LEUPHANA
UNIVERSITÄT LÜNEBURG

# Lingering illness or sudden death? Pre-exit employment developments in German establishments

Fackler, Daniel ; Schnabel, Claus; Wagner, Joachim

*Publication date:*
2012

*Document Version*
Publisher's PDF, also known as Version of record

Link to publication

*Citation for pulished version (APA):*
Fackler, D., Schnabel, C., & Wagner, J. (2012). *Lingering illness or sudden death? Pre-exit employment developments in German establishments*. (University of Lüneburg Working Papers in Economics; No. 258). Institut für Volkswirtschaftslehre der Universität Lüneburg.

**General rights**
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal ?

**Take down policy**
If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Download date: 12. Okt.. 2024

WORKING PAPER

# Lingering illness or sudden death? Pre-exit employment developments in German establishments

by

Daniel Fackler, Claus Schnabel, and Joachim Wagner

University of Lüneburg
Working Paper Series in Economics

**No. 258**

December 2012

www.leuphana.de/institute/ivwl/publikationen/working-papers.html

ISSN 1860 - 5508

# Lingering illness or sudden death?
# Pre-exit employment developments in German establishments*

Daniel Fackler[a], Claus Schnabel[b] and Joachim Wagner[c]

ABSTRACT: Using a large administrative dataset for Germany, this paper compares employment developments in exiting and surviving establishments. For both West and East Germany we find a clear "shadow of death" effect reflecting lingering illness: establishments shrink dramatically already several years before closure, employment growth rates differ strongly between exiting and surviving establishments, and this difference becomes stronger as exit approaches. We further show that prior to exit the workforce becomes on average more skilled, more female and older in exiting compared to surviving establishments. These effects are more clearly visible in West than in East Germany. Our results also hold when applying a matching approach.

ZUSAMMENFASSUNG: Anhand umfangreicher administrativer Daten für Deutschland vergleicht diese Studie Beschäftigungsentwicklungen in sterbenden und überlebenden Betrieben. Die Ergebnisse bestätigen sowohl für West- als auch Ostdeutschland die Existenz eines sogenannten „shadow of death"-Effekts: bereits mehrere Jahre vor der Schließung weisen sterbende Betriebe deutliche Beschäftigungsrückgänge auf und es gibt signifikante Unterschiede in den Beschäftigungswachstumsraten sterbender und überlebender Betriebe, die mit dem Herannahen der Schließung zunehmen. Weiterhin zeigt sich, dass das durchschnittliche Qualifikationsniveau, der Frauenanteil sowie das Median-Alter der Belegschaft in schließenden Betrieben im Vergleich zu überlebenden (stärker) ansteigen. Diese Effekte sind für Westdeutschland deutlicher ausgeprägt als für Ostdeutschland. Die Robustheit der Ergebnisse wird anhand eines Matching-Ansatzes bestätigt.

Keywords: firm exits, shadow of death, Germany

JEL-Classification: L2, D22, J65

---

* We would like to thank the German Research Foundation for financial support under the project SCHN 730/5-1 resp. WA 610/5-1 "Firm exits" (Betriebsschließungen) and the team of the Research Data Centre of the Federal Employment Agency at the Institute for Employment Research for their exceptional support and cooperation. We also thank participants in the economic research seminar at the University of Erlangen-Nuremberg for constructive comments.

[a] University of Erlangen-Nürnberg, Chair of Labour and Regional Economics, Lange Gasse 20, 90403 Nürnberg, Germany, E-mail: daniel.fackler@wiso.uni-erlangen.de

[b] University of Erlangen-Nürnberg, Chair of Labour and Regional Economics, Lange Gasse 20, 90403 Nürnberg, Germany, E-mail: claus.schnabel@wiso.uni-erlangen.de

[c] Leuphana University Lüneburg, Institute of Economics, P.O. Box 2440, 21314 Lüneburg, Germany, E-mail: Wagner@leuphana.de

# 1. INTRODUCTION

Although firm closures are important drivers of structural change and economic development, they are unpleasant for all parties involved – be they employees, management, investors, banks, suppliers or customers. Therefore these agents are interested to know how likely a firm is to survive, what determines firm exits and whether there is a “shadow of death” visible already some time before a firm finally closes down, thus making preventive actions possible. While there is some literature on the determinants of firm exits (e.g., Bernard/Jensen 2007 for the US, Box 2008 for Sweden, Bellone et al. 2008 for France, Disney et al. 2003 for the UK, Esteve-Pérez/Mañez-Castillejo 2008 for Spain, Fackler et al. 2012 for Germany), much less is known about the processes taking place before closure. In order to fill this research gap, this paper analyzes whether firm closures occur suddenly and unexpectedly or whether employment processes can be observed that indicate an upcoming closure. This is important to know for several reasons. If firms typically suffer sudden deaths, possibilities to prevent these would be very limited, and the resulting layoffs are likely to be mass-layoffs creating particularly serious problems for employees and employment agencies. In contrast, if firms usually show a lingering illness before finally exiting, falls in employment can be expected to be much smoother, spreading over several years. Such a process of gradual employment reduction in turn may be a valuable signal of an upcoming closure and might thus improve the prospects of taking measures that help to prevent firm failure.

In this paper, we particularly address two research questions: Do changes in overall employment differ between exiting and surviving establishments? And, more specifically, does the composition of the workforce in terms of skill level, gender and age develop differently in exiting and surviving establishments? In analyzing these questions, our paper makes two major contributions to the literature: First, as we have a very large representative dataset containing 50 percent of all establishments in Germany and covering the period 1975-2008, we are able to study employment trends preceding exits in much greater detail than previously possible. Second, we investigate how the composition of the workforce develops prior to firm closure. Concerning changes in the gender and age structure of the workforce, to the best of our knowledge, no comparison of exiting and surviving firms does exist, and concerning changes in the skill structure, we are the first ones to examine this for Germany.

As mentioned above, there is not much literature focusing on pre-exit developments. An early paper by Hambrick/D'Aveni (1988) compares 57 large bankruptcies with 57 matched survivors. The authors find that a poorer performance in failing firms shows up very early. Based on their findings they conclude that at least in large companies there should be options to prevent failure. Studying productivity dynamics in Israeli industry, Griliches/Regev (1995) report that exiting firms are less productive than surviving firms already several years before they finally exit. This is what they call a "shadow of death" effect. The existence of such an effect in terms of declining productivity is confirmed by several other studies (Bellone et al. 2006 for France, Kiyota/Takizawa 2006 for Japan, Carreira/Teixeira 2011 for Portugal). Examining firms' adjustment processes for the US (Wisconsin), Troske (1996) finds that employment growth and the firm size relative to industry average decline before exit. Similar results suggesting that firms tend to shrink before closure are obtained by Bellone et al. (2006) for France and Huynh/Petrunia (2011) for Canada.[4]

For Germany there are three studies on the "shadow of death" effect. Wagner (1999) examines three exit cohorts of manufacturing firms in the federal state of Lower Saxony. He finds that declining employment can be observed only for a relatively small fraction of all exits and that there is no significant relationship between productivity and the probability of exit which makes him conclude that there is no "shadow of death" effect. By contrast, empirical evidence for the federal state of Saxony by Niese (2003) shows that there is a negative relationship between productivity and the probability of exit already three years before closure. Additionally he finds a negative relationship between both employment and productivity growth and the probability of exit, which is in favor of a "shadow of death" effect.

The study which is closest to ours is by Almus (2004). Using 1,765 observations from a telephone survey and applying a matching approach, he analyzes employment growth of exiting versus surviving firms for the period 1990-1999. He finds declining employment levels and significantly lower growth rates in exiting firms up to three years before closure, confirming the existence of a "shadow of death" effect. However, the study considers only the entry cohorts of 1990-1993 and thus focuses on relatively young firms. As our dataset contains a substantially

[4] Some studies also take account of further indicators besides productivity and firm size. Bellone et al. (2006) additionally find declining relative profitability before exit. Huynh/Petrunia (2011) mainly focus on the development of financial indicators. Their main finding is that leverage increases before exit.

larger and more representative sample and covers a much longer time period than Almus (2004), we will be able to provide more comprehensive evidence on the "shadow of death".

Our second research question, how the composition of the workforce develops before exit, is particularly interesting since a "shadow of death" effect in terms of declining employment may reflect two different reactions to economic distress by management and employees. Declining employment can on the one hand be interpreted as a downward adjustment of the employment level initiated by firm management trying to prevent closure. On the other hand, employees of distressed firms may be induced to look for other jobs and leave the firm if possible. If the first effect is dominant, we would expect the composition of the workforce to become more skilled before closure since the management may try to get rid of the least productive workers first. If the second effect dominates, we would expect that the workforce becomes less skilled since those workers with the best labor market opportunities, i.e. the more skilled ones, are likely to leave first while less skilled workers are more likely to stay until the end (Lengermann/Vilhuber 2002, Schwerdt 2011). Of course, such a loss of human capital can additionally worsen a firm's situation and speed up the exit process. Empirically, Schwerdt (2011) finds for Austria that workers leaving dying firms already before closure experience better post-separation outcomes, i.e. higher employment probabilities and earnings, suggesting that these workers are more productive than those staying until the end. For the US (Maryland), Lengermann/Vilhuber (2002) also report that the composition of the workforce becomes less skilled before large displacements occur. Both studies thus imply that the second effect is more important.[5]

Like the skill composition, the gender composition of the workforce may also change as exit approaches, and this again can reflect various reactions by employees and management. Taking the perspective of employees first, women may be less inclined than men to leave firms in distress. They usually face higher search frictions and are less mobile than men, not least due to family reasons, and there is some empirical evidence that women's labor supply to the firm is substantially less elastic than men's (see Manning 2003 and Hirsch et al. 2010). In contrast, management may find it easier to lay off women than men since they often

[5] Using a model of two-sided learning where management and employees learn about each other's behavior, Pfann/Hamermesh (2008) analyze employment developments, quits and layoffs at Fokker Aircraft, a large Dutch firm, during its last six years of existence. They find, inter alia, that these last years were characterized by declining employment and that those workers who stayed until the end seemed to be more valuable for the firm (in that they had more tenure, better job evaluations and more internal training courses than those leaving the firm).

have less tenure and firm-specific human capital. If women have less tenure and are secondary wage earners, they also enjoy a lesser degree of actual employment protection in Germany. Depending on the relative strength of these opposite effects, the share of women in the workforce may either rise or fall prior to firm exit.

A third characteristic of the workforce that may also change as exit approaches is the age structure. From the view of employees, older workers have fewer incentives to leave distressed firms. They usually have more tenure and therefore more firm-specific human capital which would be worthless in other firms, and their labor market opportunities may be worse than those of younger workers. From the perspective of management, the case for retaining older employees in times of distress is more ambiguous. On the one hand, older workers are more likely to be kept in the firm because of their experience and specific knowledge and because lay-offs of older employees are usually more difficult and costly due to employment protection laws. On the other hand, older workers may be less flexible and therefore not the right ones to successfully implement changes in a firm's strategy designed to prevent closure. Moreover, laying off older employees may relieve firms from the "burden" of high seniority wages. Depending on the relative strength of these different effects, the average age of the workforce may either rise or fall prior to firm exit. Which of these effects dominates is an open question.

In the following analysis we address these considerations empirically proceeding as follows. Section 2 describes our dataset and the procedure to identify firm exits. In section 3, we provide descriptive evidence on pre-exit employment developments. To check the validity of our descriptive results, we then apply a matching approach. This approach and its empirical results are discussed in section 4. Section 5 concludes.

## 2. Data and identification of exits

For the following analysis we use the German Establishment History Panel (BHP), a large and representative administrative dataset provided by the Research Data Centre of the Federal Employment Agency at the Institute for Employment Research. The BHP contains a random sample of 50 percent of all establishments with at least one employee liable to social security and currently covers the period 1975 to 2008 for West Germany and 1991-2008 for East Germany, but because of the bad data quality in East Germany shortly after reunification it is recommended to use the East German data only from 1993 onwards (Hethey-Meier/Seth 2010: 8).

The data are annual and reflect the situation in the establishment on June 30th of each year. They are created by aggregating the underlying social security data - the "Employee and Benefit Recipient History" (BLH) – at the establishment level. The BHP contains information on industry[6], location, number of employees, composition of the workforce and wage structure (for more detailed information, see Spengler 2008, Hethey-Meier/Seth 2010). Major advantages of the BHP compared to other datasets are that it covers all industries and a longer time span and that it can be considered very reliable as it is based on mandatory social security announcements.

Since every establishment is allocated a unique identification number which normally does not change, we are able to follow establishments over time. Generally we regard establishments as exits in that year when they appear in the data for the last time, that is when for the last time they report having employees who are liable to social security.[7] Analogously, establishments are considered to be entries in the year when they first appear in the data.[8]

Identifying entries and exits only based on newly appearing or disappearing establishment numbers has an important shortcoming: events like changes of ownership or legal form, outsourcing or other administrative changes can result in a change of the establishment number, which would lead to an overestimation of the number of entries and exits.[9] To solve this problem, we use extension files on establishment histories provided by the Research Data Center that are based on the work by Hethey/Schmieder (2010) who analyze worker flows between establishment numbers in the underlying personal level data.[10] They use maximum

---

[6] Since there are breaks in the industry classification, a time-consistent industry classification variable based on the procedure by Eberle et al. (2011) was provided by the Research Data Center.

[7] Since establishments disappear from the dataset when they stop having employees liable to social security, exit might have occurred later than recorded in the data. Similarly, entry could have occurred earlier. As we are mainly interested in establishments' employment history, these shortcomings do not affect our investigation.

[8] For establishments that already appear in the data in 1975 we do not know whether they entered in 1975 or earlier which means that we also do not know their exact age.

[9] For a more detailed discussion of the problems concerning the identification of entries and exits see Brixy/Fritsch (2002).

[10] Since 1999 marginal part-time workers are included in the BLH and therefore also in our BHP data set. For time-consistency those employment relationships were dropped in the analysis of Hethey/Schmieder (2010) that makes use of personal level data. For the identification of establishments' entries and exits we follow their approach. However, as we do not have access to the worker-level data, we are not able to construct a fully time-consistent data set, e.g by calculating employment shares without marginal part-time workers in the numerator. Nevertheless, we decided not to exclude all establishments with marginal workers from our sample.

clustered in- and outflows, that is the largest groups of workers switching from one establishment number to another, to classify newly appearing and disappearing establishment numbers into seven categories each. This procedure enables researchers to discriminate between true entries and exits and other events causing a change of the establishment number. The way how these extension files are used in this study to identify true exits is described in greater detail by Fackler et al. (2012).[11]

Our sample is restricted to the private sector, i.e. the public sector and other non-profit sectors are excluded from the analysis. We further exclude the agriculture and the mining sector because exits in these sectors are strongly subject to political influence (e.g., subsidization, EU downsizing plans).

In the following, we analyze the employment developments of exiting establishments in the last five years of existence and compare them with surviving establishments. The period of exit, i.e. when establishments are ultimately observed, is denoted t. Survivors are defined as establishments that continue to exist for at least five years after period t. This is to make sure that we do not compare exits with other establishments that are already in serious distress and may also exit soon. We only look at establishments that are at least five years old in period t. This ensures that our comparison of exiting and surviving establishments is not affected by establishments that enter the two groups during the last five years. This procedure restricts the following analysis to the exit cohorts 1980-2003 for West Germany and 1998-2003 for East Germany.[12]

## 3. DESCRIPTIVE EVIDENCE

Our empirical investigation begins with a descriptive analysis of employment growth and the development of the workforce composition for exiting compared to surviving establishments. Since the employment growth rates and employment shares that are calculated for the following analyses would be rather meaningless measures for very small establishments, we restrict our analysis to establishments with at least

[11] We also ran robustness checks applying different classifications of exits which did not affect our main insights.

[12] Since considering only the last five years might appear quite arbitrary, we ran a robustness check analyzing exits in the last ten years of existence. Correspondingly, we chose only establishments that were at least ten years old in period t and defined survivors as continuing for at least ten years. This could be done for the exit cohorts 1985-1998 for West Germany while it was not feasible for East Germany. Running this robustness check did not alter our main insights.

ten employees in t-5 (i.e. five years before they are observed for the last time) in order to obtain results that can be interpreted in a meaningful manner. As most exiting establishments are small, this leads to a considerable reduction of the relevant sample (by about 75 percent). To make sure that the results are not mainly driven by this constraint, we also conducted the same analyses without this restriction which made the relevant effects appear less pronounced but did not change our main insights.[13]

We start our descriptive analysis by comparing employment growth of exiting and surviving establishments.[14] Average employment growth rates for these two groups are presented in Table 1. For both East and West Germany one can see that employment growth rates are negative for exiting establishments in all five years before closure and that this employment reduction becomes stronger as exit approaches, culminating in an employment reduction by about 40 percent in the last period. Comparing exits and survivors shows that employment growth rates differ significantly between both groups in all periods and that the difference becomes larger as exit approaches, reaching almost 40 percentage points in the last period. This evidence points to a strong and long lasting “shadow of death” effect which is in line with previous empirical evidence outlined in Section 1. Additional support for this effect is obtained when we look at those establishments where the number of employees did not increase in any of the five years before closure: This phenomenon is found in 17 percent of all exiting firms but only in 6 percent of all survivors in our West German sample. A similar picture shows up for East Germany where the corresponding rates are 15 percent of the exits and only 7 percent of the survivors.

In a next step we analyze how the qualification structure develops before closure, making use of three different indicators. The first is the percentage share of low qualified employees in the workforce, i.e. those who do not have an upper secondary school leaving certificate as their highest school qualification or do not have a vocational qualification. The other two indicators reflect the occupational status of employees: they are the shares of skilled occupations (skilled manual occupations, skilled services, skilled commercial and administrative occupations, technicians) and of highly skilled occupations (semiprofessions, engineers,

---

[13] The results of this robustness check for the matched sample (see section 4) can be found in the Appendix.

[14] As proposed by Davis/Haltiwanger (1999: 2718f.), the employment growth rate g for establishment i between two periods t and t-1 is calculated by $g_{i,t} = (emp_{i,t} - emp_{i,t-1})/(0.5*(emp_{i,t} + emp_{i,t-1}))$.

professions, managers) calculated according to the Blossfeld (1987) occupational classification (see also Hethey-Meier/Seth 2010).

Table 2 shows changes of these three indicators in percentage points for exiting and surviving establishments over the five years observed. For West Germany it can be seen that the share of low qualified employees decreases slightly for both exits and survivors. For exiting establishments this effect is significantly stronger in the last four periods before closure, and the difference becomes larger as death approaches. Between t and t-1, for instance, the share of low qualified employees falls by 1.7 percentage points in exiting establishments while it decreases by only 0.4 percentage points in surviving establishments. Having in mind that employment reductions prior to exit can reflect reactions by management trying to get rid of less productive workers and by (skilled) employees looking for other jobs, the fact that the share of low qualified employees decreases more strongly in exiting establishments suggests that the first effect slightly dominates. A corresponding picture emerges by looking at the development of the shares of skilled and highly skilled occupations. Both shares stay relatively constant in surviving establishments while they become increasingly larger in exiting establishments as death approaches. In contrast to Schwerdt (2011) and Lengermann/Vilhuber (2002) our descriptive evidence therefore suggests that the composition of the workforce becomes more skilled before closure.[15]

For East Germany the picture is not that clear. Looking at the development of the share of low qualified employees, systematic differences between exits and survivors before an upcoming closure cannot be observed. However, the shares of skilled and highly skilled occupations increase more strongly in exiting establishments and the difference is statistically significant in the last (resp. the last two) periods before closure. This also tends to support the view that the workforce composition becomes more skilled as exit approaches.

The lower panel of Table 2 presents percentage point changes in the shares of females in the workforce over the five years observed. Both for West and East Germany we can see that the share of women increases slightly for both exits and survivors but this effect is always stronger in exiting establishments. The difference becomes larger as death approaches, being most pronounced in the last two periods. The descriptive evidence thus suggests that women are more likely to

[15] This finding might partly reflect that those who manage the process of closure and stay until the end are probably highly qualified. Note, however, that this argument is not very relevant for those (smaller) firms which are managed by the owner since owners are not included in our data.

remain on board until the ship sinks. We do not know, however, whether this gender effect partly reflects the influence of other variables such as skill and age.

When analyzing how the age structure of the workforce develops prior to exit we look at the median age of the workforce, which should reflect systematic changes of the age structure. Table 3 shows absolute changes of the median age for exits and survivors. One can see that the median age rises over time for both exiting and surviving establishments which may reflect the demographic change taking place in Germany. For West Germany this increase in the median age becomes stronger for exits as death approaches while it stays relatively constant for survivors. Accordingly, the difference between exits and survivors also becomes larger and is statistically significant in all five periods prior to exit. In the last period, for instance, the median age of the workforce increases by 1.1 years in dying establishments while it increases by only 0.4 years in surviving establishments. The age effect in East Germany is similar although less pronounced. The median age increases slightly stronger in exiting establishments and the difference is statistically significant in the last two periods before exit. These results may reflect that older workers have fewer incentives to leave distressed firms or that management refrains from laying off older workers because of their firm-specific human capital and their higher costs of dismissal.

## 4. MATCHING ANALYSIS

The descriptive analysis in the previous section has already revealed several interesting insights about employment developments taking place before closure but the results could partially be driven by the fact that exiting and surviving establishments differ with respect to other relevant characteristics that can affect employment developments. To check the stability of our results, we therefore apply a propensity score matching approach (see e.g. Caliendo/Kopeinig 2008) which enables us to construct a group of survivors whose characteristics are as similar as possible to those of the exiting establishments five years prior to firm closure. We perform one-to-one nearest neighbor matching without replacement using the Stata module PSMATCH2 by Leuven/Sianesi (2003). In order to make sure that we do not compare exits and survivors facing completely different economic conditions we only allow for matches within the same year and the same two-digit industry. To compute the propensity score a probit regression is estimated with the dependent

variable being one for exits and zero for survivors.[16] As covariates we include the logarithm of the number of employees in t-5 as a third order polynomial, the workforce composition in t-5 (the shares of low qualified employees, skilled occupations, highly skilled occupations, females, and the median age), dummies for year of entry and type of entry (according to the classification by Hethey/Schmieder 2010) and regional dummies (30 administrative districts in West Germany and eight in East Germany).

Means of selected variables for exits and survivors before and after matching are presented in Tables 4a (West Germany) and 4b (East Germany). To get an impression of the matching quality, these tables also show the standardized bias in percent, the percentage reduction of the absolute bias through matching as well as t-tests to see whether there remain significant differences in the means for both groups after matching. Caliendo/Kopeinig (2008) state that a standardized bias below three or five percent can be regarded as sufficient. A standardized bias below five percent is achieved for all variables in both West and East Germany (also for those not listed in Tables 4a and 4b) and it is greater than three percent in only very few cases. The t-tests show that there are still significant differences after matching for some variables, but these differences are very small and the standardized bias still suggests that these covariates are balanced quite well. Despite some remaining significant differences after matching, Tables 4a and 4b show that exits and survivors in our matched sample are very similar with respect to size and workforce composition in t-5. The same applies to the variables not listed in Tables 4a and 4b (dummies for region, year of entry and type of entry).

When assessing the matching quality one should keep in mind that we only allow for matches within the same year and two-digit industry, which means that we perform matching within more than 1700 cells in our West German sample and more than 400 cells in the East German one. As the number of observations in those cells can become very small in some cases, the matching quality with respect to other covariates can be negatively affected by this approach.

The results after matching, presented in Tables 5-7 analogously to Tables 1-3, are largely the same as in the descriptive analysis, suggesting that they are not driven by other variables that differ strongly between exits and survivors (e.g. establishment size). For both parts of Germany we still find that employment growth rates are negative for exits in all five years before closure, that they differ strongly

[16] Our results do not change when we use a complementary log-log model for estimating the propensity score.

between exiting and surviving establishments, and that this effect becomes stronger as exit approaches (see Table 5).

Regarding the development of the qualification structure (Table 6), all three indicators show for West Germany that the composition of the workforce becomes more skilled in exiting establishments compared to survivors prior to exit. For East Germany, the evidence is once again not that clear. The development of the shares of low qualified employees and skilled occupations never differs significantly between both groups and the share of highly skilled occupations increases significantly stronger in exiting establishments just in the two last periods before closure, thus providing only weak evidence for an increasing average skill level of the workforce prior to exit. Concerning the gender structure (Table 6), we again find a significantly stronger increase in the share of women in exiting firms for West Germany. For East Germany, a significantly positive difference appears only in the last period. With respect to the age structure (Table 7), the results for West Germany still show that the median age of the workforce increases significantly stronger in exiting establishments in all the five periods under observation. For East Germany a significantly positive difference can be found only in the last two periods while the differences in the other periods are positive but not statistically significant.

These insights still hold when running several robustness checks. As already mentioned above, our sample is reduced considerably by looking at only establishments with at least ten employees in t-5. We therefore also conducted our analyses without this restriction, although the interpretation of the measures used in this study is questionable in this case (as discussed in section 3). Appendix Tables 1-3 show that the relevant effects are still visible but are less pronounced. As looking at the last five years before exit might appear arbitrary, we also investigated employment developments in the last ten years, using only establishments that are at least ten years old in period t and defining survivors as firms that continue to exist for at least ten years from period t onwards (this check was only possible for West Germany). We further experimented with different exit classifications and restricted our analyses to some cohorts that exited in recession or boom years. Finally, we also ran nonparametric Kolmogorov-Smirnov tests which confirmed the results of our significant t-tests for differences in means by rejecting the null hypothesis of equality of distribution functions for the two samples of exits and survivors. The results of those robustness checks not shown in the Appendix are available upon request from the first author.

## 5. CONCLUSIONS

Using a large administrative dataset, this paper has investigated employment developments in German establishments taking place in the last five years before closure. We find for both East and West Germany that establishments shrink in all five years before they finally exit, that employment growth rates differ substantially between exiting and surviving establishments, and that this difference becomes stronger as exit approaches. This provides evidence for the existence of a so-called "shadow of death" effect, thus extending and generalizing previous evidence for Germany by Almus (2004) who found this shadow to be present up to three years before closure in an entry sample of young firms. Hence establishments typically do not face sudden deaths, and the development of overall employment preceding exit can be better described as a lingering illness.

As a "shadow of death" effect in terms of falling employment may reflect different reactions to economic distress by management and employees, we have further investigated how the composition of the workforce develops in terms of qualification, gender and age in the years before exit. For West Germany we find that the workforce becomes more skilled in exiting compared to surviving establishments as exit approaches. This suggests that the management's reaction of getting rid of less productive workers seems to be slightly more important than the voluntary quits of skilled employees. For East Germany, most of the empirical results go in the same direction but the differences between exits and survivors are not statistically significant in many cases. Although the picture is less clear for East Germany, it still tends to suggest that the average skill level of the workforce increases prior to exit. Interestingly, these results are in contrast to existing empirical evidence for Austria (Schwerdt 2011) and the U.S. (Lengermann/Vilhuber 2002) who found that the composition of the workforce becomes less skilled prior to exit. This suggests that more research on this topic is needed, ideally using comparable datasets for different countries.

Our analysis further provides first evidence on the development of the gender and the age structure of the workforce in exiting compared to surviving establishments, two issues that (to the best of our knowledge) have not been investigated before. Our results for West Germany clearly show that the share of women rises more in exiting compared to surviving establishment, suggesting that women are less likely than men to leave distressed firms, probably due to higher search frictions. Concerning the age structure, we find that the median age increases stronger in exiting than in surviving establishments. The results support the view that is

relatively unattractive for older workers to leave distressed firms and that management is less likely to dismiss them (probably due to their higher firm-specific human capital and their better employment protection). Although the picture concerning both the gender and age structure is less clear for East Germany, the results still point in the same direction as those for West Germany.

Our empirical results have some important implications for studies on the relationships between firm size and the probability of exit. Researchers should be aware of the fact that current firm size may be endogenous as firms tend to reduce employment as a response to economic distress that finally leads to closure. The same applies to the relationship between workforce composition and the probability of exit. Furthermore, as mentioned for example by Schwerdt (2011), labor turnover before exit should also be taken into account when examining the effects of displacement on labor market outcomes like earnings. The upshot is that it may be misleading to regard firm exits as exogenous shocks that are unrelated to worker characteristics, as it is often assumed in the literature (see e.g. Farber 1999, Kletzer 1998).

The fact that usually employment has declined for several years before firms finally exit shows that job losses due to plant closures spread over a longer period of time and therefore typically do not culminate in one mass layoff at the end. This implies that excessively declining employment (as well as the development of other indicators that we cannot observe in our data) may serve as a valuable indicator for an upcoming closure.

## REFERENCES

Almus, M. (2004): The Shadow of Death – An Empirical Analysis of the Pre-Exit Performance of New German Firms, in: Small Business Economics 23, 189-201.

Bellone, F./Musso, P./Quéré, M./Nesta, L. (2006): Productivity and market selection of French manufacturing firms in the nineties, in: Revue de L'OFCE 97, 319-349.

Bellone, F./Musso, P./Nesta, L./Quéré, M. (2008): Market selection along the firm life cycle, in: Industrial and Corporate Change 17, 753-777.

Bernard, A. B./Jensen, J. B. (2007): Firm structure, multinationals, and manufacturing plant deaths, in: Review of Economics and Statistics 89, 193-204.

Blossfeld, H.-P. (1987): Labor Market Entry and the Sexual Segregation of Careers in the Federal Republic of Germany, in: American Journal of Sociology 93, 89-118.

Box, M. (2008): The death of firms: exploring the effects of environment and birth cohort on firm survival in Sweden, in: Small Business Economics 31, 379-393.

Brixy, U./Fritsch, M. (2002): Die Betriebsdatei der Beschäftigtenstatistik der Bundesanstalt für Arbeit, in: Fritsch, M./Grotz, R. (eds.): Das Gründungsgeschehen in Deutschland, Heidelberg, 55-78.

Caliendo, M./Kopeinig, S. (2008): Some Practical Guidance for the Implementation of Propensity Score Matching, in: Journal of Economic Surveys 22, 31-72.

Carreira, C./Teixeira, P. (2011): The shadow of death: analysing the pre-exit productivity of Portuguese manufacturing firms, in: Small Business Economics 36, 337-351.

Davis, S. J./Haltiwanger, J. (1999): Gross Job Flows, in: Ashenfelter, O./Card D. (eds.): Handbook of Labor Economics, Volume 3B, Amsterdam, 2711-2805.

Disney, R./Haskel, J./Heden, Y. (2003): Entry, Exit and Establishment Survival in UK Manufacturing, in: Journal of Industrial Economics 51, 91-112.

Eberle, J./Jacobebbinghaus, P./Ludsteck, J./Witter, J. (2011): Generation of time-consistent industry codes in the face of classification changes - Simple heuristic based on the Establishment History Panel (BHP), FDZ-Methodenreport 5/2011, Nürnberg.

Esteve-Pérez, S./Mañez-Castillejo, J. A. (2008): The Resource-Based Theory of the Firm and Firm Survival, in: Small Business Economics 30, 231–249.

Fackler, D./Schnabel, C./Wagner, J. (2012): Establishment Exits in Germany: The Role of Size and Age, IZA Discussion Paper No. 6349, Bonn. Forthcoming in: Small Business Economics.

Farber, H. S. (1999): Mobility and stability: the dynamics of job change in labor markets, in: Ashenfelter, O./Card D. (eds.): Handbook of Labor Economics, Volume 3B, Amsterdam, 2439-2483.

Griliches, Z./Regev, H. (1995): Firm productivity in Israeli industry 1979-1988, in: Journal of Econometrics 65, 175-203.

Hambrick, D. C./D'Aveni, R. A. (1988): Large Corporate Failures as Downward Spirals, in: Administrative Science Quarterly 33, 1-23.

Hethey, T./Schmieder, J. F. (2010): Using Worker Flows in the Analysis of Establishment Turnover – Evidence from German Administrative Data, FDZ-Methodenreport 6/2010, Nürnberg.

Hethey-Meier, T./Seth, S. (2010): The Establishment History Panel (BHP) 1975 – 2008 – Handbook Version 1.0.2, FDZ-Datenreport 4/2010, Nürnberg.

Hirsch, B./Schank, T./Schnabel, C. (2010): Differences in Labor Supply to Monopsonistic Firms and the Gender Pay Gap: An Empirical Analysis Using Linked Employer-Employee Data from Germany, in: Journal of Labor Economics 28, 291-330.

Huynh, K. P./Petrunia, R. J. (2011) Post-Entry Struggle for Life and Pre-Exit Shadow of Death from a Financial Perspective, paper presented at the 11th Comparative Analysis of Enterprise Data & COST Conference 2012 in Nürnberg.

Kiyota, K./Takizawa, M. (2006): The Shadow of Death: Pre-exit Performance of Firms in Japan, RIETI Discussion Paper Series 06-E-033, Tokyo.

Kletzer, L. G. (1998): Job Displacement, in: Journal of Economic Perspectives 12(1), 115-136.

Lengermann, P./Vilhuber, L. (2002): Abandoning the Sinking Ship: The Composition of Worker Flows Prior to Displacement, LEHD Technical Paper No. TP-2002-11, Suitland, Maryland.

Leuven, E./Sianesi, B. (2003): PSMATCH2: Stata module to perform full Mahalanobis and propensity score matching, common support graphing, and covariate imbalance testing, version 4.06, available under http://ideas.repec.org/c/boc/bocode/ s432001.html.

Manning, A. (2003): Monopsony in Motion: Imperfect Competition in Labor Markets, Princeton, NJ.

Niese, M. (2003): Ursachen von Betriebsschließungen, Münster.

Pfann, G. A./Hamermesh, D. S. (2008): Two-Sided Learning with Applications to Labor Turnover and Worker Displacement, in: Jahrbücher für Nationalökonomie und Statistik 228, 423-445.

Schwerdt, G. (2011): Labor turnover before plant closure: “Leaving the sinking ship” vs. “Captain throwing ballast overboard”, in: Labour Economics 18: 93-101.

Spengler, A. (2008): The Establishment History Panel, in: Schmollers Jahrbuch 128, 501-509.

Troske, K. R. (1996): The dynamic adjustment process of firm entry and exit in manufacturing and finance, insurance and real estate, in: Journal of Law and Economics 39, 705-735.

Wagner, J. (1999): The Life History of Cohorts of Exits from German Manufacturing, in: Small Business Economics 13, 71-79.

**Table 1:** Employment growth rates for exiting versus surviving establishments (in percent)

| Period | West Germany | | | East Germany | | |
|---|---|---|---|---|---|---|
| | **Exits** | **Survivors** | **Difference** | **Exits** | **Survivors** | **Difference** |
| **t, t-1** | -40.35 | -0.46 | -39.89*** | -39.98 | -1.84 | -38.15*** |
| **t-1, t-2** | -12.69 | 0.04 | -12.73*** | -15.45 | -1.33 | -14.13*** |
| **t-2, t-3** | -7.54 | 0.32 | -7.86*** | -9.30 | -0.01 | -9.30*** |
| **t-3, t-4** | -5.15 | 0.52 | -5.67*** | -5.46 | 1.49 | -6.95*** |
| **t-4, t-5** | -4.16 | -0.01 | -4.16*** | -3.64 | 2.83 | -6.47*** |
| **Obs.** | 62,674 | 1,862,973 | --- | 5,403 | 60,499 | --- |

Notes: West Germany 1980-2003, East Germany 1998-2003, private sector without agriculture and mining, establishments with at least 10 employees in t-5, ***/**/* indicates statistical significance at the 1/5/10% level.

**Table 2:** Changes in the employment structure for exiting versus surviving establishments (in percentage points)

| Period | West Germany | | | East Germany | | |
|---|---|---|---|---|---|---|
| | Exits | Survivors | Difference | Exits | Survivors | Difference |
| | **Low qualified employees** | | | | | |
| **t, t-1** | -1.71 | -0.42 | -1.29*** | -0.21 | -0.32 | 0.11 |
| **t-1, t-2** | -0.66 | -0.37 | -0.29*** | -0.38 | -0.18 | -0.19* |
| **t-2, t-3** | -0.51 | -0.37 | -0.14*** | 0.01 | -0.07 | 0.08 |
| **t-3, t-4** | -0.48 | -0.41 | -0.07** | 0.30 | 0.13 | 0.17* |
| **t-4, t-5** | -0.44 | -0.45 | 0.02 | 0.52 | 0.39 | 0.13 |
| | **Skilled occupations** | | | | | |
| **t, t-1** | 1.16 | -0.01 | 1.17*** | 0.44 | -0.09 | 0.54*** |
| **t-1, t-2** | 0.16 | -0.01 | 0.17*** | 0.05 | -0.05 | 0.10 |
| **t-2, t-3** | 0.08 | -0.02 | 0.10*** | 0.07 | -0.07 | 0.14 |
| **t-3, t-4** | 0.03 | -0.02 | 0.04 | 0.07 | -0.06 | 0.13 |
| **t-4, t-5** | 0.06 | 0.00 | 0.06* | 0.28 | 0.01 | 0.27** |
| | **Highly skilled occupations** | | | | | |
| **t, t-1** | 0.89 | 0.02 | 0.87*** | 0.79 | -0.06 | 0.85*** |
| **t-1, t-2** | 0.24 | 0.01 | 0.23*** | 0.22 | -0.07 | 0.30*** |
| **t-2, t-3** | 0.12 | 0.01 | 0.11*** | -0.00 | -0.09 | 0.08 |
| **t-3, t-4** | 0.07 | 0.01 | 0.06*** | -0.02 | -0.02 | 0.08 |
| **t-4, t-5** | 0.03 | 0.01 | 0.03** | -0.00 | -0.12 | 0.12* |
| | **Females** | | | | | |
| **t, t-1** | 1.97 | 0.19 | 1.79*** | 1.57 | 0.21 | 1.36*** |
| **t-1, t-2** | 0.47 | 0.19 | 0.28*** | 0.66 | 0.29 | 0.37*** |
| **t-2, t-3** | 0.35 | 0.21 | 0.15*** | 0.30 | 0.24 | 0.07 |
| **t-3, t-4** | 0.37 | 0.21 | 0.16*** | 0.42 | 0.25 | 0.17* |
| **t-4, t-5** | 0.33 | 0.23 | 0.10*** | 0.53 | 0.35 | 0.18** |
| **Obs.** | 62,674 | 1,862,973 | --- | 5,403 | 60,499 | --- |

Notes: West Germany 1980-2003, East Germany 1998-2003, private sector without agriculture and mining, establishments with at least 10 employees in t-5, ***/**/* indicates statistical significance at the 1/5/10% level.

**Table 3:** Changes in the median age for exiting versus surviving establishments (absolute changes in years)

| Period | West Germany | | | East Germany | | |
|---|---|---|---|---|---|---|
| | **Exits** | **Survivors** | **Difference** | **Exits** | **Survivors** | **Difference** |
| **t, t-1** | 1.14 | 0.39 | 0.75*** | 0.73 | 0.56 | 0.17*** |
| **t-1, t-2** | 0.71 | 0.38 | 0.33*** | 0.79 | 0.53 | 0.26*** |
| **t-2, t-3** | 0.57 | 0.37 | 0.20*** | 0.58 | 0.51 | 0.07 |
| **t-3, t-4** | 0.54 | 0.37 | 0.17*** | 0.49 | 0.48 | 0.02 |
| **t-4, t-5** | 0.51 | 0.39 | 0.12*** | 0.53 | 0.47 | 0.06 |
| **Obs.** | 62,674 | 1,862,973 | --- | 5,403 | 60,499 | --- |

Notes: West Germany 1980-2003, East Germany 1998-2003, private sector without agriculture and mining, establishments with at least 10 employees in t-5, ***/**/* indicates statistical significance at the 1/5/10% level.

**Table 4a:** Balancing of selected variables before and after matching, West Germany

| Variable (in t-5) | Sample | Mean | | Standardized bias (percent) | Reduction of absolute bias (percent) | t-test (difference in means) |
|---|---|---|---|---|---|---|
| | | Exits | Survivors | | | |
| Number of employees | Unmatched | 38.147 | 61.864 | -7.8 | | -14.11*** |
| | Matched | 38.153 | 38.407 | -0.1 | 98.9 | -0.47 |
| Low qualified employees (%) | Unmatched | 24.748 | 25.426 | -3.0 | | -7.53*** |
| | Matched | 24.744 | 25.084 | -1.5 | 49.8 | -2.56** |
| Skilled occupations (%) | Unmatched | 50.072 | 52.959 | -9.1 | | -22.45*** |
| | Matched | 50.081 | 49.875 | 0.6 | 92.9 | 1.14 |
| Highly skilled occupations (%) | Unmatched | 5.055 | 5.723 | -5.4 | | -12.62*** |
| | Matched | 5.056 | 4.672 | 3.1 | 42.5 | 6.10*** |
| Females (%) | Unmatched | 37.035 | 36.298 | 2.4 | | 6.03*** |
| | Matched | 37.031 | 37.427 | -1.3 | 46.2 | -2.25** |
| Median age (years) | Unmatched | 35.204 | 34.188 | 13.7 | | 34.37*** |
| | Matched | 35.202 | 35.195 | 0.1 | 99.3 | 0.16 |

Notes: Exit cohorts 1980-2003, private sector without agriculture and mining, establishments with at least 10 employees in t-5, ***/**/* indicates statistical significance at the 1/5/10% level.

**Table 4b:** Balancing of selected variables before and after matching, East Germany

| Variable (in t-5) | Sample | Mean | | Standardized bias (percent) | Reduction of absolute bias (percent) | t-test (difference in means) |
|---|---|---|---|---|---|---|
| | | Exits | Survivors | | | |
| Number of employees | Unmatched | 31.227 | 35.411 | -5.1 | | -3.32*** |
| | Matched | 31.166 | 30.283 | 1.1 | 78.9 | 0.71 |
| Low qualified employees (%) | Unmatched | 10.834 | 10.882 | -0.3 | | -0.21 |
| | Matched | 10.820 | 10.756 | 0.4 | -33.3 | 0.20 |
| Skilled occupations (%) | Unmatched | 51.320 | 49.099 | 6.5 | | 4.63*** |
| | Matched | 51.373 | 50.493 | 2.6 | 60.4 | 1.32 |
| Highly skilled occupations (%) | Unmatched | 6.985 | 9.323 | -14.1 | | -9.18*** |
| | Matched | 6.992 | 6.557 | 2.6 | 81.4 | 1.54 |
| Females (%) | Unmatched | 28.962 | 37.105 | -26.5 | | -18.16*** |
| | Matched | 28.983 | 28.343 | 2.1 | 92.1 | 1.13 |
| Median age (years) | Unmatched | 35.812 | 35.790 | 0.4 | | 0.25 |
| | Matched | 35.808 | 35.598 | 3.5 | -872.7 | 1.82* |

Notes: Exit cohorts 1998-2003, private sector without agriculture and mining, establishments with at least 10 employees in t-5, ***/**/* indicates statistical significance at the 1/5/10% level.

**Table 5:** Employment growth rates for exiting versus surviving establishments (in percent), matched sample

| **Period** | **West Germany** | | | **East Germany** | | |
|---|---|---|---|---|---|---|
| | **Exits** | **Survivors** | **Difference** | **Exits** | **Survivors** | **Difference** |
| **t, t-1** | -40.35 | -0.66 | -39.69*** | -40.01 | -3.41 | -36.61*** |
| **t-1, t-2** | -12.68 | -0.01 | -12.67*** | -15.43 | -2.54 | -12.90*** |
| **t-2, t-3** | -7.55 | 0.40 | -7.95*** | -9.29 | -1.40 | -7.89*** |
| **t-3, t-4** | -5.15 | 0.77 | -5.92*** | -5.46 | 0.45 | -5.91*** |
| **t-4, t-5** | -4.17 | 0.26 | -4.42*** | -3.63 | 2.13 | -5.76*** |
| **Obs.** | 62,659 | 62,659 | --- | 5,392 | 5,392 | --- |

Notes: West Germany 1980-2003, East Germany 1998-2003, private sector without agriculture and mining, establishments with at least 10 employees in t-5, ***/**/* indicates statistical significance at the 1/5/10% level.

**Table 6:** Changes in the employment structure for exiting versus surviving establishments (in percentage points), matched sample

| Period | West Germany | | | East Germany | | |
|---|---|---|---|---|---|---|
| | Exits | Survivors | Difference | Exits | Survivors | Difference |
| | **Low qualified employees** | | | | | |
| **t, t-1** | -1.71 | -0.43 | -1.28*** | -0.20 | -0.52 | 0.32 |
| **t-1, t-2** | -0.66 | -0.37 | -0.29*** | -0.37 | -0.18 | -0.19 |
| **t-2, t-3** | -0.51 | -0.36 | -0.15*** | 0.00 | -0.10 | 0.10 |
| **t-3, t-4** | -0.48 | -0.36 | -0.12** | 0.30 | 0.22 | 0.08 |
| **t-4, t-5** | -0.44 | -0.30 | -0.13*** | 0.53 | 0.43 | 0.09 |
| | **Skilled occupations** | | | | | |
| **t, t-1** | 1.16 | 0.02 | 1.14*** | 0.44 | -0.05 | 0.49 |
| **t-1, t-2** | 0.16 | -0.05 | 0.21*** | 0.06 | -0.00 | 0.06 |
| **t-2, t-3** | 0.08 | 0.01 | 0.07 | 0.07 | 0.17 | -0.10 |
| **t-3, t-4** | 0.03 | -0.07 | 0.10** | 0.07 | -0.16 | 0.24 |
| **t-4, t-5** | 0.06 | 0.03 | 0.04 | 0.27 | 0.06 | 0.22 |
| | **Highly skilled occupations** | | | | | |
| **t, t-1** | 0.89 | 0.03 | 0.86*** | 0.79 | 0.01 | 0.78*** |
| **t-1, t-2** | 0.24 | 0.02 | 0.22*** | 0.23 | -0.10 | 0.33*** |
| **t-2, t-3** | 0.12 | -0.00 | 0.12*** | -0.01 | -0.04 | 0.03 |
| **t-3, t-4** | 0.07 | 0.01 | 0.06** | -0.02 | -0.02 | 0.00 |
| **t-4, t-5** | 0.03 | 0.01 | 0.02 | -0.00 | -0.10 | 0.09 |
| | **Females** | | | | | |
| **t, t-1** | 1.97 | 0.19 | 1.78*** | 1.57 | 0.47 | 1.10*** |
| **t-1, t-2** | 0.47 | 0.21 | 0.25*** | 0.66 | 0.53 | 0.13 |
| **t-2, t-3** | 0.35 | 0.23 | 0.12*** | 0.31 | 0.50 | -0.19 |
| **t-3, t-4** | 0.37 | 0.22 | 0.16*** | 0.42 | 0.31 | 0.11 |
| **t-4, t-5** | 0.33 | 0.27 | 0.06* | 0.52 | 0.44 | 0.08 |
| **Obs.** | 62,659 | 62,659 | --- | 5,392 | 5,392 | --- |

Notes: West Germany 1980-2003, East Germany 1998-2003, private sector without agriculture and mining, establishments with at least 10 employees in t-5, ***/**/* indicates statistical significance at the 1/5/10% level.

**Table 7:** Changes in the median age for exiting versus surviving establishments (absolute changes in years), matched sample

| Period | West Germany | | | East Germany | | |
|---|---|---|---|---|---|---|
| | **Exits** | **Survivors** | **Difference** | **Exits** | **Survivors** | **Difference** |
| **t, t-1** | 1.14 | 0.39 | 0.75*** | 0.74 | 0.57 | 0.17* |
| **t-1, t-2** | 0.71 | 0.37 | 0.33*** | 0.79 | 0.55 | 0.24*** |
| **t-2, t-3** | 0.57 | 0.36 | 0.22*** | 0.57 | 0.53 | 0.04 |
| **t-3, t-4** | 0.54 | 0.36 | 0.18*** | 0.50 | 0.48 | 0.01 |
| **t-4, t-5** | 0.51 | 0.33 | 0.18*** | 0.53 | 0.43 | 0.09 |
| **Obs.** | 62,659 | 62,659 | --- | 5,392 | 5,392 | --- |

Notes: West Germany 1980-2003, East Germany 1998-2003, private sector without agriculture and mining, establishments with at least 10 employees in t-5, ***/**/* indicates statistical significance at the 1/5/10% level.

## APPENDIX

**Appendix Table 1:** Employment growth rates for exiting versus surviving establishments (in percent), matched sample, all establishments

| Period | West Germany | | | East Germany | | |
|---|---|---|---|---|---|---|
| | **Exits** | **Survivors** | **Difference** | **Exits** | **Survivors** | **Difference** |
| **t, t-1** | -14.67 | 1.63 | -16.30*** | -17.08 | 0.90 | -17.98*** |
| **t-1, t-2** | -4.98 | 2.55 | -7.53*** | -6.95 | 2.07 | -9.03*** |
| **t-2, t-3** | -1.95 | 3.50 | -5.44*** | -3.11 | 4.00 | -7.11*** |
| **t-3, t-4** | -0.29 | 4.80 | -5.09*** | 0.71 | 6.81 | -6.09*** |
| **t-4, t-5** | 1.73 | 8.05 | -6.32*** | 5.51 | 12.63 | -7.13*** |
| **Obs.** | 433,573 | 433,573 | --- | 32,047 | 32,047 | --- |

Notes: West Germany 1980-2003, East Germany 1998-2003, private sector without agriculture and mining, establishments with one or more employees in t-5, ***/**/* indicates statistical significance at the 1/5/10% level.

**Appendix Table 2:** Changes in the employment structure for exiting versus surviving establishments (in percentage points), matched sample, all establishments

| Period | West Germany | | | East Germany | | |
|---|---|---|---|---|---|---|
| | Exits | Survivors | Difference | Exits | Survivors | Difference |
| | **Low qualified employees** | | | | | |
| **t, t-1** | -0.90 | -0.43 | -0.46*** | -0.39 | -0.34 | -0.05 |
| **t-1, t-2** | -0.57 | -0.49 | -0.08** | -0.12 | -0.27 | 0.15 |
| **t-2, t-3** | -0.34 | -0.35 | 0.01 | 0.33 | 0.06 | 0.28*** |
| **t-3, t-4** | -0.46 | -0.24 | -0.23*** | 0.05 | 0.11 | -0.06 |
| **t-4, t-5** | -0.38 | -0.12 | -0.26*** | 0.31 | 0.58 | -0.27*** |
| | **Skilled occupations** | | | | | |
| **t, t-1** | 0.10 | -0.11 | 0.22*** | 0.09 | -0.15 | 0.24* |
| **t-1, t-2** | -0.13 | -0.14 | 0.02 | -0.28 | -0.33 | 0.05 |
| **t-2, t-3** | -0.17 | -0.12 | -0.05 | -0.15 | -0.23 | 0.07 |
| **t-3, t-4** | -0.21 | -0.10 | -0.11*** | -0.15 | -0.20 | 0.04 |
| **t-4, t-5** | -0.14 | 0.09 | -0.23*** | -0.05 | 0.17 | -0.22 |
| | **Highly skilled occupations** | | | | | |
| **t, t-1** | 0.23 | -0.01 | 0.24*** | 0.13 | -0.16 | 0.30*** |
| **t-1, t-2** | 0.04 | -0.01 | 0.06*** | -0.01 | -0.13 | 0.12* |
| **t-2, t-3** | -0.02 | -0.04 | 0.02 | -0.11 | -0.18 | 0.07 |
| **t-3, t-4** | -0.04 | -0.03 | -0.01 | -0.33 | -0.21 | -0.13* |
| **t-4, t-5** | -0.06 | 0.01 | -0.06*** | -0.31 | -0.30 | -0.02 |
| | **Females** | | | | | |
| **t, t-1** | 0.76 | 0.26 | 0.50*** | 0.56 | 0.32 | 0.23* |
| **t-1, t-2** | 0.33 | 0.25 | 0.08*** | 0.37 | 0.25 | 0.12 |
| **t-2, t-3** | 0.31 | 0.27 | 0.04 | 0.18 | 0.44 | -0.26** |
| **t-3, t-4** | 0.36 | 0.27 | 0.09*** | 0.29 | 0.43 | -0.14 |
| **t-4, t-5** | 0.32 | 0.20 | 0.13*** | 0.34 | 1.00 | -0.66*** |
| **Obs.** | 433,573 | 433,573 | --- | 32,047 | 32,047 | --- |

Notes: West Germany 1980-2003, East Germany 1998-2003, private sector without agriculture and mining, establishments with one or more employees in t-5, ***/**/* indicates statistical significance at the 1/5/10% level.

**Appendix Table 3:** Changes in the median age for exiting versus surviving establishments (absolute changes in years), matched sample, all establishments

| Period | West Germany | | | East Germany | | |
|---|---|---|---|---|---|---|
| | **Exits** | **Survivors** | **Difference** | **Exits** | **Survivors** | **Difference** |
| **t, t-1** | 0.90 | 0.47 | 0.43*** | 0.73 | 0.60 | 0.14*** |
| **t-1, t-2** | 0.76 | 0.45 | 0.31*** | 0.73 | 0.60 | 0.13*** |
| **t-2, t-3** | 0.68 | 0.37 | 0.31*** | 0.67 | 0.50 | 0.17*** |
| **t-3, t-4** | 0.66 | 0.32 | 0.34*** | 0.57 | 0.40 | 0.17*** |
| **t-4, t-5** | 0.62 | 0.06 | 0.56*** | 0.58 | 0.21 | 0.37*** |
| **Obs.** | 433,573 | 433,573 | --- | 32,047 | 32,047 | --- |

Notes: West Germany 1980-2003, East Germany 1998-2003, private sector without agriculture and mining, establishments with one or more employees in t-5, ***/**/* indicates statistical significance at the 1/5/10% level.

# Working Paper Series in Economics

(recent issues)

No.257: *Horst Raff* and *Joachim Wagner*: Productivity and the Product Scope of Multi-product Firms: A Test of Feenstra-Ma, December 2012

No.256: *Christian Pfeifer* and *Joachim Wagner*: Is innovative firm behavior correlated with age and gender composition of the workforce? Evidence from a new type of data for German enterprises, December 2012

No.255: *Maximilian Benner*: Cluster Policy as a Development Strategy. Case Studies from the Middle East and North Africa, December 2012

No.254: *Joachim Wagner* und *John P. Weche Gelübcke*: Firmendatenbasiertes Benchmarking der Industrie und des Dienstleistungssektors in Niedersachsen – Methodisches Konzept und Anwendungen (Projektbericht), Dezember 2012

No.253: *Joachim Wagner*: The Great Export Recovery in German Manufacturing Industries, 2009/2010, November 2012

No.252: *Joachim Wagner*: Daten des IAB-Betriebspanels und Firmenpaneldaten aus Erhebungen der Amtlichen Statistik – substitutive oder komplementäre Inputs für die Empirische Wirtschaftsforschung?, Oktober 2012

No.251: *Joachim Wagner*: Credit constraints and exports: Evidence for German manufacturing enterprises, October 2012

No.250: *Joachim Wagner*: Productivity and the extensive margins of trade in German manufacturing firms: Evidence from a non-parametric test, September 2012 [published in: Economics Bulletin 32 (2012), 4, 3061-3070]

No.249: *John P. Weche Gelübcke*: Foreign and Domestic Takeovers in Germany: First Comparative Evidence on the Post-acquisition Target Performance using new Data, September 2012

No.248: *Roland Olbrich, Martin Quaas,* and *Stefan Baumgärtner*: Characterizing commercial cattle farms in Namibia: risk, management and sustainability, August 2012

No.247: *Alexander Vogel* and *Joachim Wagner*: Exports, R&D and Productivity in German Business Services Firms: A test of the Bustos-model, August 2012

No.246: *Alexander Vogel* and *Joachim Wagner*: Innovations and Exports of German Business Services Enterprises: First evidence from a new type of firm data, August 2012

No.245: *Stephan Humpert*: Somewhere over the Rainbow: Sexual Orientation Discrimination in Germany, July 2012

No.244: *Joachim Wagner*: Exports, R&D and Productivity: A test of the Bustos-model with German enterprise data, June 2012 [published in: Economics Bulletin, 32 (2012), 3, 1942-1948]

No.243: *Joachim Wagner*: Trading many goods with many countries: Exporters and importers from German manufacturing industries, June 2012 [published in: Jahrbuch für Wirtschaftswissenschaften/Review of Economics, 63 (2012), 2, 170-186]

No.242: *Joachim Wagner*: German multiple-product, multiple-destination exporters: Bernard-Redding-Schott under test, June 2012 [published in: Economics Bulletin, 32 (2012), 2, 1708-1714]

No.241: *Joachim Fünfgelt* and *Stefan Baumgärtner*: Regulation of morally responsible agents with motivation crowding, June 2012

No.240: *John P. Weche Gelübcke*: Foreign and Domestic Takeovers: Cherry-picking and Lemon-grabbing, April 2012

No.239: *Markus Leibrecht* and *Aleksandra Riedl*: Modelling FDI based on a spatially augmented gravity model: Evidence for Central and Eastern European Countries, April 2012

No.238: *Norbert Olah, Thomas Huth* und *Dirk Löhr*: Monetarismus mit Liquiditätsprämie Von Friedmans optimaler Inflationsrate zur optimalen Liquidität, April 2012

No.237: *Markus Leibrecht* and *Johann Scharler*: Government Size and Business Cycle Volatility; How Important Are Credit Contraints?, April 2012

No.236: *Frank Schmielewski* and *Thomas Wein*: Are private banks the better banks? An insight into the principal-agent structure and risk-taking behavior of German banks, April 2012

No.235: *Stephan Humpert*: Age and Gender Differences in Job Opportunities, March 2012

No.234: *Joachim Fünfgelt* and *Stefan Baumgärtner*: A utilitarian notion of responsibility for sustainability, March 2012

No.233: *Joachim Wagner*: The Microstructure of the Great Export Collapse in German Manufacturing Industries, 2008/2009, February 2012

No.232: *Christian Pfeifer* and *Joachim Wagner*: Age and gender composition of the workforce, productivity and profits: Evidence from a new type of data for German enterprises, February 2012

No.231: *Daniel Fackler, Claus Schnabel,* and *Joachim Wagner*: Establishment exits in Germany: the role of size and age, February 2012

No.230: *Institut für Volkswirtschaftslehre*: Forschungsbericht 2011, January 2012

No.229: *Frank Schmielewski*: Leveraging and risk taking within the German banking system: Evidence from the financial crisis in 2007 and 2008, January 2012

No.228: *Daniel Schmidt* and *Frank Schmielewski*: Consumer reaction on tumbling funds – Evidence from retail fund outflows during the financial crisis 2007/2008, January 2012

No.227: *Joachim Wagner*: New Methods for the Analysis of Links between International Firm Activities and Firm Performance: A Practitioner's Guide, January 2012

No.226: *Alexander Vogel* and *Joachim Wagner*: The Quality of the KombiFiD-Sample of Business Services Enterprises: Evidence from a Replication Study, January 2012 [published in: Schmollers Jahrbuch/Journal of Applied Social Science Studies 132 (2012), 3, 379-392]

No.225: *Stefanie Glotzbach*: Environmental justice in agricultural systems. An evaluation of success factors and barriers by the example of the Philippine farmer network MASIPAG, January 2012

No.224: *Joachim Wagner*: Average wage, qualification of the workforce and export performance in German enterprises: Evidence from KombiFiD data, January 2012 [published in: Journal for Labour Market Research, 45 (2012), 2, 161-170]

No.223: *Maria Olivares* and *Heike Wetzel*: Competing in the Higher Education Market: Empirical Evidence for Economies of Scale and Scope in German Higher Education Institutions, December 2011

No.222: *Maximilian Benner*: How export-led growth can lead to take-off, December 2011

No.221: *Joachim Wagner* and *John P. Weche Gelübcke*: Foreign Ownership and Firm Survival: First evidence for enterprises in Germany, December 2011

No.220: *Martin F. Quaas, Daan van Soest,* and *Stefan Baumgärtner*: Complementarity, impatience, and the resilience of natural-resource-dependent economies, November 2011

No.219: *Joachim Wagner*: The German Manufacturing Sector is a Granular Economy, November 2011 [published in: Applied Economics Letters, 19(2012), 17, 1663-1665]

No.218: *Stefan Baumgärtner, Stefanie Glotzbach, Nikolai Hoberg, Martin F. Quaas, and Klara Stumpf*: Trade-offs between justices , economics, and efficiency, November 2011

No.217: *Joachim Wagner*: The Quality of the KombiFiD-Sample of Enterprises from Manufacturing Industries: Evidence from a Replication Study, November 2011 [published in: Schmollers Jahrbuch/Journal of Applied Social Science Studies 132 (2012), 3, 393-403]

No.216: *John P. Weche Gelübcke*: The Performance of Foreign Affiliates in German Manufacturing: Evidence from a new Database, November 2011

No.215: *Joachim Wagner*: Exports, Foreign Direct Investments and Productivity: Are services firms different?, September 2011

No.214: *Stephan Humpert and Christian Pfeifer*: Explaining Age and Gender Differences in Employment Rates: A Labor Supply Side Perspective, August 2011

No.213: *John P. Weche Gelübcke*: Foreign Ownership and Firm Performance in German Services: First Evidence based on Official Statistics, August 2011 [forthcoming in: The Service Industries Journal]

No.212: *John P. Weche Gelübcke*: Ownership Patterns and Enterprise Groups in German Structural Business Statistics, August 2011 [published in: Schmollers Jahrbuch / Journal of Applied Social Science Studies, 131(2011), 4, 635-647]

No.211: *Joachim Wagner*: Exports, Imports and Firm Survival: First Evidence for manufacturing enterprises in Germany, August 2011

No.210: *Joachim Wagner*: International Trade and Firm Performance: A Survey of Empirical Studies since 2006, August 2011 [published in: Review of World Economics, 2012, 148 (2), 235-267]

No.209: *Roland Olbrich, Martin F. Quaas, and Stefan Baumgärtner*: Personal norms of sustainability and their impact on management – The case of rangeland management in semi-arid regions, August 2011

No.208: *Roland Olbrich, Martin F. Quaas, Andreas Haensler and Stefan Baumgärtner*: Risk preferences under heterogeneous environmental risk, August 2011

No.207: *Alexander Vogel and Joachim Wagner*: Robust estimates of exporter productivity premia in German business services enterprises, July 2011 [published in: Economic and Business Review, 13 (2011), 1-2, 7-26]

No.206: *Joachim Wagner*: Exports, imports and profitability: First evidence for manufacturing enterprises, June 2011 [published in: Open Economies Review 23 (2012), 5, 747-765]

No.205: *Sebastian Strunz*: Is conceptual vagueness an asset? Resilience research from the perspective of philosophy of science, May 2011

No.204: *Stefanie Glotzbach*: On the notion of ecological justice, May 2011

(see www.leuphana.de/institute/ivwl/publikationen/working-papers.html for a complete list)

Leuphana Universität Lüneburg
Institut für Volkswirtschaftslehre
Postfach 2440
D-21314 Lüneburg
Tel.: ++49 4131 677 2321
email: brodt@leuphana.de

www.leuphana.de/institute/ivwl/publikationen/working-papers.html