to the base year (Figure 4) show rather similar developments for all four groups. Between 2003 and 2007, it decreases by around 20 per cent for closures and

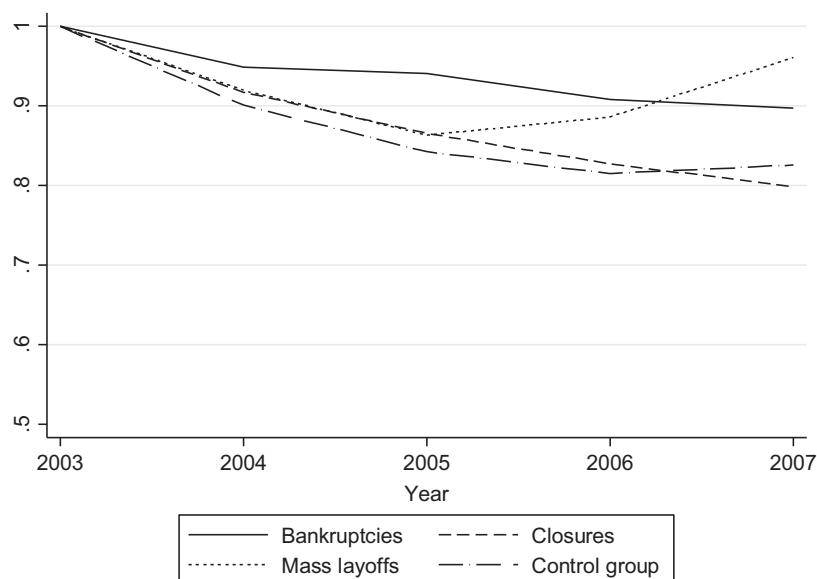


Figure 4. Churning rate relative to the base year 2003.

Notes: BHP years 2003–2007, West Germany, private sector, w/o agriculture, forestry, hunting and mining; plants that already existed in 2002.

the control group and by about 10 per cent for bankruptcies. For mass layoffs, the churning rate reaches its minimum in 2005 where it is 14 per cent lower than in the base year and increases slightly in the next two years. Taken together, the descriptive analysis of the worker flow measures reveals that remarkable differences in the *developments* between the four groups can be found only with respect to the separation rate, which is in line with the development of the employment levels (Figure 1). However, one has to keep in mind that there are substantial permanent differences in the worker flow rates as shown in Table 2. The overall picture that emerges from the analysis of levels and developments of the worker flow measures will be discussed later.

IV. Econometric analysis

Estimation approach

In the following, we estimate random effects panel regressions for the period 2002–2007 with the dependent variable being the natural logarithm of the number of employees, the accession-, separation- or

churning-rate, respectively. As right-hand-side variables, we include year dummies, time-invariant dummies for the three displacement events, and interaction terms between the year dummies and the event dummies. In this regression model, the time-invariant event dummies measures the difference in the base year (i.e. 2002)¹³ between each of the three treatment groups and the control group. Year dummies capture the employment evolution in the control group and thus account for any aggregate employment patterns, for example due to business cycle fluctuations. The interaction terms between year dummies and the time-invariant event indicators describe how differences between control and treatment groups evolve over time.

As control variables, we include dummies for 2-digit industries, 30 administrative districts (*Regierungsbezirke*), 9 plant size classes¹⁴ and 3 age classes,¹⁵ in order to compare affected plants with the average plant within the same industry, region, size-class (referring to the base year 2002) and age-class (in 2007). We also control for the plants' initial workforce composition, thereby including the percentages of low and highly qualified workers (according to the classification by Blossfeld 1987), women, and the median age of the workforce. To be sure, the results might still

¹³In the worker flow regressions, the reference year is 2003 (and not 2002) because the flow measures refer to the period between two reference dates.

¹⁴The plant size classes are 1–4, 5–9, 10–19, 20–49, 50–99, 100–199, 200–499, 500–999, 1000 and more employees.

¹⁵The age classes are 5–10, 11–20 and older than 20 years when exiting the market.

partly be driven by unobserved firm characteristics that we are not able to control for. We therefore conducted a robustness test estimating regressions with plant fixed effects in order to control for all time-invariant plant characteristics and to reduce heterogeneity as much as possible. A major disadvantage of fixed effects estimations is that they do not allow us to identify permanent differences between the four groups but only developments over time. These patterns are, however, almost identical to the results presented later.

Employment regressions

Estimation results for our employment regressions are presented in Table 3. The coefficients of the event dummies indicate that, in the reference year 2002 (conditional on industry, region and plant size class), closures are about 10 per cent smaller than plants in the control group.¹⁶ Bankrupt plants are

about 2 per cent larger than plants in the control group and, as expected, plants facing mass layoffs are 18 per cent larger than plants in the control group. The regression results in Table 3 further show that plants in the control group grew by about 6 per cent between 2002 and 2007.

Looking at the coefficients of the interaction terms between the year and event dummies, one can see that bankruptcies experienced an increasingly worse employment development than the control group. Have bankrupt plants been larger than plants in the control group in 2002, they lost about 9 per cent compared to the control group until 2006. The most severe employment reductions, however, are faced by closures. Here, the relative decline in employment amounts to 16 per cent between 2002 and 2006. In the last period before the event, relative employment reductions in bankrupt plants are slightly larger than in closed plants whereas the relative employment reductions in the years before are always larger in closed plants. For mass layoffs, our estimates of the interaction terms between the year dummies and the event dummy show an employment increase until the year 2006, followed by a reduction in the last year. It is important to note that this drop is likely to be driven by the definition of mass layoffs requiring that there is no employment increase of more than 30 per cent prior to the mass layoff (and after it). This restriction does not apply to the control group. Taken together, the results of the employment regressions show that the three events under examination can be clearly ordered by the magnitude of the shadow of death. While there are no employment reductions preceding mass layoffs, the shadow is moderate for bankruptcies and substantial and long lasting for closures.¹⁷

The long-run shrinking process of closures without bankruptcy may occur because some business plans turn out to be not profitable and, for example in the sense of the passive learning model of Jovanovic (1982), employers decide to disinvest. Disinvestment may take time due to employment protection regularities or because parts of the plant generate a mark-up over variable costs and carry on until replacement investments become necessary. Moreover, many closures are voluntary exits and often do not reflect a failure of the business activity *per se* but, for example

Table 3. Regression results – employment levels.

Variable	Log (number of employees)
Bankruptcy (dummy)	0.0240 (4.14)***
Closure (dummy)	−0.1000 (−39.81)***
Mass layoff (dummy)	0.1639 (12.03)***
Year 2002 (reference)	–
Year 2003 (dummy)	0.0256 (67.96)***
Year 2004 (dummy)	0.0637 (138.31)***
Year 2005 (dummy)	0.0599 (115.19)***
Year 2006 (dummy)	0.0653 (115.10)***
Year 2007 (dummy)	0.0612 (99.55)***
Year 2003 × bankruptcy	0.0059 (0.83)
Year 2004 × bankruptcy	0.0052 (0.60)
Year 2005 × bankruptcy	−0.0290 (−2.87)***
Year 2006 × bankruptcy	−0.0914 (−8.02)***
Year 2007 × bankruptcy	−0.4272 (−27.64)***
Year 2003 × closure	−0.0343 (−14.07)***
Year 2004 × closure	−0.0674 (−22.20)***
Year 2005 × closure	−0.1108 (−31.64)***
Year 2006 × closure	−0.1744 (−44.84)***
Year 2007 × closure	−0.3253 (−69.84)***
Year 2003 × mass layoff	0.0901 (4.11)***
Year 2004 × mass layoff	0.1740 (4.86)***
Year 2005 × mass layoff	0.2325 (5.64)***
Year 2006 × mass layoff	0.3181 (7.09)***
Year 2007 × mass layoff	0.2388 (5.07)***
Intercept	1.0217 (237.64)***
R-squared	0.8087
No. of observations	5,941,105

Notes: BHP years 2002–2007, West Germany, private sector, w/o agriculture, forestry, hunting and mining; regressions are based on the sample of plants that already existed in 2002; all regressions control for two-digit industries, administrative districts, plant size and age, and workforce composition (see also Section 4.1); ***, ** or * denotes significance at the 1, 5 or 10 per cent level, respectively; t-values in parentheses; standard errors are clustered at the plant level.

¹⁶This is computed as $(\exp(-0.1000)-1)*100\%$. In the text, all effects of the employment regressions are reported this way.

¹⁷Note that almost all differences in the developments (i.e. the coefficients of the interaction terms) between the four groups are statistically significant at the 1 per cent level.

retirement decisions or situations where the firm owner built up more profitable alternatives (for a discussion, see Müller and Stegmaier 2015). Hence, disinvestment strategies may also happen in the absence of economic difficulties. Contrarily to closures, bankruptcies reduce employment at a much smaller scale. A comparison of the employment development for bankruptcies and closures therefore suggests that the latter group contains planned exits following long-run shrinking strategies while bankrupt plants try to stay in business at a given scale and shut down with a huge employment drop and many unpaid bills.

Potential reasons for the pre-event employment growth of plants facing mass layoffs could be an increased hiring of workers due to some temporary peak in the plants' order situation or these plants may experience idiosyncratic shocks (e.g. important consumers terminate cooperation) interrupting the plants' growth process and forcing employers to reduce their employment level substantially. Not least because mass layoffs are much more costly for the employer than stepwise employment reductions one can hardly believe that a sudden collapse resulting in a mass layoff after continuous growth in the years before was foreseen by the relevant actors.

Worker flow regressions

In a next step, we estimated regressions for the worker flow measures described earlier. Starting with the **accession rate**, one can see from Table 4 that both plants facing mass layoffs and bankruptcies in 2007 have a higher accession rate than the control group in the base year (more precisely between the reference dates in 2002 and 2003). The difference is about 6 percentage points for bankruptcies and 20 percentage points for mass layoffs. For closures, by contrast, the accession rate in the base year hardly differs from the control group. The coefficients of the year dummies, which capture the evolution in the control group, show a declining accession rate which seems to be nearly constant from 2005 onwards. This might indicate, *inter alia*, that employment fluctuations decrease as plants become older (see also the results on separations and churning below). Comparing the developments of the accession rates over time, there are hardly any economically and statistically significant differences between the four groups until 2006. Only in 2007, the accession rate decreases for each of the three events with the largest drop for mass layoffs and the smallest for closures. Despite this drop in the last period, both bankruptcies and mass layoffs still

Table 4. Regression results – worker flows.

Variable	Accession rate	Separation rate	Churning rate
Bankruptcy (dummy)	0.0648 (13.28)***	0.0668 (14.88)***	0.0690 (11.42)***
Closure (dummy)	−0.0034 (−1.93)*	0.0388 (21.89)***	0.0115 (4.90)***
Mass layoff (dummy)	0.2028 (11.50)***	0.1002 (8.87)***	0.2445 (12.30)***
Year 2003 (reference)	–	–	–
Year 2004 (dummy)	−0.0103 (−27.03)***	−0.0266 (−76.51)***	−0.0224 (−47.16)***
Year 2005 (dummy)	−0.0445 (−122.65)***	−0.0203 (−58.83)***	−0.0350 (−73.32)***
Year 2006 (dummy)	−0.0466 (−129.13)***	−0.0313 (−91.15)***	−0.0414 (−86.76)***
Year 2007 (dummy)	−0.0489 (−136.03)***	−0.0274 (−78.44)***	−0.0380 (−78.77)***
Year 2004 × bankruptcy	0.0007 (0.12)	−0.0011 (−0.20)	0.0060 (0.85)
Year 2005 × bankruptcy	−0.0015 (−0.25)	0.0262 (4.42)***	0.0157 (2.15)**
Year 2006 × bankruptcy	−0.0121 (−2.05)**	0.0445 (7.22)***	0.0109 (1.47)
Year 2007 × bankruptcy	−0.0416 (−6.95)***	0.2130 (25.94)***	0.0028 (0.36)
Year 2004 × closure	0.0026 (1.14)	0.0003 (0.11)	0.0030 (1.03)
Year 2005 × closure	0.0032 (1.45)	0.0095 (4.06)***	0.0030 (1.04)
Year 2006 × closure	−0.0078 (−3.60)***	0.0171 (7.15)***	0.0002 (0.08)
Year 2007 × closure	−0.0193 (−8.84)***	0.0647 (24.03)***	−0.0115 (−3.81)***
Year 2004 × mass layoff	−0.0070 (−0.41)	0.0034 (0.29)	−0.0242 (−1.66)*
Year 2005 × mass layoff	−0.0223 (−1.21)	0.0070 (0.58)	−0.0443 (−2.72)***
Year 2006 × mass layoff	0.0046 (0.26)	0.0022 (0.17)	−0.0246 (−1.46)
Year 2007 × mass layoff	−0.0757 (−4.80)***	0.0801 (5.75)***	0.0153 (0.95)
Intercept	0.4435 (314.84)***	0.3468 (264.94)***	0.4702 (239.00)***
R-squared	0.0692	0.0561	0.0710
No. of observations	4,876,403	4,876,403	4,876,403

Notes: BHP years 2003–2007, West Germany, private sector, w/o agriculture, forestry, hunting and mining; regressions are based on the sample of plants that already existed in 2002; all regressions control for two-digit industries, administrative districts, plant size and age, and workforce composition (see also Section 4.1); ***, ** or * denotes significance at the 1, 5 or 10 per cent level, respectively; t-values in parentheses; standard errors are clustered at the plant level.

have a considerably higher accessions rate than the control group.¹⁸

Turning to the **separation rate**, our results show that in the base year, the separation rate is higher in all treatment groups than in the control group. The difference is largest for mass layoffs with 10 percentage points and smallest for closures with 4 percentage points. The evolution in the control group again suggests that employment fluctuations decrease on average as plants get older. The coefficients of the interaction terms show that the separation rate for each of the three events increases relative to the control group, in particular in the last pre-event period. This effect is strongest for bankruptcies with 21 percentage points between 2003 and 2007 and moderate for closures and mass layoffs with 6 and 8 percentage points, respectively.

Looking at the results for accessions and separations jointly, the picture that emerges is in line with the results of the employment regressions presented above. Although the separation rate for bankruptcies increases considerably already in 2005 and 2006, their accession rate remains on such a high level that employment decreases only slightly. Note that the separation rates for closures are lower than for bankruptcies and mass layoffs. The long-run shrinking of closures as reported in Table 3 is achieved with an accession rate (separation rate) comparable to (slightly above) the control group's levels. The major difference to bankruptcies is that closures seem to undertake no efforts to stabilize employment levels by increased hiring. Except for the last year, mass layoffs always have a higher accession than separation rate, which is consistent with the results from the employment regression.

To put it differently, bankruptcies have a high accession rate to compensate their substantial amount of separations while closures' accession rate is too low to even compensate for their comparably low separation rate. As the firm arguably has more control over the accession rate than over the separation rate (e.g. because of employment protection legislation and voluntary quits), we would expect firms that intend to stay in business to have a high accession rate when the separation rate is

high. One may argue that there is an upper bound to the accession rate, for example due to limited capacities of firms to search, to administer hires, and to train new employees. If this is true, high separation rates may drive firms out of business even if management tries to stay in. Contrarily, firms having a moderate separation rate but an even lower accession rate obviously intend to shrink and this is exactly what we observe for closures. We think that the higher level of accessions points at a struggle to defend a certain production level before finally experiencing a sudden collapse. Although we also find an increasing separation rate for bankruptcies as exit approaches, their constantly high accession rate serves as a strong signal that these firms intend to stay in business.

The **churning rate** regressions reveal that, in the reference year, bankruptcies and mass layoffs have substantially higher churning rates than the control group because of their substantially higher accession and separation rates. The difference is about 7 percentage points for bankruptcies and 24 percentage points for mass layoffs. For closures, by contrast, the churning rate in the base year hardly differs between treatment and control group and, thus, there is no indication of management action going against the shrinking process. Looking at the development over time, the churning rate for the control group decreases somewhat. The coefficients of the interaction terms reveal that there are hardly any systematic and statistically significant differences in the developments between the four groups. The latter makes us conclude that – despite the higher amount of churning for bankruptcies and mass layoffs – there is no clear indicator for economic distress leading to a displacement event in the near future. With respect to closures without bankruptcy, it is hard to test whether they are planned, but the fact that the employment reductions in closing plants, in contrast to bankruptcies, do not come along with increased churning points at strategic shrinking rather than a struggle for life followed by an unintended collapse.

¹⁸The difference between treatment and control group in a given year equals the sum of the coefficients of the time-invariant event-dummy and the respective interaction term between year and event-dummy.

Further results, heterogeneities and robustness tests

Since the employment fluctuations before collective displacements likely come along with changes of the workforce composition, we also investigate changes in the skill, gender and age structure. For this purpose, we run the same regressions as presented above with the dependent variables being the percentages of low, medium and highly qualified workers (according to the classification by Blossfeld 1987), the percentage of women, and the median age of the workforce. The results that are presented in [Appendix Table A1](#) reveal for closures and bankruptcies that the workforce becomes slightly better qualified as exit approaches since the share of low-qualified workers slightly decreases and the share of medium-qualified workers increases relative to the control group in the last one or 2 years. For mass layoffs, the development seems to go in the opposite direction. The share of women increases slightly, in particular for bankruptcies and closures. The median age of the workforce becomes somewhat higher for closures as exit approaches whereas it decreases prior to mass layoffs and does not differ significantly from the control group for bankruptcies in the last years before the event. Taken together, the observed patterns for bankruptcies and closures are very similar to those reported by Fackler, Schnabel, and Wagner (2014) for plant closures (without differentiating between bankruptcies and other closures) who also reported an increasing skill level, share of women and median age of the workforce before exit. An increasing skill level might point to a slightly employer dominated selection process before market exit and increasing shares of women and older workers may reflect lower mobility of these two groups. The selection processes prior to mass layoffs seem to differ from closures and bankruptcies, but one has to keep in mind that mass layoffs *per se* entail within-plant selectivity of laid off workers, which is not the case for bankruptcies and other closures.

In order to take heterogeneities by plant size and age into account, we have run our main regressions separately for three size classes, that is plants with less than 50, 50–249, and 250 or more employees in 2002, and three age classes, that is for plants that were 5–10, 11–20 and more than 20 years old when exiting the market. Looking at the different employment

developments by size ([Appendix Table A2](#)) reveals stronger employment declines in larger plants for both closures and bankruptcies. The results still show a more pronounced shadow of death for closures compared to bankruptcies. For mass layoffs, we find increasing employment only for plants with less than 250 employees in 2002 and this trend is stronger for the smallest size class. For larger plants, however, the employment level even decreases significantly compared to the control group in the last 2 years. These patterns suggest that the somewhat surprising employment increase that we observe for mass layoffs *on average* is likely to be driven by the plant size restriction (at least 50 employees) in the event year and employment developments for mass layoffs should therefore be interpreted with caution. Looking at the results by plant age ([Appendix Table A3](#)) reveals a somewhat stronger shadow of death for older bankruptcies whereas the results for closures differ hardly among age classes. For mass layoffs, we find that the employment increase is less pronounced for older plants.

Regarding worker flows by size ([Appendix Tables A4–A6](#)), we find higher accession rates relative to the control group for bankruptcies and mass layoffs, but not for closures, in all size classes. These differences are, however, less pronounced for larger plants. Differences in developments compared to the control group are less distinct than differences in levels for all three events in all size classes. The separation rate increases with plant size for closures, whereas there is no such clear-cut nexus for bankruptcies and mass layoffs. Separation rates increase over time for all events in all size classes and this development is somewhat more pronounced for larger plants, which is in line with the stronger employment declines in larger plants. Churning rates are generally higher for bankruptcies and mass layoff and there are no systematically different developments visible between event types and size classes. The worker flow regressions by plant age ([Appendix Tables A7–A9](#)) reveal again higher accession, separation and churning rates for bankruptcies and mass layoffs than for closures in all age classes and these differences are generally less pronounced for older plants. Developments differ hardly among age classes and the observed differences, such as the stronger increase in the

separation rate for older bankruptcies, are in line with the employment developments described earlier. Overall, we conclude that the stronger employment decline for larger plants is driven by a stronger increase in separation rates.

We have also performed various additional robustness tests. First, since our analyses focus on Western Germany, we have also run our main regressions for Eastern Germany (see [Appendix Tables A10 and A11](#)),¹⁹ which reveals very similar patterns as for Western Germany. Second, one might argue that the control group should not contain plants facing other displacement events or even the same event occurring earlier or later than in 2007. We therefore restricted the control group to plants that did not experience any of the three displacement events until 2010, which did not alter any of our insights. Third, we additionally controlled for plant size not only in 2002 but also in 2001 and to 2000 to make sure that treated and non-treated plants had comparable growth paths before 2002 and obtained remarkably similar results. Fourth, replicating our analyses for plants facing a displacement event in 2008, an event-cohort that may already be affected by the Great Recession (note that an event in 2008 means that the event took place between 30 June 2008 and 29 June 2009), reveals again very similar results. Finally, we ran our regressions separately for the secondary (manufacturing and construction) and the tertiary sector (services).²⁰ For the tertiary sector, we still find the same patterns as in our main specification for each of the three events. The same applies to closures and bankruptcies in the secondary sector. For mass layoffs in the secondary sector, we do not find that employment increases prior to the event and there is even an employment reduction in the last year (but insignificant and much smaller than for closures and bankruptcies). Accordingly, the worker flow patterns for mass layoffs in the secondary sector also differ somewhat. However, one has to note that our mass layoff sample in the secondary sector comprises only 74 plants whereas the respective number for the tertiary sector is 243. In addition, we ran

another robustness test excluding the construction sector since large construction sites may be assigned an own plant ID that disappears as soon as construction is finished. However, excluding the construction sector does not affect our results. Taken together, we conclude that our insights are robust over several different specifications and sample restrictions. Only the pre-event employment increase in plants facing mass layoffs must be interpreted with some caution since they may be partly driven by the requirement of having at least 50 employees in the event year. However, since this is the standard definition for mass layoffs that is widely used in the job displacement literature (e.g. Jacobson, LaLonde, and Sullivan 1993), we still think that these patterns are interesting and worth reporting.

V. Conclusions

We analyzed the development of employment levels and worker flows before three collective displacement events, that is mass layoffs, bankruptcies, and closures without bankruptcy. Our results show that there are substantial differences in the shadow of death between plants closing due to bankruptcy and other plant closures. Closures shrink by a higher percentage than bankruptcies in any but the last of the 5 years prior to ultimate shut down. In addition, employment reductions in closing plants, in contrast to bankruptcies, do not come along with increased excess worker flows (churning), which points to strategic shrinking rather than a struggle for life followed by an unintended collapse. Moreover, leaving the market after repaying debts normally requires a planned exit strategy. As bankruptcies reduce employment at a smaller scale and compensate their high separation rate with a high accession rate, our reading of this result is that these plants try to stay in business at a given scale and shut down with a huge employment drop and many unpaid bills. Interestingly, plants facing mass layoffs experience a long-lasting and monotone employment increase before the event and a

¹⁹The results of all other robustness tests are available on request.

²⁰Investigating the shadow of death with respect to productive efficiency and sunk costs for French firms (but without being able to distinguish between different types of firm exit) Blanchard, Huiban, and Mathieu (2014) find that firm exit in the service sector occurs more suddenly than in manufacturing.

higher amount of worker flows. The employment increase, however, should be interpreted with caution since it may be partly driven by the widely used definition of mass layoffs (e.g. Jacobson, LaLonde, and Sullivan 1993) requiring that plants have to have at least 50 employees when the event takes place. Nevertheless, we think that despite the higher amount of worker flows, these developments cannot be interpreted as warning signals or hints why the growth path of these plants was interrupted later. Taken together, we conclude that there is a strong and long-lasting shadow of death preceding closures without bankruptcy, a moderate shadow of death before bankruptcies, and no shadow of death preceding mass layoffs.

The fact that closures without bankruptcy reduce the number of workers over a long time span implies that the consequences of closures might be heavily underestimated in the public debate as it is often concerned with the final employment levels. At the same time, the rather smooth employment reductions probably make it easier for affected employees to find new jobs and for local labour markets as well as employment agencies to adjust to these job reallocation processes. However, the opposite seems to apply to bankruptcies and mass layoffs.

Regarding the literature on the consequences of job displacement, our results suggest that mass layoffs and bankruptcies can better be regarded as unanticipated exogenous shocks for affected employees than closures without bankruptcy. In order to investigate the fate of workers displaced from small and medium sized plants, which is indispensable to obtain a complete picture of the consequences of involuntary job loss, one has, of course, to use closures or bankruptcies. This topic is of particular importance given the disproportionately strong contribution of small firms to overall job creation and destruction (e.g. Hijzen, Upward, and Wright 2010; Fuchs and Weyh 2010). The much shorter shadow of death in case of bankruptcies makes it easier to determine pre-event periods that are likely to be affected by selective worker attrition. However, detailed worker level analyses of the selection processes coming along with the plant level employment patterns reported in this article are highly desired and leave room for further research.

Acknowledgements

The authors thank Stephan Madaus, Claus Schnabel, Richard Upward, Till von Wachter, participants of the 18th Colloquium on Personnel Economics, the 2015 IWH Workshop on Firm Exit and Job Displacement, the 2015 Comparative Analysis of Enterprise Data Conference and an anonymous referee for valuable comments. The authors also thank Julia Cachay and Stefan Süßmann for excellent research assistance. The authors gratefully acknowledge financial support by the German Research Foundation (DFG) under the project ‘Wage and employment effects of bankruptcies’.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was supported by the German Research Foundation (DFG) [285911066].

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Appendix Table A1. Regression results – employment structure.

Variable	Low-skilled workers	Medium-skilled workers	High-skilled workers	Female workers	Median age
Bankruptcy (dummy)	0.0779 (0.84)	−0.0198 (−0.21)	−0.0914 (−2.24)**	−1.5488 (−17.38)***	−0.0667 (−2.13)**
Closure (dummy)	−0.3509 (−9.66)***	0.3109 (8.06)***	0.0592 (3.15)***	−0.4588 (−11.75)***	0.1122 (8.16)***
Mass layoff (dummy)	3.5504 (10.33)***	−2.0114 (−6.66)***	−1.3397 (−8.67)***	−0.2498 (−0.87)	−0.4156 (−4.44)***
Year 2002 (reference)	—	—	—	—	—
Year 2003 (dummy)	0.1187 (6.97)***	0.0769 (4.43)***	−0.0941 (−11.93)***	−0.1470 (−8.98)***	0.5015 (88.04)***
Year 2004 (dummy)	0.5609 (28.01)***	−0.2510 (−12.26)***	−0.2035 (−21.67)***	0.0462 (2.35)**	1.0284 (151.23)***
Year 2005 (dummy)	0.7818 (35.20)***	−0.4549 (−20.03)***	−0.2007 (−19.06)***	−0.0074 (−0.34)	1.6071 (213.43)***
Year 2006 (dummy)	1.0204 (42.78)***	−0.6803 (−27.91)***	−0.2150 (−19.03)***	0.0380 (1.65)*	2.1377 (264.74)***
Year 2007 (dummy)	1.2368 (48.94)***	−0.8594 (−33.32)***	−0.2261 (−18.90)***	0.1432 (5.84)***	2.6973 (314.12)***
Year 2003 × bankruptcy	−0.1153 (−0.42)	0.1657 (0.60)	−0.0691 (−0.61)	0.0701 (0.27)	−0.2002 (−2.39)**
Year 2004 × bankruptcy	−0.0882 (−0.27)	0.2780 (0.85)	−0.1012 (−0.75)	−0.2561 (−0.85)	−0.2727 (−2.75)***
Year 2005 × bankruptcy	0.0042 (0.01)	0.0009 (0.00)	−0.0661 (−0.43)	0.0031 (0.01)	−0.1791 (−1.63)
Year 2006 × bankruptcy	−0.5244 (−1.35)	0.3057 (0.77)	0.0520 (0.30)	−0.1559 (−0.44)	−0.0787 (−0.66)
Year 2007 × bankruptcy	−2.0542 (−4.57)***	1.8656 (4.03)***	−0.0143 (−0.07)	1.7767 (4.24)***	0.0969 (0.73)
Year 2003 × closure	−0.1628 (−1.58)	−0.0533 (−0.50)	0.0788 (1.67)*	0.1380 (1.39)	0.0368 (1.09)
Year 2004 × closure	−0.0894 (−0.71)	−0.0839 (−0.64)	0.0659 (1.14)	0.3559 (2.93)***	0.1380 (3.41)***
Year 2005 × closure	−0.2519 (−1.79)*	0.1763 (1.20)	0.0166 (0.25)	0.3307 (2.45)**	0.1401 (3.13)***
Year 2006 × closure	−0.4138 (−2.70)***	0.4004 (2.50)**	0.0518 (0.70)	0.2784 (1.91)*	0.2887 (6.00)***
Year 2007 × closure	−1.4099 (−8.51)***	1.2866 (7.43)***	0.2474 (3.03)***	0.5639 (3.48)***	0.2848 (5.49)***
Year 2003 × mass layoff	0.0903 (0.18)	−0.4277 (−0.89)	0.0029 (0.01)	0.1487 (0.33)	−0.2554 (−1.81)*
Year 2004 × mass layoff	0.9960 (1.42)	−1.3377 (−2.11)**	0.0708 (0.24)	−0.3362 (−0.67)	−0.6067 (−2.93)***
Year 2005 × mass layoff	1.2746 (1.52)	−1.4800 (−2.10)**	−0.3101 (−0.71)	−0.1659 (−0.28)	−0.6608 (−2.91)***
Year 2006 × mass layoff	1.6169 (1.72)*	−1.4331 (−1.79)*	−0.6074 (−1.36)	−0.2187 (−0.35)	−1.0698 (−4.23)***
Year 2007 × mass layoff	1.3595 (1.38)	−1.1358 (−1.32)	−0.5694 (−1.28)	1.0046 (1.63)	−0.8171 (−3.14)***
Intercept	21.2917 (76.89)***	17.3717 (68.06)***	0.5218 (5.63)***	13.3152 (62.70)***	9.3017 (133.76)***
R-squared	0.7815	0.7678	0.7272	0.7623	0.6417
No. of observations	5,941,105	5,941,105	5,941,105	5,941,105	5,941,105

Notes: BHP years 2002–2007, West Germany, private sector, w/o agriculture, forestry, hunting and mining; regressions are based on the sample of plants that already existed in 2002; median age in years, all other dependent variables are percentages; all regressions control for two-digit industries, administrative districts, plant size and age, and workforce composition (see also Section 4.1); ***, ** or * denote significance at the 1, 5 or 10 per cent level, respectively; t-values in parentheses; standard errors are clustered at the plant level.

Appendix Table A2. Regression results – employment levels by plant size (in 2002).

Variable	Log (number of employees)		
	<50 workers	50–249 workers	250 + workers
Bankruptcy (dummy)	0.0241 (3.95)***	–0.0151 (–1.19)	–0.0714 (–1.63)
Closure (dummy)	–0.0971 (–38.29)***	0.0214 (1.82)*	0.0356 (0.98)
Mass layoff (dummy)	0.2499 (7.65)***	–0.0113 (–0.79)	–0.0868 (–2.72)***
Year 2002 (reference)	–	–	–
Year 2003 (dummy)	0.0285 (72.99)***	–0.0322 (–24.52)***	–0.0414 (–12.18)***
Year 2004 (dummy)	0.0693 (145.75)***	–0.0396 (–21.36)***	–0.0745 (–15.21)***
Year 2005 (dummy)	0.0674 (126.38)***	–0.0769 (–32.14)***	–0.1316 (–20.81)***
Year 2006 (dummy)	0.0737 (127.19)***	–0.0833 (–29.64)***	–0.1712 (–22.51)***
Year 2007 (dummy)	0.0704 (112.83)***	–0.0984 (–29.16)***	–0.2165 (–22.98)***
Year 2003 × bankruptcy	0.0103 (1.40)	–0.0389 (–1.77)*	–0.2312 (–1.34)
Year 2004 × bankruptcy	0.0135 (1.49)	–0.0854 (–2.61)***	–0.2172 (–0.97)
Year 2005 × bankruptcy	–0.0130 (–1.28)	–0.2159 (–4.36)***	–0.3809 (–1.67)*
Year 2006 × bankruptcy	–0.0709 (–6.24)***	–0.3322 (–5.78)***	–0.5900 (–1.94)*
Year 2007 × bankruptcy	–0.3647 (–25.62)***	–1.1735 (–11.46)***	–2.6241 (–5.56)***
Year 2003 × closure	–0.0331 (–13.82)***	–0.3049 (–7.38)***	–0.7148 (–3.72)***
Year 2004 × closure	–0.0642 (–21.83)***	–0.6140 (–10.29)***	–1.3015 (–4.72)***
Year 2005 × closure	–0.1028 (–31.04)***	–1.1486 (–13.81)***	–1.9584 (–6.14)***
Year 2006 × closure	–0.1598 (–44.49)***	–1.7815 (–18.14)***	–2.9700 (–8.98)***
Year 2007 × closure	–0.2945 (–70.41)***	–3.2000 (–38.14)***	–4.9806 (–23.57)***
Year 2003 × mass layoff	0.3139 (4.82)***	0.0775 (4.49)***	0.0249 (0.62)
Year 2004 × mass layoff	0.6995 (7.06)***	0.1202 (5.16)***	–0.0472 (–0.55)
Year 2005 × mass layoff	0.9476 (9.55)***	0.1636 (5.56)***	–0.1116 (–1.25)
Year 2006 × mass layoff	1.1538 (11.81)***	0.2469 (7.77)***	–0.1981 (–2.00)**
Year 2007 × mass layoff	1.1086 (12.34)***	0.2049 (6.31)***	–0.4839 (–3.39)***
Intercept	1.0208 (230.59)***	4.3915 (187.68)***	5.7183 (73.09)***
R-squared	0.7248	0.4109	0.5118
No. of observations	5,652,888	243,103	45,114

Notes: BHP years 2003–2007, West Germany, private sector, w/o agriculture, forestry, hunting and mining; regressions are based on the sample of plants that already existed in 2002; all regressions control for two-digit industries, administrative districts, plant size and age, and workforce composition (see also Section 4.1); ***, ** or * denotes significance at the 1, 5 or 10 per cent level, respectively; t-values in parentheses; standard errors are clustered at the plant level.

Appendix Table A3. Regression results – employment levels by plant age (in 2007).

Variable	Log (number of employees)		
	5–10 years	11–20 years	> 20 years
Bankruptcy (dummy)	0.0234 (2.42)**	0.0331 (3.03)***	0.0233 (2.70)***
Closure (dummy)	–0.0779 (–19.00)***	–0.1267 (–26.18)***	–0.1154 (–28.03)***
Mass layoff (dummy)	0.2500 (9.94)***	0.1463 (6.02)***	0.0541 (2.58)**
Year 2002 (reference)	–	–	–
Year 2003 (dummy)	0.0723 (98.85)***	0.0120 (17.06)***	–0.0129 (–25.84)***
Year 2004 (dummy)	0.1426 (162.05)***	0.0464 (53.85)***	–0.0028 (–4.43)***
Year 2005 (dummy)	0.1628 (166.78)***	0.0391 (40.18)***	–0.0271 (–37.81)***
Year 2006 (dummy)	0.1845 (175.69)***	0.0454 (42.78)***	–0.0387 (–48.96)***
Year 2007 (dummy)	0.1906 (170.16)***	0.0407 (35.12)***	–0.0534 (–61.17)***
Year 2003 × bankruptcy	0.0239 (1.87)*	0.0039 (0.30)	–0.0371 (–3.91)***
Year 2004 × bankruptcy	0.0456 (2.94)***	–0.0217 (–1.35)	–0.0580 (–4.95)***
Year 2005 × bankruptcy	0.0131 (0.74)	–0.0476 (–2.62)***	–0.1097 (–7.83)***
Year 2006 × bankruptcy	–0.0346 (–1.74)*	–0.1221 (–5.86)***	–0.1880 (–12.37)***
Year 2007 × bankruptcy	–0.3389 (–14.31)***	–0.4200 (–14.97)***	–0.6042 (–22.12)***
Year 2003 × closure	–0.0395 (–8.72)***	–0.0326 (–7.48)***	–0.0371 (–10.56)***
Year 2004 × closure	–0.0784 (–14.10)***	–0.0649 (–11.95)***	–0.0687 (–15.34)***
Year 2005 × closure	–0.1180 (–19.18)***	–0.1066 (–16.93)***	–0.1201 (–21.93)***
Year 2006 × closure	–0.1777 (–27.11)***	–0.1708 (–24.39)***	–0.1896 (–29.68)***
Year 2007 × closure	–0.3154 (–42.52)***	–0.3266 (–38.04)***	–0.3553 (–44.03)***
Year 2003 × mass layoff	0.1738 (3.56)***	0.0269 (0.98)	0.0630 (2.34)**
Year 2004 × mass layoff	0.3046 (3.92)***	0.1279 (2.20)**	0.0882 (2.39)**
Year 2005 × mass layoff	0.4161 (4.96)***	0.1707 (2.42)**	0.1087 (2.35)**
Year 2006 × mass layoff	0.5480 (6.21)***	0.3028 (3.99)***	0.1129 (2.23)**
Year 2007 × mass layoff	0.4838 (5.61)***	0.2008 (2.63)***	0.0382 (0.59)
Intercept	1.0084 (98.22)***	1.0720 (120.72)***	1.1151 (176.72)***
R-squared	0.7041	0.7851	0.8629
No. of observations	2,168,824	1,570,815	2,201,466

Notes: BHP years 2003–2007, West Germany, private sector, w/o agriculture, forestry, hunting and mining; regressions are based on the sample of plants that already existed in 2002; all regressions control for two-digit industries, administrative districts, plant size and workforce composition (see also Section 4.1); ***, ** or * denotes significance at the 1, 5 or 10 per cent level, respectively; t-values in parentheses; standard errors are clustered at the plant level.

Appendix Table A4. Regression results – accession rate by plant size (in 2002).

Variable	Accession rate		
	<50 workers	50–249 workers	250 + workers
Bankruptcy (dummy)	0.0689 (13.32)***	0.0088 (0.99)	0.0227 (0.90)
Closure (dummy)	–0.0041 (–2.33)**	–0.0184 (–2.39)**	–0.0167 (–0.91)
Mass layoff (dummy)	0.4233 (9.60)***	0.1045 (7.20)***	0.0532 (1.89)*
Year 2003 (reference)	–	–	–
Year 2004 (dummy)	–0.0107 (–26.88)***	–0.0011 (–1.41)	–0.0053 (–3.92)***
Year 2005 (dummy)	–0.0457 (–120.16)***	–0.0218 (–28.73)***	–0.0212 (–16.45)***
Year 2006 (dummy)	–0.0485 (–128.34)***	–0.0099 (–12.12)***	–0.0135 (–9.82)***
Year 2007 (dummy)	–0.0513 (–136.39)***	–0.0026 (–3.26)***	–0.0022 (–1.50)
Year 2004 × bankruptcy	0.0002 (0.03)	0.0024 (0.26)	0.0545 (1.06)
Year 2005 × bankruptcy	–0.0012 (–0.19)	–0.0100 (–1.05)	–0.0099 (–0.36)
Year 2006 × bankruptcy	–0.0139 (–2.22)**	0.0031 (0.25)	0.0230 (0.83)
Year 2007 × bankruptcy	–0.0427 (–6.73)***	–0.0367 (–2.74)***	–0.0482 (–1.01)
Year 2004 × closure	0.0029 (1.28)	–0.0003 (–0.03)	0.0073 (0.39)
Year 2005 × closure	0.0041 (1.86)*	–0.0059 (–0.57)	0.0646 (1.58)
Year 2006 × closure	–0.0063 (–2.89)***	–0.0132 (–0.96)	0.0352 (0.92)
Year 2007 × closure	–0.0171 (–7.76)***	–0.0498 (–3.27)***	–0.0293 (–0.65)
Year 2004 × mass layoff	0.0147 (0.27)	–0.0198 (–1.45)	–0.0430 (–1.26)
Year 2005 × mass layoff	–0.0563 (–1.07)	–0.0334 (–1.79)*	–0.0282 (–0.98)
Year 2006 × mass layoff	–0.0875 (–1.76)*	0.0038 (0.22)	–0.0128 (–0.34)
Year 2007 × mass layoff	–0.2387 (–5.53)***	–0.0662 (–4.73)***	–0.0517 (–1.47)
Intercept	0.4458 (305.77)***	0.4786 (82.92)***	0.3259 (24.12)***
R-squared	0.0670	0.3140	0.3525
No. of observations	4,636,478	202,347	37,578

Notes: BHP years 2003–2007, West Germany, private sector, w/o agriculture, forestry, hunting and mining; regressions are based on the sample of plants that already existed in 2002; all regressions control for two-digit industries, administrative districts, plant size and age, and workforce composition (see also Section 4.1); ***, ** or * denotes significance at the 1, 5 or 10 per cent level, respectively; t-values in parentheses; standard errors are clustered at the plant level.

Appendix Table A5. Regression results – separation rate by plant size (in 2002).

Variable	Separation rate		
	<50 workers	50–249 workers	250 + workers
Bankruptcy (dummy)	0.0681 (14.47)***	0.0413 (3.19)***	0.1493 (2.03)**
Closure (dummy)	0.0363 (20.53)***	0.1883 (7.91)***	0.3608 (4.15)***
Mass layoff (dummy)	0.1433 (5.81)***	0.0471 (4.01)***	0.0477 (2.15)**
Year 2003 (reference)	–	–	–
Year 2004 (dummy)	–0.0269 (–73.92)***	–0.0242 (–24.82)***	–0.0121 (–5.27)***
Year 2005 (dummy)	–0.0206 (–57.27)***	–0.0168 (–15.58)***	–0.0053 (–2.12)**
Year 2006 (dummy)	–0.0314 (–87.59)***	–0.0337 (–31.38)***	–0.0157 (–5.81)***
Year 2007 (dummy)	–0.0277 (–76.19)***	–0.0250 (–21.31)***	–0.0078 (–2.65)***
Year 2004 × bankruptcy	–0.0012 (–0.20)	0.0077 (0.55)	–0.0772 (–1.71)*
Year 2005 × bankruptcy	0.0249 (4.03)***	0.0445 (2.09)**	0.0447 (0.48)
Year 2006 × bankruptcy	0.0425 (6.65)***	0.0807 (3.52)***	0.0268 (0.25)
Year 2007 × bankruptcy	0.1985 (24.00)***	0.3988 (9.78)***	0.7111 (4.02)***
Year 2004 × closure	0.0004 (0.17)	0.0209 (0.80)	–0.1189 (–1.16)
Year 2005 × closure	0.0082 (3.53)***	0.1492 (4.14)***	0.0321 (0.30)
Year 2006 × closure	0.0152 (6.41)***	0.1927 (4.49)***	0.1615 (1.07)
Year 2007 × closure	0.0593 (22.43)***	0.5528 (10.89)***	0.4841 (3.11)***
Year 2004 × mass layoff	–0.0326 (–1.17)	0.0099 (0.84)	0.0241 (0.50)
Year 2005 × mass layoff	–0.0154 (–0.49)	0.0017 (0.13)	0.0591 (1.92)*
Year 2006 × mass layoff	–0.0125 (–0.45)	–0.0074 (–0.52)	0.0945 (2.21)**
Year 2007 × mass layoff	0.0807 (2.93)***	0.0510 (3.64)***	0.2209 (3.13)***
Intercept	0.3480 (258.82)***	0.4271 (62.32)***	0.3356 (17.32)***
R-squared	0.0542	0.2035	0.1817
No. of observations	4,636,478	202,347	37,578

Notes: BHP years 2003–2007, West Germany, private sector, w/o agriculture, forestry, hunting and mining; regressions are based on the sample of plants that already existed in 2002; all regressions control for two-digit industries, administrative districts, plant size and age, and workforce composition (see also Section 4.1); ***, ** or * denotes significance at the 1, 5 or 10 per cent level, respectively; t-values in parentheses; standard errors are clustered at the plant level.

Appendix Table A6. Regression results – churning rate by plant size (in 2002).

Variable	Churning rate		
	<50 workers	50–249 workers	250 + workers
Bankruptcy (dummy)	0.0719 (11.23)***	0.0193 (1.82)*	0.0842 (1.75)*
Closure (dummy)	0.0117 (4.92)***	–0.0165 (–1.59)	–0.0178 (–0.73)
Mass layoff (dummy)	0.3729 (8.01)***	0.1390 (7.35)***	0.0650 (2.14)**
Year 2003 (reference)	–	–	–
Year 2004 (dummy)	–0.0224 (–45.00)***	–0.0222 (–30.48)***	–0.0171 (–13.94)***
Year 2005 (dummy)	–0.0352 (–70.07)***	–0.0341 (–42.52)***	–0.0255 (–19.15)***
Year 2006 (dummy)	–0.0416 (–83.11)***	–0.0386 (–46.14)***	–0.0285 (–21.72)***
Year 2007 (dummy)	–0.0387 (–76.47)***	–0.0253 (–29.51)***	–0.0188 (–12.95)***
Year 2004 × bankruptcy	0.0061 (0.82)	0.0070 (0.70)	–0.0166 (–0.88)
Year 2005 × bankruptcy	0.0176 (2.26)**	–0.0067 (–0.62)	–0.0445 (–0.89)
Year 2006 × bankruptcy	0.0109 (1.38)	0.0161 (1.21)	–0.0357 (–0.72)
Year 2007 × bankruptcy	0.0044 (0.52)	–0.0167 (–0.92)	–0.0740 (–0.82)
Year 2004 × closure	0.0027 (0.94)	0.0234 (1.80)*	0.0201 (0.65)
Year 2005 × closure	0.0031 (1.04)	0.0083 (0.58)	0.0173 (0.39)
Year 2006 × closure	0.0005 (0.15)	–0.0109 (–0.59)	0.0318 (0.59)
Year 2007 × closure	–0.0106 (–3.45)***	–0.0495 (–2.19)**	–0.0457 (–0.74)
Year 2004 × mass layoff	–0.0757 (–1.81)*	–0.0019 (–0.14)	–0.0377 (–1.21)
Year 2005 × mass layoff	–0.0705 (–1.48)	–0.0420 (–2.67)***	–0.0075 (–0.25)
Year 2006 × mass layoff	–0.0341 (–0.73)	–0.0345 (–2.03)**	0.0301 (0.74)
Year 2007 × mass layoff	0.0124 (0.29)	0.0039 (0.23)	–0.0020 (–0.05)
Intercept	0.4713 (232.00)***	0.7168 (86.20)***	0.4581 (23.62)***
R-squared	0.0668	0.4255	0.5045
No. of observations	4,636,478	202,347	37,578

Notes: BHP years 2003–2007, West Germany, private sector, w/o agriculture, forestry, hunting and mining; regressions are based on the sample of plants that already existed in 2002; all regressions control for two-digit industries, administrative districts, plant size and age, and workforce composition (see also Section 4.1); ***, ** or * denotes significance at the 1, 5 or 10 per cent level, respectively; t-values in parentheses; standard errors are clustered at the plant level.

Appendix Table A7. Regression results – accession rate by plant age (in 2007).

Variable	Accession rate		
	5–10 years	11–20 years	> 20 years
Bankruptcy (dummy)	0.0932 (10.40)***	0.0595 (6.73)***	0.0189 (3.13)***
Closure (dummy)	0.0026 (0.79)	–0.0108 (–3.41)***	–0.0125 (–5.25)***
Mass layoff (dummy)	0.2894 (8.28)***	0.1723 (6.96)***	0.1293 (5.11)***
Year 2003 (reference)	–	–	–
Year 2004 (dummy)	–0.0240 (–31.05)***	–0.0039 (–5.57)***	–0.0016 (–3.28)***
Year 2005 (dummy)	–0.0677 (–92.25)***	–0.0376 (–55.88)***	–0.0271 (–58.90)***
Year 2006 (dummy)	–0.0747 (–102.79)***	–0.0368 (–54.83)***	–0.0265 (–57.77)***
Year 2007 (dummy)	–0.0808 (–112.03)***	–0.0393 (–58.63)***	–0.0250 (–54.43)***
Year 2004 × bankruptcy	–0.0005 (–0.04)	–0.0113 (–1.02)	0.0171 (2.15)**
Year 2005 × bankruptcy	–0.0117 (–1.09)	–0.0006 (–0.05)	0.0191 (2.52)**
Year 2006 × bankruptcy	–0.0202 (–1.92)*	–0.0175 (–1.52)	0.0114 (1.48)
Year 2007 × bankruptcy	–0.0693 (–6.41)***	–0.0312 (–2.85)***	–0.0036 (–0.45)
Year 2004 × closure	–0.0001 (–0.02)	0.0089 (2.10)**	0.0024 (0.76)
Year 2005 × closure	0.0013 (0.31)	0.0099 (2.41)**	0.0028 (0.92)
Year 2006 × closure	–0.0097 (–2.37)**	–0.0033 (–0.82)	–0.0062 (–2.08)**
Year 2007 × closure	–0.0194 (–4.75)***	–0.0171 (–4.25)***	–0.0175 (–5.73)***
Year 2004 × mass layoff	–0.0124 (–0.38)	0.0363 (1.34)	–0.0362 (–1.37)
Year 2005 × mass layoff	–0.0333 (–0.84)	0.0029 (0.12)	–0.0316 (–1.15)
Year 2006 × mass layoff	–0.0101 (–0.28)	0.0578 (2.15)**	–0.0235 (–0.93)
Year 2007 × mass layoff	–0.1233 (–3.82)***	–0.0514 (–2.41)**	–0.0496 (–2.13)**
Intercept	0.4798 (141.62)***	0.3933 (135.07)***	0.3145 (168.82)***
R-squared	0.0693	0.0482	0.0434
No. of observations	1,760,191	1,293,610	1,822,602

Notes: BHP years 2003–2007, West Germany, private sector, w/o agriculture, forestry, hunting and mining; regressions are based on the sample of plants that already existed in 2002; all regressions control for two-digit industries, administrative districts, plant size, and workforce composition (see also Section 4.1); ***, ** or * denotes significance at the 1, 5 or 10 per cent level, respectively; t-values in parentheses; standard errors are clustered at the plant level.

Appendix Table A8. Regression results – separation rate by plant age (in 2007).

Variable	Separation rate		
	5–10 years	11–20 years	> 20 years
Bankruptcy (dummy)	0.0807 (10.25)***	0.0564 (6.72)***	0.0506 (7.78)***
Closure (dummy)	0.0471 (14.91)***	0.0310 (9.32)***	0.0297 (11.14)***
Mass layoff (dummy)	0.0965 (4.92)***	0.1272 (5.34)***	0.0586 (3.99)***
Year 2003 (reference)	–	–	–
Year 2004 (dummy)	–0.0274 (–41.10)***	–0.0276 (–41.32)***	–0.0253 (–52.50)***
Year 2005 (dummy)	–0.0229 (–34.85)***	–0.0211 (–31.89)***	–0.0173 (–35.78)***
Year 2006 (dummy)	–0.0318 (–48.58)***	–0.0337 (–51.23)***	–0.0292 (–60.80)***
Year 2007 (dummy)	–0.0270 (–40.80)***	–0.0286 (–42.65)***	–0.0269 (–54.92)***
Year 2004 × bankruptcy	–0.0095 (–0.96)	0.0090 (0.83)	0.0024 (0.29)
Year 2005 × bankruptcy	0.0258 (2.52)**	0.0218 (1.99)*	0.0315 (3.43)***
Year 2006 × bankruptcy	0.0351 (3.26)***	0.0463 (3.95)***	0.0558 (6.24)***
Year 2007 × bankruptcy	0.1872 (14.41)***	0.2050 (13.33)***	0.2535 (17.50)***
Year 2004 × closure	0.0008 (0.20)	0.0050 (1.16)	–0.0036 (–1.03)
Year 2005 × closure	0.0035 (0.84)	0.0153 (3.46)***	0.0119 (3.27)***
Year 2006 × closure	0.0102 (2.44)**	0.0228 (5.09)***	0.0203 (5.39)***
Year 2007 × closure	0.0513 (11.33)***	0.0719 (13.97)***	0.0736 (16.83)***
Year 2004 × mass layoff	0.0171 (0.69)	–0.0147 (–0.66)	0.0043 (0.37)
Year 2005 × mass layoff	0.0159 (0.67)	–0.0084 (–0.36)	0.0107 (0.69)
Year 2006 × mass layoff	0.0162 (0.75)	–0.0494 (–2.02)**	0.0293 (1.55)
Year 2007 × mass layoff	0.0943 (4.34)***	0.0700 (2.58)**	0.0740 (3.11)***
Intercept	0.3476 (113.37)***	0.3447 (124.92)***	0.2868 (156.08)***
R-squared	0.0664	0.0527	0.0373
No. of observations	1,760,191	1,293,610	1,822,602

Notes: BHP years 2003–2007, West Germany, private sector, w/o agriculture, forestry, hunting and mining; regressions are based on the sample of plants that already existed in 2002; all regressions control for two-digit industries, administrative districts, plant size and workforce composition (see also Section 4.1); ***, ** or * denotes significance at the 1, 5 or 10 per cent level, respectively; t-values in parentheses; standard errors are clustered at the plant level.

Appendix Table A9. Regression results – churning rate by plant age (in 2007).

Variable	Churning rate		
	5–10 years	11–20 years	> 20 years
Bankruptcy (dummy)	0.0932 (8.37)***	0.0625 (5.69)***	0.0334 (4.34)***
Closure (dummy)	0.0229 (5.14)***	0.0084 (1.92)*	–0.0053 (–1.69)*
Mass layoff (dummy)	0.2946 (8.44)***	0.2719 (7.13)***	0.1474 (5.38)***
Year 2003 (reference)	–	–	–
Year 2004 (dummy)	–0.0297 (–30.01)***	–0.0208 (–24.21)***	–0.0165 (–28.46)***
Year 2005 (dummy)	–0.0454 (–46.06)***	–0.0338 (–38.76)***	–0.0260 (–43.83)***
Year 2006 (dummy)	–0.0528 (–53.70)***	–0.0400 (–45.79)***	–0.0315 (–53.27)***
Year 2007 (dummy)	–0.0514 (–52.12)***	–0.0355 (–40.01)***	–0.0268 (–44.47)***
Year 2004 × bankruptcy	0.0000 (0.01)	0.0084 (0.65)	0.0149 (1.60)
Year 2005 × bankruptcy	0.0135 (1.02)	0.0141 (1.01)	0.0239 (2.48)**
Year 2006 × bankruptcy	0.0055 (0.42)	0.0051 (0.36)	0.0266 (2.59)***
Year 2007 × bankruptcy	–0.0090 (–0.65)	0.0167 (1.08)	0.0114 (1.04)
Year 2004 × closure	0.0019 (0.34)	0.0044 (0.82)	0.0042 (1.08)
Year 2005 × closure	–0.0040 (–0.72)	0.0061 (1.10)	0.0096 (2.38)**
Year 2006 × closure	–0.0056 (–1.02)	0.0028 (0.50)	0.0060 (1.48)
Year 2007 × closure	–0.0123 (–2.16)**	–0.0158 (–2.81)***	–0.0060 (–1.41)
Year 2004 × mass layoff	–0.0326 (–1.06)	–0.0171 (–0.61)	–0.0216 (–1.42)
Year 2005 × mass layoff	–0.0469 (–1.43)	–0.0468 (–1.48)	–0.0396 (–2.05)**
Year 2006 × mass layoff	0.0013 (0.04)	–0.0661 (–2.08)**	–0.0172 (–0.87)
Year 2007 × mass layoff	0.0689 (2.14)**	–0.0196 (–0.65)	–0.0094 (–0.45)
Intercept	0.4683 (102.27)***	0.4432 (107.86)***	0.3695 (139.92)***
R-squared	0.0629	0.0748	0.0660
No. of observations	1,760,191	1,293,610	1,822,602

Notes: BHP years 2003–2007, West Germany, private sector, w/o agriculture, forestry, hunting and mining; regressions are based on the sample of plants that already existed in 2002; all regressions control for two-digit industries, administrative districts, plant size and workforce composition (see also Section 4.1); ***, ** or * denotes significance at the 1, 5 or 10 per cent level, respectively; t-values in parentheses; standard errors are clustered at the plant level.

Appendix Table A10. Regression results – employment levels (East Germany).

Variable	Log (number of employees)
Bankruptcy (dummy)	0.0430 (4.38)***
Closure (dummy)	−0.1222 (−24.35)***
Mass layoff (dummy)	0.2078 (6.75)***
Year 2002 (reference)	−
Year 2003 (dummy)	0.0282 (33.60)***
Year 2004 (dummy)	0.0466 (45.44)***
Year 2005 (dummy)	0.0180 (15.69)***
Year 2006 (dummy)	0.0195 (15.55)***
Year 2007 (dummy)	0.0172 (12.78)***
Year 2003 × bankruptcy	0.0157 (1.18)
Year 2004 × bankruptcy	0.0026 (0.16)
Year 2005 × bankruptcy	−0.0360 (−1.96)*
Year 2006 × bankruptcy	−0.0774 (−3.84)***
Year 2007 × bankruptcy	−0.3458 (−13.81)***
Year 2003 × closure	−0.0360 (−6.87)***
Year 2004 × closure	−0.0761 (−11.78)***
Year 2005 × closure	−0.1253 (−17.53)***
Year 2006 × closure	−0.1904 (−24.43)***
Year 2007 × closure	−0.3476 (−38.59)***
Year 2003 × mass layoff	0.0348 (0.60)
Year 2004 × mass layoff	0.0816 (1.14)
Year 2005 × mass layoff	0.1921 (2.18)**
Year 2006 × mass layoff	0.3027 (2.97)***
Year 2007 × mass layoff	0.2800 (2.70)***
Intercept	1.0038 (118.26)***
R-squared	0.7845
No. of observations	1,328,830

Notes: BHP years 2002–2007, East Germany, private sector, w/o agriculture, forestry, hunting and mining; regressions are based on the sample of plants that already existed in 2002; all regressions control for two-digit industries, administrative districts, plant size and age, and workforce composition (see also Section 4.1); ***, ** or * denotes significance at the 1, 5 or 10 per cent level, respectively; t-values in parentheses; standard errors are clustered at the plant level.

Appendix Table A11. Regression results – worker flows (East Germany).

Variable	Accession rate	Separation rate	Churning rate
Bankruptcy (dummy)	0.0739 (8.30)***	0.0607 (7.57)***	0.0717 (6.70)***
Closure (dummy)	−0.0023 (−0.64)	0.0434 (11.52)***	0.0138 (2.77)***
Mass layoff (dummy)	0.1657 (4.20)***	0.1100 (3.65)***	0.1912 (4.48)***
Year 2003 (reference)	−	−	−
Year 2004 (dummy)	−0.0205 (−24.86)***	−0.0160 (−20.52)***	−0.0207 (−20.17)***
Year 2005 (dummy)	−0.0509 (−63.99)***	−0.0011 (−1.38)	−0.0296 (−28.28)***
Year 2006 (dummy)	−0.0447 (−56.07)***	−0.0235 (−30.52)***	−0.0368 (−35.29)***
Year 2007 (dummy)	−0.0507 (−63.85)***	−0.0298 (−38.70)***	−0.0410 (−38.88)***
Year 2004 × bankruptcy	−0.0130 (−1.14)	0.0090 (0.84)	−0.0160 (−1.27)
Year 2005 × bankruptcy	−0.0240 (−2.25)**	0.0223 (2.06)**	−0.0156 (−1.22)
Year 2006 × bankruptcy	−0.0243 (−2.30)**	0.0337 (3.15)***	0.0007 (0.05)
Year 2007 × bankruptcy	−0.0460 (−4.21)***	0.1784 (12.59)***	−0.0025 (−0.18)
Year 2004 × closure	0.0010 (0.20)	0.0034 (0.70)	0.0017 (0.28)
Year 2005 × closure	0.0017 (0.36)	0.0137 (2.67)***	0.0078 (1.20)
Year 2006 × closure	−0.0130 (−2.80)***	0.0120 (2.32)**	−0.0092 (−1.43)
Year 2007 × closure	−0.0259 (−5.63)***	0.0697 (12.12)***	−0.0113 (−1.73)*
Year 2004 × mass layoff	−0.0027 (−0.06)	−0.0136 (−0.47)	0.0014 (0.05)
Year 2005 × mass layoff	0.0361 (0.77)	−0.0268 (−0.84)	−0.0023 (−0.07)
Year 2006 × mass layoff	0.0416 (1.26)	−0.0400 (−1.46)	0.0203 (0.59)
Year 2007 × mass layoff	−0.0387 (−1.13)	0.0173 (0.56)	0.0607 (2.06)**
Intercept	0.4182 (150.33)***	0.3225 (123.34)***	0.4289 (111.21)***
R-squared	0.0571	0.0451	0.0552
No. of observations	1,086,175	1,086,175	1,086,175

Notes: BHP years 2003–2007, East Germany, private sector, w/o agriculture, forestry, hunting and mining; regressions are based on the sample of plants that already existed in 2002; all regressions control for two-digit industries, administrative districts, plant size and age, and workforce composition (see also Section 4.1); ***, ** or * denotes significance at the 1, 5 or 10 per cent level, respectively; t-values in parentheses; standard errors are clustered at the plant level.