FRIEDRICH-ALEXANDER-UNIVERSITÄT ERLANGEN-NÜRNBERG

Lehrstuhl für VWL, insbes. Arbeitsmarkt- und Regionalpolitik
Professor Dr. Claus Schnabel

Diskussionspapiere
Discussion Papers

NO. 84

Survival of spinoffs and other startups: First evidence for the private sector in Germany, 1976-2008

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AUGUST 2013

ISSN 1615-5831

Editor: Prof. Dr. Claus Schnabel, Friedrich-Alexander-Universität Erlangen-Nürnberg

Survival of spinoffs and other startups: First evidence for the private sector in Germany, 1976-2008*

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ABSTRACT: Using a 50 percent sample of all establishments in the German private sector, we report that spinoffs are larger and initially employ more skilled and more experienced workers than other startups. Controlling for these and other differences, we find that spinoffs are less likely to exit than other startups. We show that in West and East Germany and in all sectors investigated pulled spinoffs (where the parent company continues after they are founded) generally have the lowest exit hazards, followed by pushed spinoffs (where the parent company stops operations). The difference between both types of spinoffs is particularly pronounced in the first three years. Contrary to expectations, intra-industry spinoffs are not found to have lower exit hazards in our sample.

ZUSAMMENFASSUNG: Anhand eines Datensatzes, der 50 Prozent aller Betriebe der deutschen Privatwirtschaft enthält, zeigt diese Studie, dass Spinoffs zum Gründungszeitpunkt größer sind und mehr qualifizierte sowie erfahrene Mitarbeiter beschäftigen als andere Neugründungen. Unter Berücksichtigung dieser und weiterer Faktoren zeigt sich, dass Spinoffs im Vergleich zu anderen Neugründungen höhere Überlebenschancen haben. Die Ergebnisse zeigen sowohl für West- als auch Ostdeutschland sowie für alle untersuchten Branchen, dass „pulled“ Spinoffs (bei denen die Mutterfirma nach deren Gründung weiter existiert) die geringste Schließungswahrscheinlichkeit aufweisen, gefolgt von „pushed“ Spinoffs (bei denen die Mutterfirma schließt). Die Schließungswahrscheinlichkeit unterscheidet sich zwischen beiden Arten von Spinoffs vor allem in den ersten drei Jahren. Entgegen den Erwartungen weisen Spinoffs, die in derselben Branche gegründet wurden wie ihre Mutterfirmen, keine höhere Überlebenswahrscheinlichkeit auf.

Keywords: spinoffs, startups, firm exits, Germany

JEL-Classification: L2, D22, M13, C41

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* We would like to thank the German Research Foundation for financial support under the project SCHN 730/5-1 “Firm exits” (*Betriebsschließungen*). We also thank Joachim Wagner and participants in the research seminar at the University of Erlangen-Nuremberg for helpful comments. The firm level data used are confidential but not exclusive; see Spengler (2008) or Gruhl et al. (2012) for a description of how to access the data. To facilitate replication, the Stata do-files are available from the first author on request.

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1. MOTIVATION

Entries and exits of firms or establishments have increasingly received attention by economic policy and by academic researchers as they are important vehicles of structural change and economic development. Traditionally, the focus has been on the success of newly founded firms in terms of survival rates, employment growth, and other indicators of firm performance (for surveys of stylized facts, see Geroski 1995 or Caves 1998). One class of entrants that has gained special attention in recent years are spinoffs (sometimes also called spinouts), i.e. new firms founded by employees of incumbent firms. Spinoffs have stimulated the evolution of new industries and have played an important role in the development of some famous industry clusters such as Silicon Valley (Klepper 2010).

Among the growing theoretical and empirical literature on spinoffs (surveyed by Klepper 2009) we can distinguish four strands focusing on different – but often related – aspects of spinoff activities. First, there is a number of theoretical models with empirical applications that analyze potential reasons for spinoffs. These range from discoveries that for various reasons can better be exploited outside the incumbent firm (see, e.g., Wiggins 1995, Gompers et al. 2005) over employees imitating their employer's distinctive knowledge and using it to found their own firm (Franco and Filson 2006) to firms' difficulties in assessing their employees' abilities and ideas (Cabral and Wang 2008) which may lead to strategic disagreements between a firm and its best employees (Klepper and Thompson 2010). As a consequence, employees with better ideas implement them in spinoffs[1]. A second strand of the literature examines the rate at which firms spawn spinoffs, typically finding that better-performing firms record higher spinoff rates (e.g., Franco and Filson 2006) and that spinoff rates are age-dependent (e.g., Klepper 2007). Third, a smaller number of studies deal with the effects of spinoffs on their parents or on the local economy, including the creation of industry clusters (for a review of stylized facts, see Klepper 2009). Finally, a growing empirical literature analyzes the performance of spinoffs as compared to other startups, and this is also the purpose of the present paper.

Some of the theoretical approaches sketched above, which primarily model the reasons for spinoffs, have testable implications concerning the performance of spinoffs. In particular, assuming that spinoffs are typically created by superior employees (as in the models by Cabral and Wang 2008 and Klepper and Thompson 2010), they can be expected to perform better than other startups. If

[1] The formation of spinoffs has been analyzed in a number of case studies about the circumstances in parent companies that lead to spinoffs; see, e.g., Klepper and Thompson (2010) and the review by Klepper (2009, 163-165).

employees learn their employer's know-how and use it to found their own firms (Franco and Filson 2006), then these (intra-industry) spinoffs will outperform other startups that do not have such knowledge. Similarly, as spinoffs have inside knowledge of their industry and may benefit from network ties and customer links built up at their previous employment, their likelihood of survival will be greater than that of other entrepreneurial entrants (Agarwal et al. 2004).

Empirical investigations for several industries and countries have found that the performance of spinoffs, measured by survival rates and other indicators, is superior to other startups (see, e.g., Agarwal et al. 2004, Klepper 2007, Boschma and Wenting 2007, Wenting 2008). That spinoffs outperform other newly founded establishments also shows up in analyses for the universe of firms in Denmark (see, e.g., Eriksson and Kuhn 2006, Gjerløv-Juel and Dahl 2012), Brazil (Muendler et al. 2012) and Sweden (Andersson and Klepper 2013). For Germany, empirical studies exist for the automobile industry (Cantner et al. 2006; see also Rhein 2008), for the laser industry (Buenstorf 2007) and for the farm tractor industry (Buenstorf et al. 2013); they find that spinoffs survive longer than other startups. A few studies have been able to distinguish between so-called "pushed" spinoffs where the parent company stops operations and "pulled" spinoffs where the parent company continues after they are founded. They find that pulled spinoffs perform better than all other types of startups (see Eriksson and Kuhn 2006 as well as Dahl and Reichstein 2007 for Denmark, and Andersson and Klepper 2013 for Sweden). Making a related but somewhat broader distinction between "opportunity spin-offs" (triggered by the discovery of new opportunities) and "necessity spin-offs" (triggered by various adverse events at the parent company), Buenstorf (2009) finds that in the German laser industry "opportunity spin-offs" tended to have a higher longevity than other firms. Finally, some studies have shown that intra-industry spinoffs are less likely to exit in their first years of existence than other startups (see Eriksson and Kuhn 2006 for Denmark and Andersson and Klepper 2013 for Sweden).

Against this background, our paper contributes to the literature in several ways: By using a representative sample of 50 percent of all establishments in 1976-2008, we are able to chart spinoff performance in West and East Germany more broadly than previously possible, analyzing the entire private sector rather than just selected individual industries. More specifically, our rich data set allows us to investigate three main hypotheses based on the theoretical and empirical literature sketched above:

H1: Spinoffs are more likely to survive than other startups.

H2: Pulled spinoffs have a higher probability of survival than pushed spinoffs.

H3: Intra-industry spinoffs have a higher probability of survival than other spinoffs.

The paper proceeds as follows: In chapter 2, we present our dataset and describe the procedure for identifying spinoffs. Chapter 3 provides some descriptive evidence for West and East Germany and for various economic sectors. Using methods of survival analysis, our three hypotheses are tested econometrically and partially confirmed in chapter 4. Chapter 5 puts our results in an international perspective and concludes.

2. DATA

As the aim of this paper is to provide a broad picture on the survival of spinoffs in Germany during the last decades, we make use of 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 1975-2010 for West Germany and 1991-2010 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 (Gruhl et al. 2012: 9). 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[2], location, number of employees, composition of the workforce and wage structure (for more detailed information, see Spengler 2008, Gruhl et al. 2012). 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, establishments are regarded as entries in that year when they appear in the data for the first time, that is when for the first time they report having employees who are liable to social security.[3] Analogously, establishments are

[2] 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.

[3] Since establishments first appear in the dataset when they report for the first time having employees liable to social security, entry might have occurred earlier than recorded in the data. Similarly, exit could have occurred later.

considered to be exits in the year when they appear in the data for the last time. For establishments that already appear in the data in 1975 resp. 1993 we do not know whether they entered in 1975 resp. 1993 or earlier. Thus, we are able to identify entries for the first time in 1976 resp. in 1994. Exits are considered ultimately in 2008, i.e. at the current edge establishments are regarded as exits only if they do not reappear in the data for the following two years.[4] Hence our period of observation covers the years 1976-2008 for West Germany and 1994-2008 for East Germany. Our sample is further restricted to the private sector, i.e. the public sector and other non-profit sectors are excluded from the analysis. We also exclude the agriculture and the mining sector because entries and exits in these sectors are strongly subject to political influence (e.g., subsidization, EU downsizing plans).

Identifying entries and exits only based on newly appearing or disappearing establishment numbers has an important shortcoming: events like a change 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.[5] To solve this problem and to discriminate between spinoffs and startups without parent firm, we use extension files on establishment histories provided by the Research Data Center that are based on the work by Hethey and Schmieder (2010) who analyzed worker flows between establishment numbers in the underlying personal level data.[6] They use maximum 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. For very small establishments (with 1-3 employees), it would not be very meaningful to calculate the maximum clustered inflow relative to employment and it is therefore not possible to distinguish between different types of entry. Therefore, establishments with less than four initial employees are excluded from our sample.

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[4] This procedure is applied because perforated establishment histories (e.g. if an establishment does not have any employees except the owner for some time) may become a problem at the current edge. One might argue that a similar procedure should be applied to entries at the beginning of the observation period. However, as entries with less than four initial employees are excluded from our sample (as mentioned below) and perforated histories are mainly prevalent for very small establishments (Brixy and Fritsch 2002: 66f.) we do not regard this as crucial.

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

[6] 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 and 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.

Following Benedetto et al. (2007), Hethey and Schmieder (2010) define spinoffs as new establishments in which a large fraction of the initial workforce, i.e. more than 80 percent, was employed together in the same establishment in the year before, but only if this group of workers, which is called the maximum clustered inflow, did not make up more than 80 percent of that establishment's, i.e. the predecessor's, workforce. If the maximum clustered inflow makes up more than 80 percent of a new establishment's and of the predecessor's workforce this is regarded as an "ID change" if the predecessor exits and as "unclear" if the predecessor continues (since a meaningful interpretation is not possible here). These two groups are excluded from our sample since they cannot be regarded as true entries. Based on the worker flow approach by Hethey and Schmieder (2010) it is also possible to distinguish between "pulled" and "pushed" spinoffs. If the predecessor continues, the spinoff is regarded as "pulled", and as "pushed" if the predecessor exits. Note that (unlike Muendler et al. 2012) we are not able to distinguish between employee-led spinoffs and employer-initiated divestitures.[7]

As a control group of startups that were founded without a parent firm we use entries in which the maximum clustered inflow makes up less than 30 percent of the initial workforce. The remaining category with the maximum clustered inflow making up between 30 and 80 percent of a new establishment's initial workforce is excluded from our analysis since this group may contain both spinoffs and startups without a parent firm. We also conducted several robustness checks with varying definitions of spinoffs and control groups (for instance by adding those entrants labeled "chunky" by Hethey and Schmieder 2010 to either one of these groups), which did not change our insights.

Concerning establishment exits, the procedure which is applied to distinguish between true and spurious exits is generally similar to the one applied to entries (see Hethey and Schmieder 2010 for a more detailed description). How these extension files are used in this study to identify true exits is described in greater detail by Fackler et al. (2012).

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[7] Our data also do not distinguish between new firms (i.e. legal units) and newly established branch plants. This, however, should not be a serious problem for our investigation. As 86 percent of all establishments (i.e. local units) in Germany are separate firms comprising only one establishment (Koch and Krenz 2010), one can expect that new establishments are also new firms in most cases. Moreover, the definition of spinoffs used in our study is rather restrictive: more than 80 percent of a new establishment's employees must have been employed together in the same establishment in the year before. In branch plants, by contrast, it can be expected that a larger fraction of the workforce is hired externally. Thus it is very likely that spinoffs are new firms rather than branch plants.

3. DESCRIPTIVE EVIDENCE

We start our empirical investigation with a brief comparison of the three groups of startups that are in the focus of this paper – pushed spinoffs (where the parent company stops operations), pulled spinoffs (where it continues to operate), and other startups. Tables 1 and 2 make clear that these three groups differ in terms of initial establishment size and workforce composition. In West and in East Germany, spinoffs are generally larger and have a higher median age of the workforce than other startups. They also have a larger share of employees in skilled occupations, and the percentage of females in the workforce is somewhat lower in spinoffs than in other startups. Looking at pushed vs. pulled spinoffs, with few exceptions (such as establishment size and the percentage of highly skilled occupations) the differences between these two types of spinoffs are not very substantial but still statistically highly significant.

(Tables 1 and 2 about here)

The three groups of startups also differ in their survival rates. Figures 1 (for West Germany) and 2 (for East Germany) present Kaplan-Meier survival estimates for the three types of startups.[8] They clearly show that in West and East Germany spinoffs have substantially higher probabilities of survival than other startups, which is in accordance with our hypothesis 1. This holds for the entire private sector (see Figures 1a and 2a) as well as for the sectors of manufacturing, construction and services separately (see Figures 1b-d and 2b-d). The difference between spinoffs and other startups is particularly pronounced in construction. Looking at average rates across all industries, we find that in West (East) Germany about 74 (67) percent of pulled spinoffs and 69 (59) percent of pushed spinoffs survive the first five years, but this is the case for only 56 (47) percent of other startups. Interestingly, survival probabilities of spinoffs and other startups do not converge much over time. The difference of the survivor curves of spinoffs and other startups is confirmed by two statistical tests. Both a log-rank and a Wilcoxon test (see Kalbfleisch and Prentice 2002: 20-23) show that the survivor functions for both pulled and pushed spinoffs always differ significantly from those of other startups.

(Figures 1 and 2 about here)

Taking a closer look at the two types of spinoffs we see that the survivor curves of pulled spinoffs always lie above those of pushed spinoffs, as suggested by hypothesis 2. This is the case in the entire private sector as well as in

[8] The Kaplan-Meier estimator is a non-parametric method that takes account of censoring and provides a graphical representation of the probability of survival at a certain point in time; for a detailed description, see Kalbfleisch and Prentice (2002: 14-19).

manufacturing, construction and services in West and East Germany. The differences between the curves are always statistically significant on the five percent level and in most cases also on the one percent level.

In order to see whether there are also differences between intra-industry and other spinoffs, Figures 3 and 4 present Kaplan-Meier survival estimates for intra- versus inter-industry spinoffs separately for pulled and pushed spinoffs.[9] Following the literature (see, e.g., Andersson and Klepper 2013) intra-industry spinoffs are defined as those startups which operate in the same two-digit industry as their parent company. In our data set, about 59 (55) percent of pulled spinoffs in West (East) Germany are intra-industry spinoffs whereas this is the case for about 81 (75) percent of pushed spinoffs. For West Germany, Figure 3a shows for pulled spinoffs that it does not make a difference in terms of survival rates whether these startups are founded in the same industry as their parents or not. For pushed spinoffs, by contrast, Figure 3b indicates that intra-industry spinoffs have slightly higher survival rates than inter-industry spinoffs (which is mainly driven by the service sector). However, this result for pushed spinoffs does not show up in East Germany (Figure 4b). Here, we only find a difference for pulled spinoffs, with an unexpected higher survival rate in the long run for inter-industry spinoffs (Figure 4a). Taken together, these descriptive results do not provide much support for our hypothesis 3.

(Figures 3 and 4 about here)

4. SURVIVAL ANALYSIS

The observed differences in survival rates between the various types of startups may reflect that these groups differ in terms of initial establishment size and workforce composition, as shown above. As we want to find out whether spinoffs as such survive longer than other startups, we need to control for those factors which potentially influence establishment exits and which may differ between the various categories of entrants. Our choice of controls reflects previous insights on the determinants of establishment exit and growth in Germany (see Fackler et al. 2012, Koch et al. 2012) and is also partly determined by the variables available in our data set. As control variables, we are able to include establishment size (4 dummy variables, to take account of potential non-linearities), the structure of the initial workforce (percentages of low qualified employees, of skilled occupations, of highly

[9] Note that the size of our sample is reduced by about 50 percent for this research question compared to number of spinoffs reported in Tables 1 and 2. The reason is that we just have access to a 50 percent random sample of the BHP which means that we only find about 50 percent of the spinoffs' parents.

skilled occupations,[10] and of females) as well as the median age of the workforce. We also include two-digit industry fixed effects, regional fixed effects (30 administrative districts in West Germany and 9 in East Germany), and year fixed effects (to account for business cycle fluctuations and other time-dependent factors). Unfortunately we do not have any information on the characteristics and biographies of the founders of startups in our establishment data set. The explanatory variables that are of main interest in our investigation of hypotheses 1 and 2 are two dummy variables that take the value of one if the entrant firm is a pushed or pulled spinoff, respectively, with other startups being the reference category.

We estimate the probability of establishment exit using piecewise constant exponential models (see Cameron and Trivedi 2005: 591, Jenkins 2005: 38-40). The piecewise constant exponential model (PCE) is a proportional hazards model in which the baseline hazard (i.e. the hazard function when all other covariates are zero) is specified as a step function. The hazard of establishment exit is thus allowed to change between time intervals but is constrained to be constant within these intervals. For this purpose dummy variables for time intervals are included in the regression. Similar to Eriksson and Kuhn (2006) and Andersson and Klepper (2013) we define time (i.e. age) intervals for the 1st year and for 2-3, 4-6, 7-10 and 11+ years. We also include interaction terms between the time interval dummies and the two dummy variables for pulled and pushed spinoffs in our model to see whether the baseline hazard differs according to the type of entry.

The assumption of the PCE that the baseline hazard is constant within defined time intervals makes it more restrictive compared to the semi-parametric Cox proportional hazards model which does not make any assumption about the shape of the baseline hazard (see, e.g., Cameron and Trivedi 2005: 592-597). However, it facilitates the computation of the baseline hazard and thus enables us to investigate whether the exit rate is age-dependent and whether the exit hazards of the various types of entrants develop differently over time. As a robustness check we compared the estimates from the PCE with those from a Cox model and found that the more restrictive specification of the baseline hazard in the PCE does not affect our results and is therefore unproblematic.

[10] Low qualified employees are those who do not have an upper secondary school leaving certificate as their highest school qualification or do not have a vocational qualification. Skilled and highly skilled occupations are defined according to the occupational classification by Blossfeld (1987). Skilled occupations include skilled manual occupations, skilled services, skilled commercial and administrative occupations and technicians; highly skilled occupations include semiprofessions, engineers, professions and managers.

The results of our estimations for West and East Germany are presented in Tables 3 and 4, respectively. They indicate that establishment exit is indeed age-dependent. It can be also seen that our control variables are highly significant and show the expected correlations in most cases. The hazard rates fall with the size of a startup, with its percentages of skilled and highly skilled occupations, and with its share of female workers. In contrast, establishment exit is more likely the higher the median age of the initial workforce.

(Tables 3 and 4 about here)

Concerning our main variables of interest, we find that in general both pulled and pushed spinoffs have lower exit hazards than the reference category of other startups. Put differently, they survive on average longer than other entrants, which confirms hypothesis 1.

A graphical representation of the baseline hazard estimates for different types of entry in West and East Germany is given in Figures 5 and 6, respectively. It can be seen that in West Germany both types of spinoffs have lower exit hazards than other entrants. This difference is most pronounced in the first six years but even though it is getting smaller over time, it remains statistically significant over all age brackets. For East Germany, the picture is broadly similar in the first years, but after 10 years the visible difference in exit hazards between spinoffs and other entrants is not statistically significant anymore. By and large, similar developments are found for the manufacturing, construction and services sectors in both West and East Germany (see Tables 3 and 4; graphs for the sector estimates are available from the authors on request).

(Figures 5 and 6 about here)

Comparing the two types of spinoffs, we see from Figures 5 and 6 that the exit hazards of pulled spinoffs tend to be lower than those of pushed spinoffs. Looking at West Germany, the estimates in Table 3 indicate that in the first year pulled spinoffs have a 57 percent lower risk of failure than other startups, whereas for pushed spinoffs this risk is just lowered by 29 percent. In East Germany, the respective figures are 56 percent for pulled and 35 percent for pushed spinoffs (see Table 4). In both West and East Germany, the difference between pulled and pushed spinoffs is highly significant in the first three years but becomes statistically insignificant thereafter. Nevertheless we may interpret this empirical evidence as confirming our hypothesis 2 that pulled spinoffs have a higher probability of survival than pushed spinoffs. This also holds for the manufacturing, construction and services sectors in both West and East Germany.

Since pulled and pushed spinoffs have different hazard rates, we run separate regressions for both types of spinoffs when investigating hypothesis 3 (that intra-industry spinoffs have a higher probability of survival than other spinoffs). Here our main variable of interest is a dummy that takes the value of one if a spinoff is founded in the two-digit industry where its parent company operates (and zero otherwise). We again estimate the probability of establishment exit using piecewise constant exponential models and include interaction terms between the time interval dummies and the intra-industry dummy.

(Tables 5 and 6 about here)

The results of our estimations for West and East Germany are presented in Tables 5 and 6 and the corresponding baseline hazard estimates in Figures 7 and 8, respectively. For West Germany, they show that – in contrast to expectations – both pulled and pushed spinoffs are more likely to survive in the first year if they are founded in an industry that differs from that of their parent company. This effect, which is mainly driven by manufacturing, quickly evaporates and is no longer statistically significant at the 5 percent level from the second year onwards. The results for East Germany do not indicate substantial differences in the hazard rates between intra- and inter-industry spinoffs for both pulled and pushed spinoffs. Only for pulled spinoffs the hazard rate is significantly higher for intra-industry spinoffs from the 11th year on, which is again in contrast to our expectations. Altogether, the results of the multivariate analysis do not provide any evidence in favor of hypothesis 3.

(Figures 7 and 8 about here)

Note that our main insights still hold when we perform several robustness tests. First, we varied our definition of spinoffs and experimented with alternative classifications by including entries labeled “chunky” by Hethey and Schmieder (2010). This category was excluded from our analysis as it may contain both spinoffs and startups without a parent firm. Treating these “chunky” entries either as spinoffs or as other entrants does not change our results. Second, we ran a robustness test restricting our sample to establishments with maximum 20 initial employees. Although we do not regard it as a serious problem that we are not able to distinguish between new firms and branch plant formations (see the discussion in chapter 2), removing implausibly large entrants additionally reduces the probability of observing formations of branch plants rather than new firms (see Fritsch and Brixy 2004). Finally, to make the results for West and East Germany more comparable we ran our estimations for West Germany also just for the years 1994-2008, which indicated that our results for West Germany are not influenced by the

longer period of observation. The results of these robustness tests are available on request.

5. CONCLUSIONS

Using a representative sample of 50 percent of all establishments in the private sector, this paper analyzed spinoff survival in West Germany (1976-2008) and East Germany (1994-2008). We showed that spinoffs are larger and initially employ more skilled and more experienced workers than other startups. Even after controlling for these and other differences, we found that spinoffs are less likely to exit than other startups. This holds in West and East Germany and across various sectors, confirming recent results for the universe of firms in Denmark (Eriksson and Kuhn 2006, Gjerløv-Juel and Dahl 2012), Brazil (Muendler et al. 2012) and Sweden (Andersson and Klepper 2013). It is also in accordance with the insights of previous studies for selected industries in Germany that found a significant impact of pre-entry experience on the survival of entrants (see, e.g., Cantner et al. 2006, Buenstorf 2007). This superior performance of spinoffs is thus about to become a stylized fact in the industrial dynamics literature.

We were also able to distinguish between pushed spinoffs (where the parent company stops operations) and pulled spinoffs (where the parent company continues after they are founded). We showed that both in West and East Germany and in all sectors investigated pulled spinoffs generally have the lowest exit hazards, followed by pushed spinoffs. The difference between both types of spinoffs is particularly pronounced in the first three years but becomes statistically insignificant thereafter. This has not been investigated and found before for the universe of firms in Germany.[11] Placing our results in the sparse international literature, our estimates are somewhere in the middle between those of Andersson and Klepper (2013) for Sweden (who find that the lower hazard of pulled spinoffs shows up at all ages) and those of Eriksson and Kuhn (2006) for Denmark (who report that pushed spinoffs do not have a lower exit risk than the reference group of non-spinoffs).

Finally, intra-industry spinoffs are not found to have lower exit hazards in our sample. This finding differs somewhat from the results by Eriksson and Kuhn (2006) for Denmark and by Andersson and Klepper (2013) for Sweden which indicate a

[11] Note that using a slightly different distinction, Buenstorf (2009) found that in the German laser industry “opportunity spinoffs“ performed best (although not statistically significantly different from “necessity spinoffs“).

lower hazard of intra-industry spinoffs in the first three years that vanishes thereafter.

Even if intra-industry spinoffs do not have an extra advantage, our results are consistent with the view that spinoffs are able to transfer know-how and competencies from their parent companies and that they benefit from network ties and customer links built up at their previous employment. This enables spinoffs to outperform other startups that do not have such knowledge. The fact that pulled spinoffs perform best may reflect that they are founded by employees with the best and most innovative ideas. Although pushed spinoffs are probably more often founded by employees trying to avoid unemployment (which cannot be tested with our data), it is remarkable that they still perform not worse than other startups. While all types of startups are important for economic development, the two types of spinoffs may play specific roles. Whether pulled spinoffs are indeed more innovative and therefore particularly important for the evolution of new industries whereas pushed spinoffs are a good way to cope with economic distress of existing firms is an interesting question that needs to be investigated in more detail.

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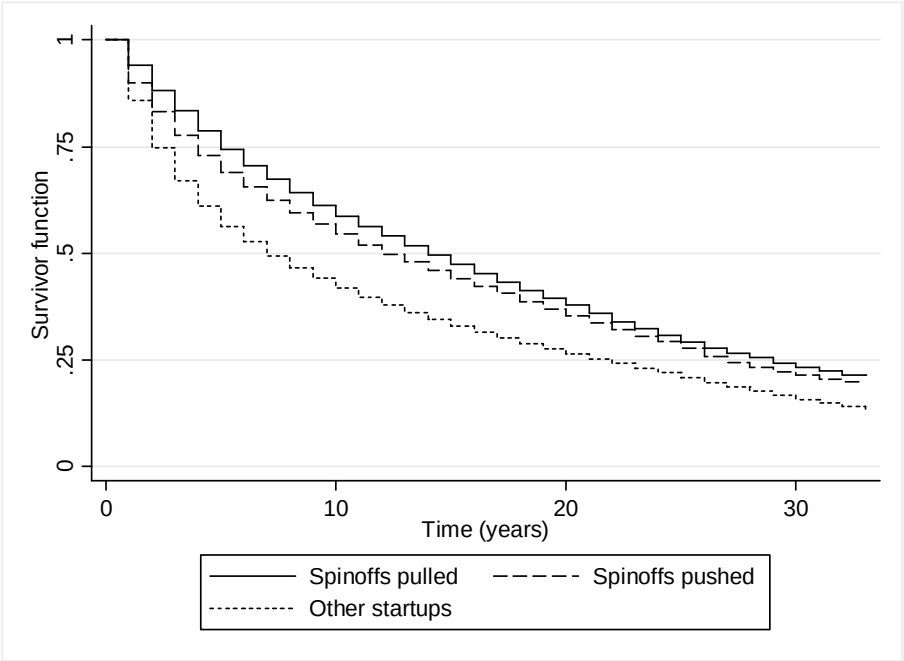
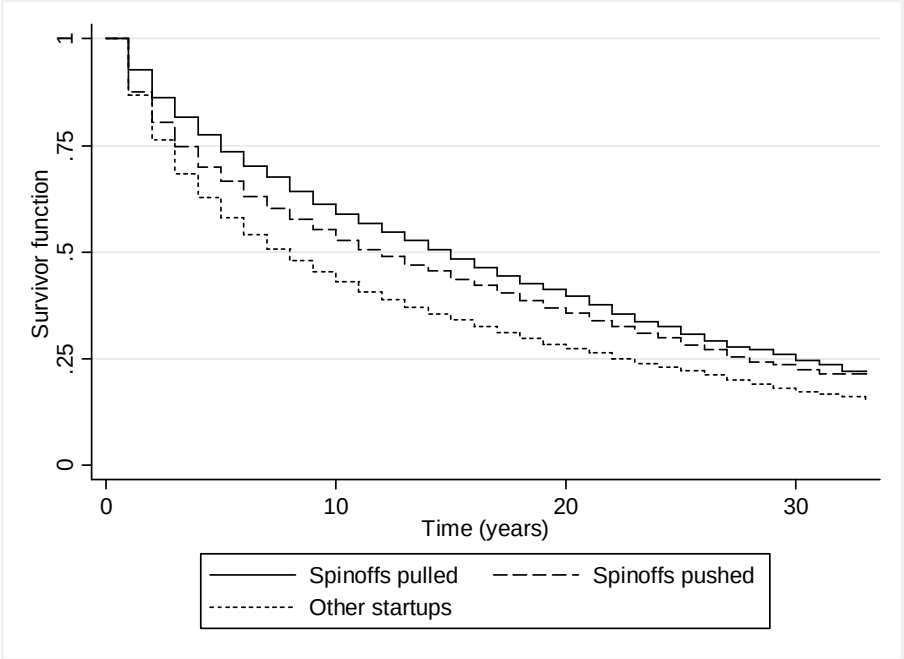
Figure 1a: Kaplan-Meier survival estimates for different types of entry, West Germany 1976-2008, all industries



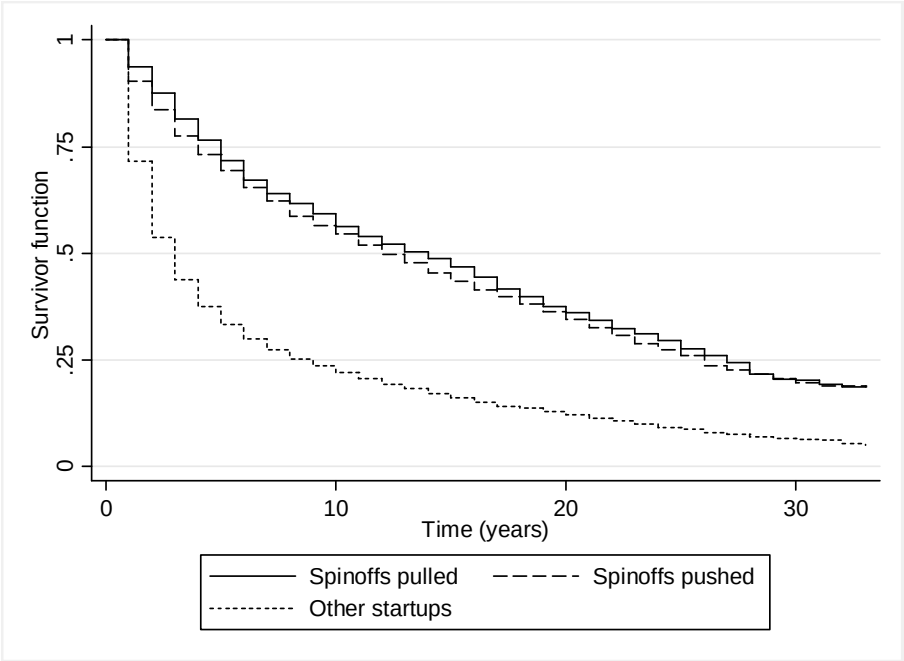
Notes: establishments with at least 4 initial employees, private sector without agriculture and mining.

Figure 1b: Kaplan-Meier survival estimates for different types of entry, West Germany 1976-2008, manufacturing



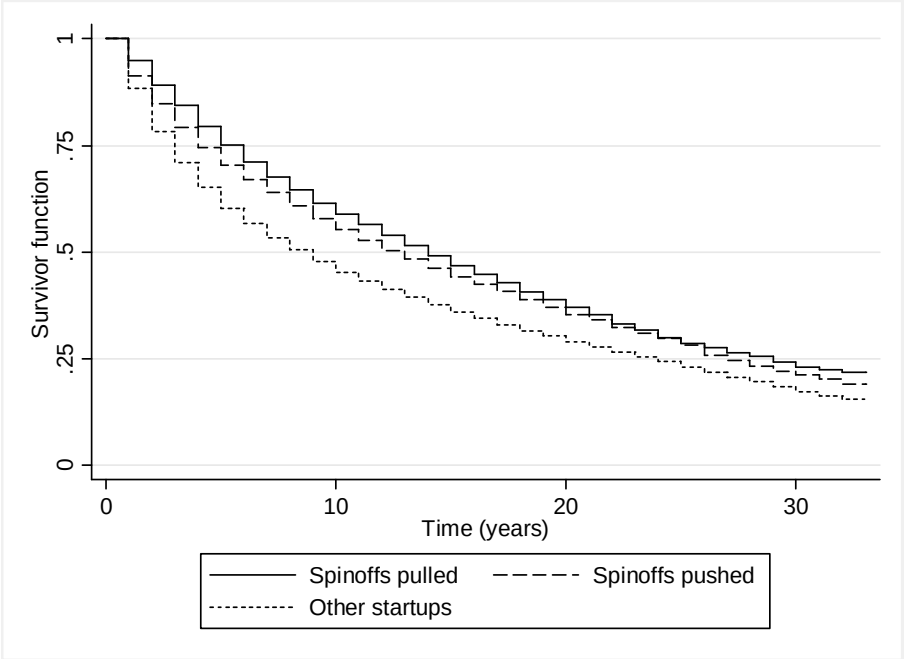
Notes: establishments with at least 4 initial employees, private sector.

Figure 1c: Kaplan-Meier survival estimates for different types of entry, West Germany 1976-2008, construction



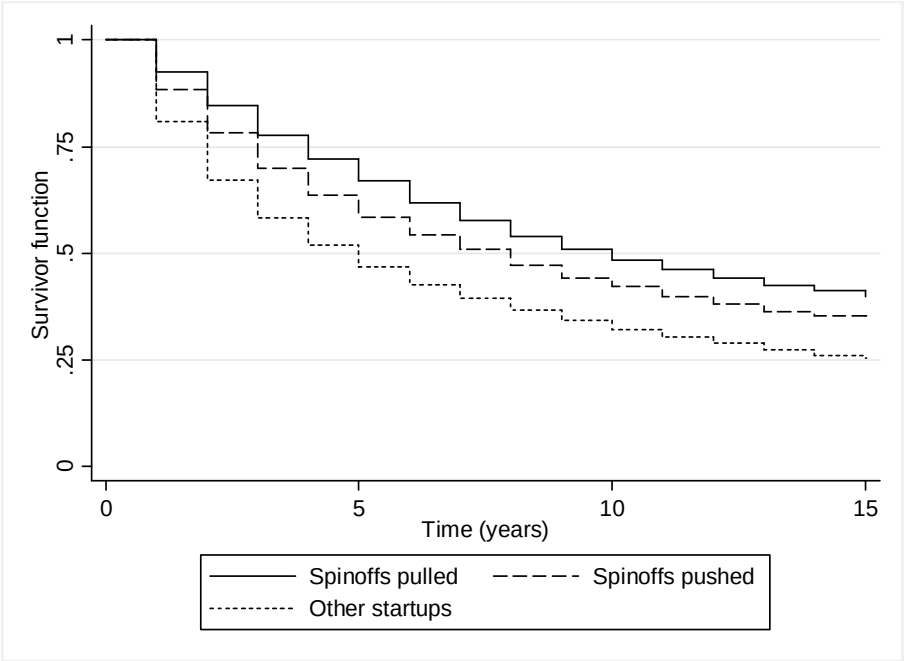
Notes: establishments with at least 4 initial employees, private sector.

Figure 1d: Kaplan-Meier survival estimates for different types of entry, West Germany 1976-2008, services



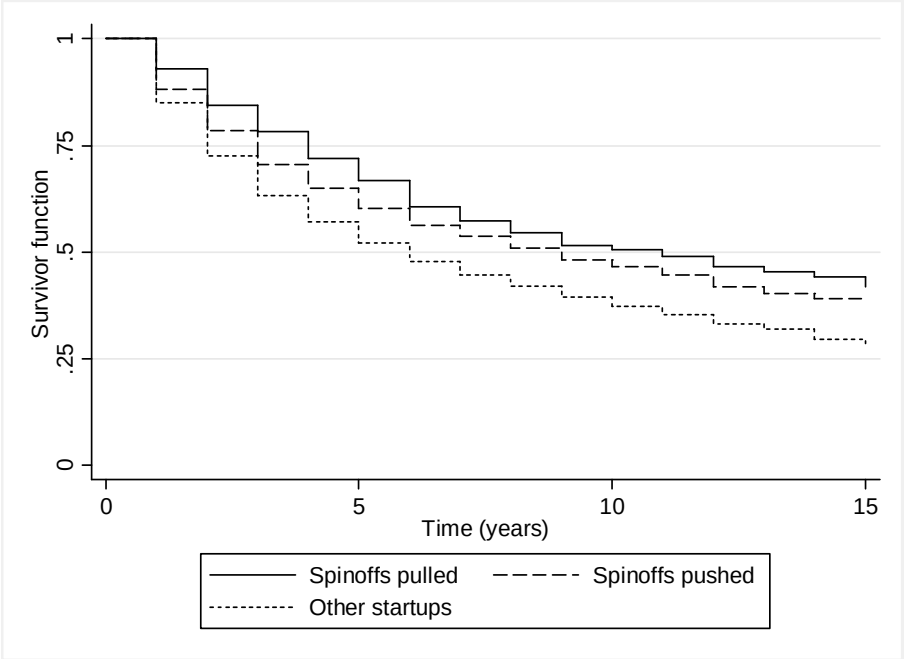
Notes: establishments with at least 4 initial employees, private sector.

Figure 2a: Kaplan-Meier survival estimates for different types of entry, East Germany 1994-2008, all industries



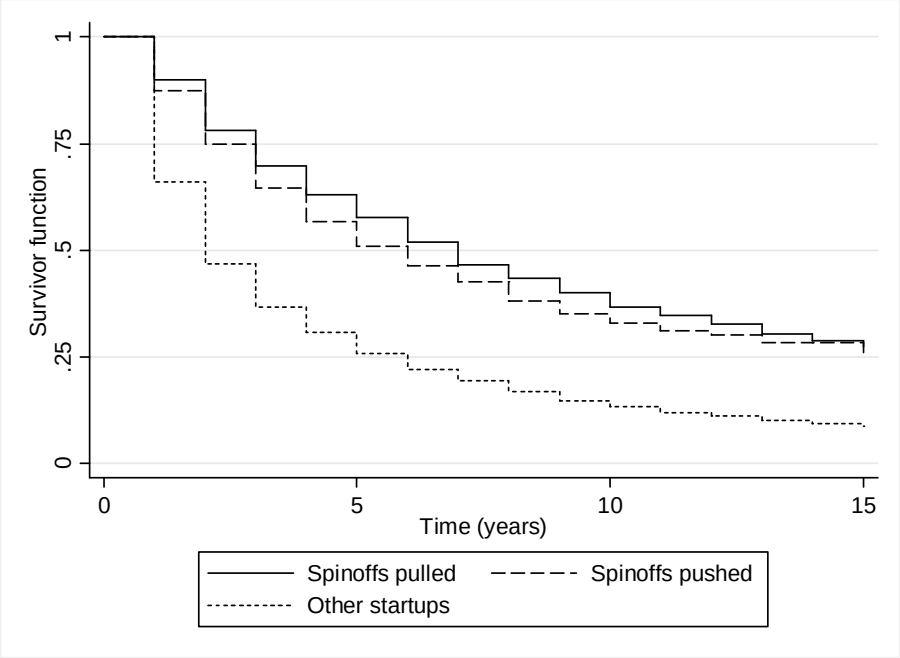
Notes: establishments with at least 4 initial employees, private sector without agriculture and mining.

Figure 2b: Kaplan-Meier survival estimates for different types of entry, East Germany 1994-2008, manufacturing



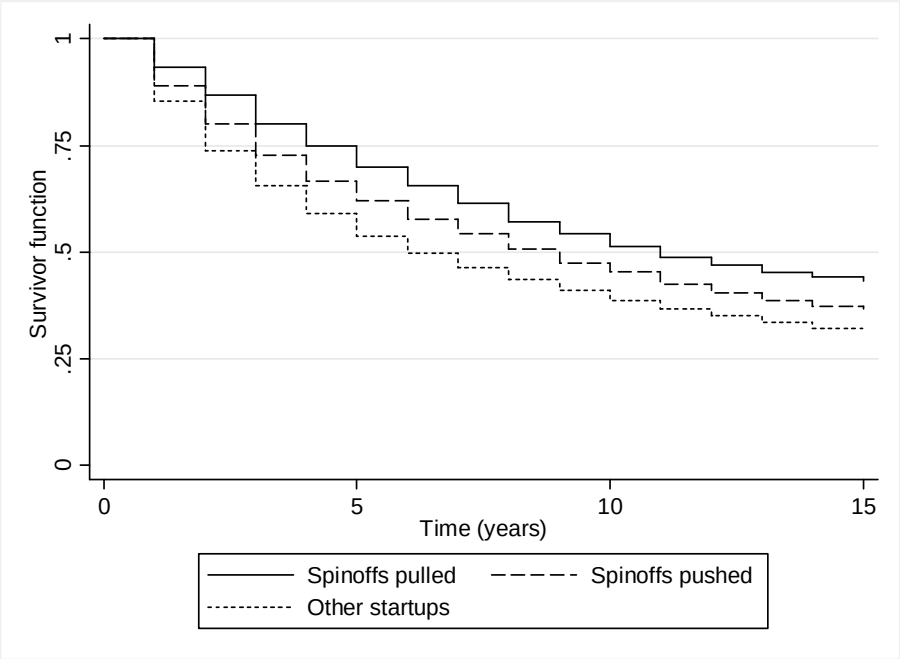
Notes: establishments with at least 4 initial employees, private sector.

Figure 2c: Kaplan-Meier survival estimates for different types of entry, East Germany 1994-2008, construction



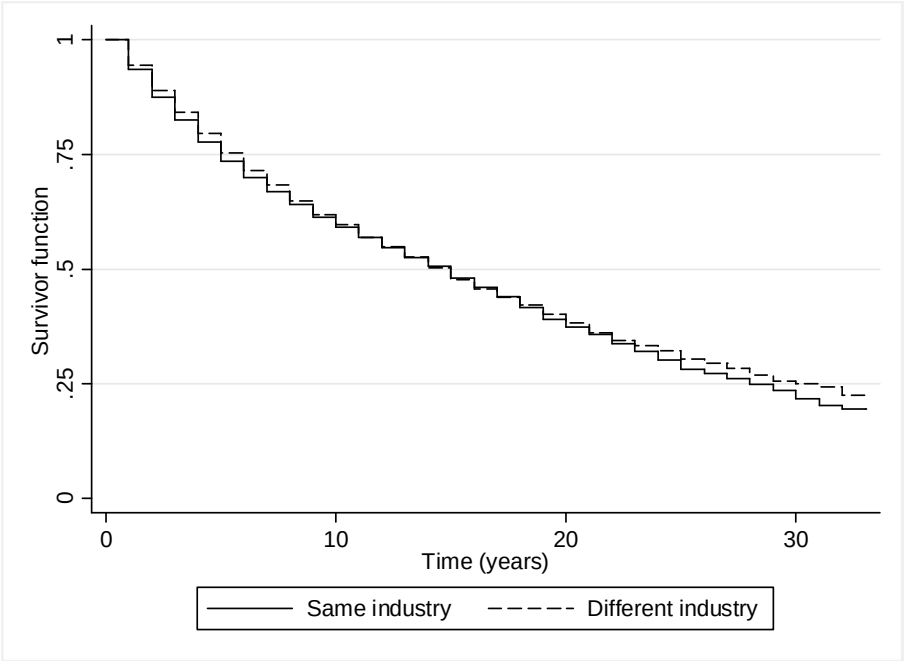
Notes: establishments with at least 4 initial employees, private sector.

Figure 2d: Kaplan-Meier survival estimates for different types of entry, East Germany 1994-2008, services



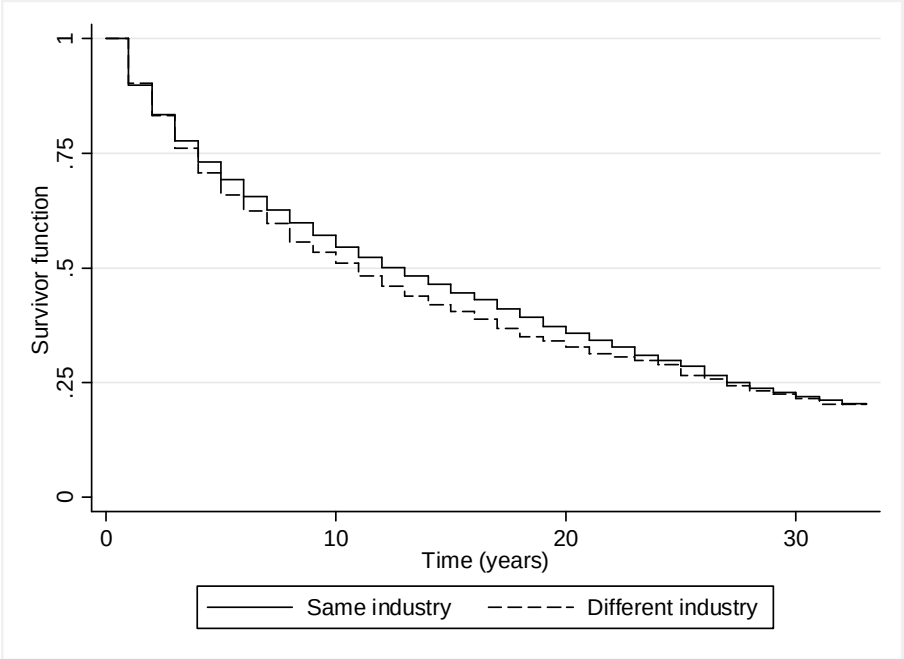
Notes: establishments with at least 4 initial employees, private sector.

Figure 3a: Kaplan-Meier survival estimates for pulled spinoffs by industry affiliation compared to parent, West Germany 1976-2008, all industries



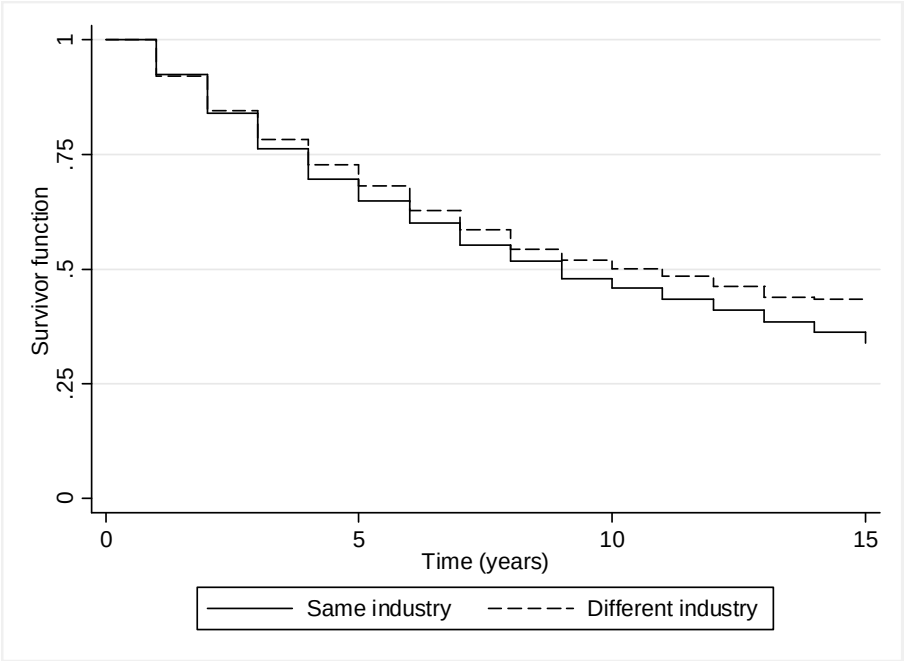
Notes: establishments with at least 4 initial employees, private sector without agriculture and mining.

Figure 3b: Kaplan-Meier survival estimates for pushed spinoffs by industry affiliation compared to parent, West Germany 1976-2008, all industries



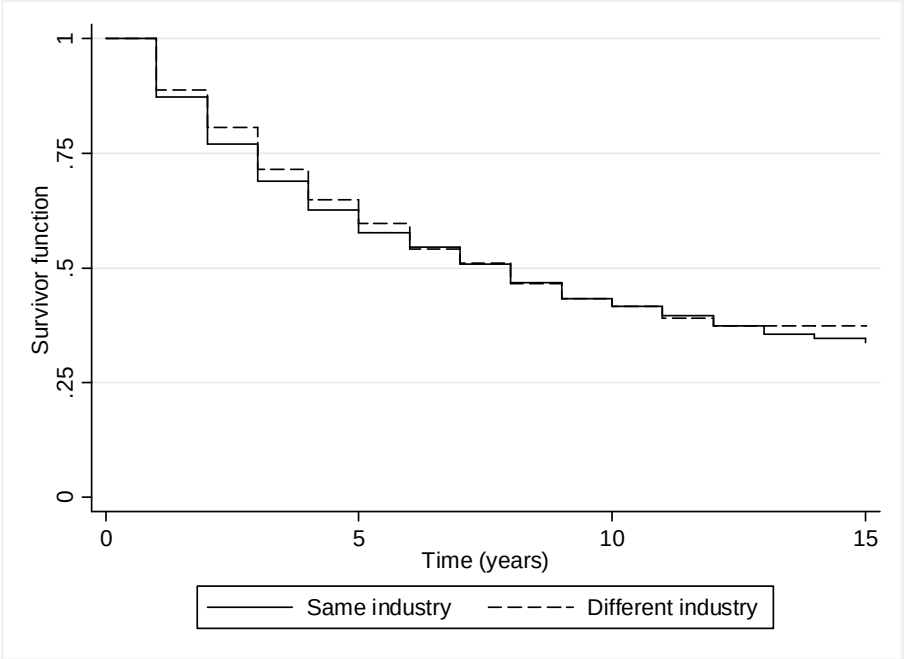
Notes: establishments with at least 4 initial employees, private sector without agriculture and mining.

Figure 4a: Kaplan-Meier survival estimates for pulled spinoffs by industry affiliation compared to parent, East Germany 1994-2008, all industries



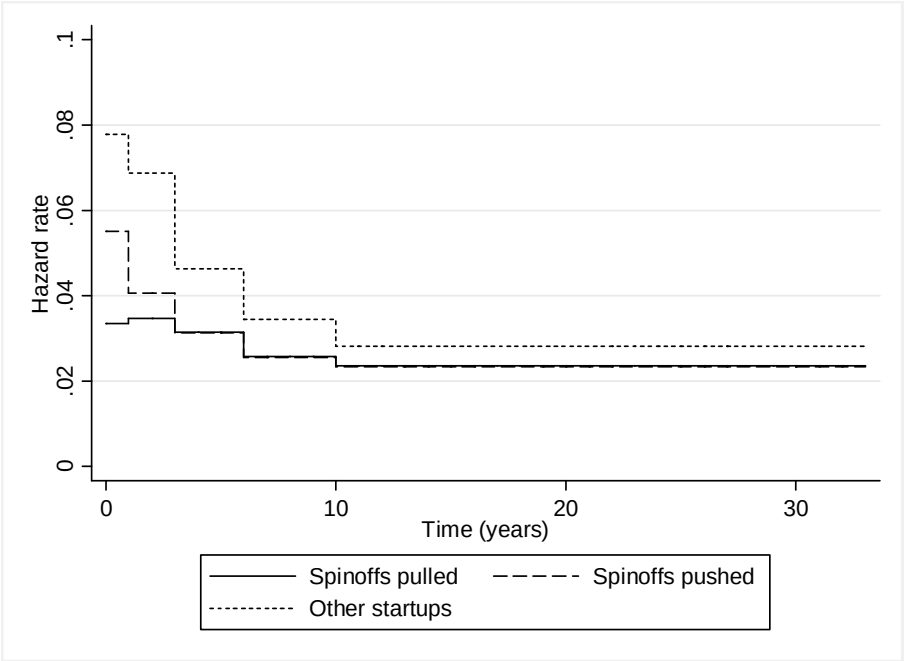
Notes: establishments with at least 4 initial employees, private sector without agriculture and mining.

Figure 4b: Kaplan-Meier survival estimates for pushed spinoffs by industry affiliation compared to parent, East Germany 1994-2008, all industries



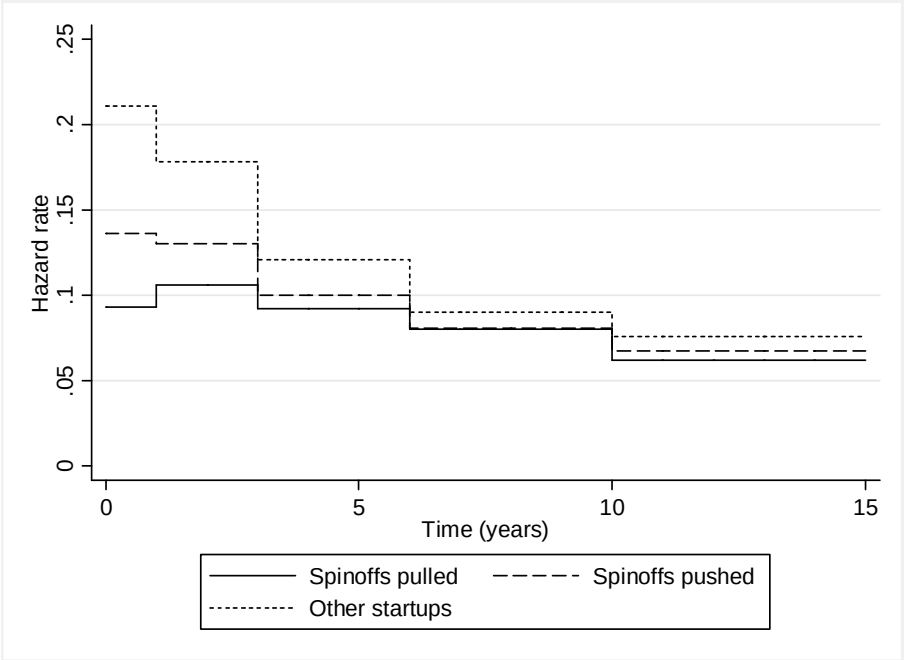
Notes: establishments with at least 4 initial employees, private sector without agriculture and mining.

Figure 5: Baseline hazard estimates for different types of entry, West Germany 1976-2008, all industries



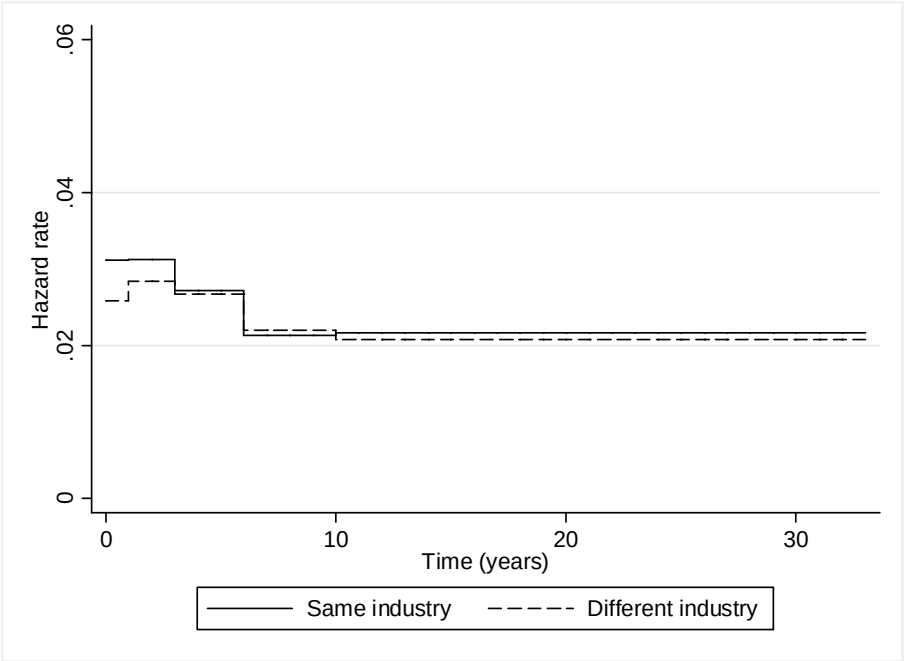
Notes: establishments with at least 4 initial employees, private sector, piecewise constant exponential model, see Table 3 for the corresponding regression results.

Figure 6: Baseline hazard estimates for different types of entry, East Germany 1994-2008, all industries



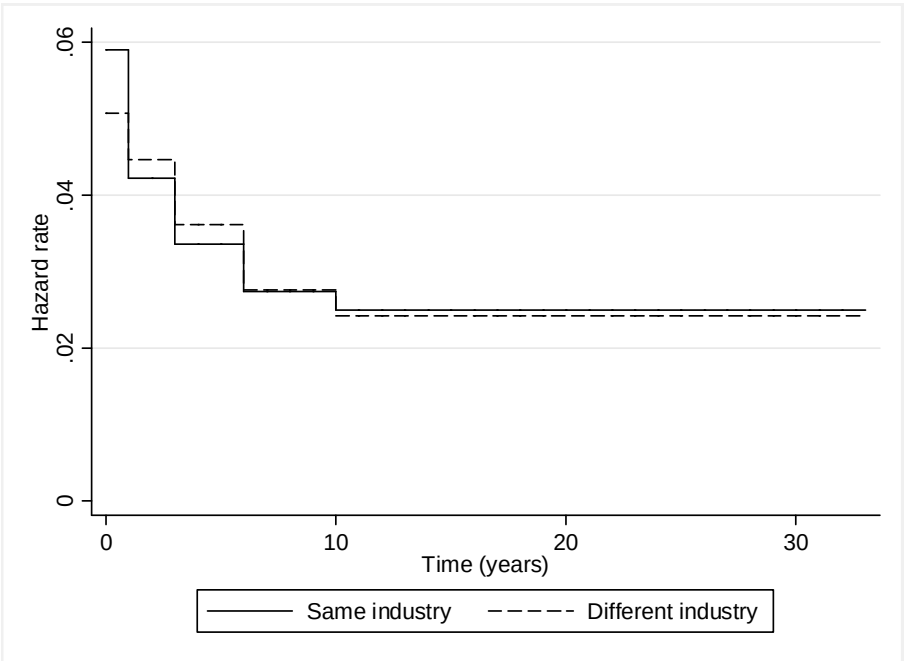
Notes: establishments with at least 4 initial employees, private sector, piecewise constant exponential model, see Table 4 for the corresponding regression results.

Figure 7a: Baseline hazard estimates for pulled spinoffs by industry affiliation compared to parent, West Germany 1976-2008, all industries



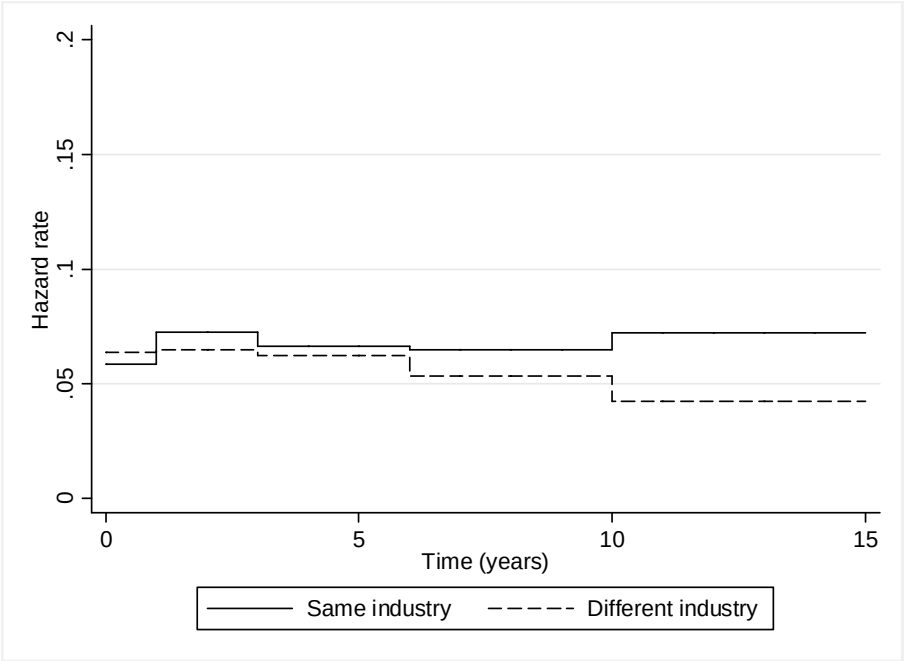
Notes: establishments with at least 4 initial employees, private sector, piecewise constant exponential model, see Table 5a for the corresponding regression results.

Figure 7b: Baseline hazard estimates for pushed spinoffs by industry affiliation compared to parent, West Germany 1976-2008, all industries



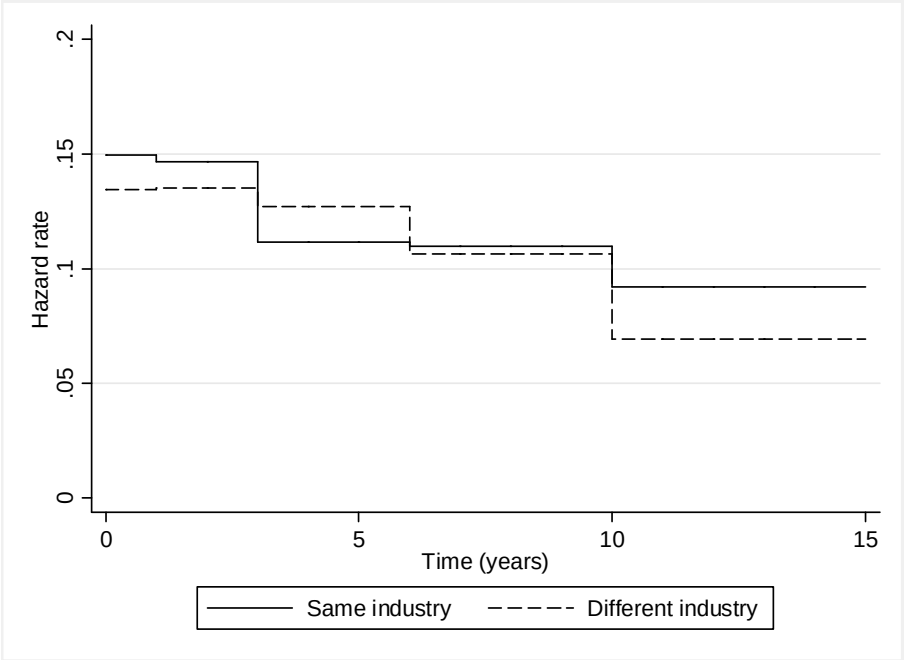
Notes: establishments with at least 4 initial employees, private sector, piecewise constant exponential model, see Table 5b for the corresponding regression results.

Figure 8a: Baseline hazard estimates for pulled spinoffs by industry affiliation compared to parent, East Germany 1994-2008, all industries



Notes: establishments with at least 4 initial employees, private sector, piecewise constant exponential model, see Table 6a for the corresponding regression results.

Figure 8b: Baseline hazard estimates for pushed spinoffs by industry affiliation compared to parent, East Germany 1994-2008, all industries



Notes: establishments with at least 4 initial employees, private sector, piecewise constant exponential model, see Table 6b for the corresponding regression results.

Table 1: Initial establishment size and workforce composition by type of entry, West Germany 1976-2008

	Spinoffs pulled	**Spinoffs pushed**	**Other startups**
No. of employees	31.89	17.64	11.18
	(115.04)	(37.81)	(23.18)
Percentage of low qualified employees	15.36	17.69	17.47
	(22.15)	(21.97)	(26.91)
Percentage of skilled occupations	51.43	54.52	43.00
	(34.79)	(35.32)	(36.66)
Percentage of highly skilled occupations	10.10	6.36	6.84
	(19.65)	(15.05)	(17.15)
Percentage of females	36.42	42.55	45.12
	(33.32)	(35.77)	(35.80)
Median age of the workforce (in years)	38.26	37.34	31.13
	(7.62)	(8.27)	(6.96)
No. of establishments	24,491	23,271	110,674

Notes: establishments with at least 4 initial employees, private sector without agriculture and mining, standard deviations in brackets.

Table 2: Initial establishment size and workforce composition by type of entry, East Germany 1994-2008

	Spinoffs pulled	**Spinoffs pushed**	**Other startups**
No. of employees	20.82 (64.72)	16.71 (53.52)	12.20 (23.56)
Percentage of low qualified employees	6.13 (13.96)	7.93 (14.41)	6.78 (17.24)
Percentage of skilled occupations	47.97 (36.54)	51.01 (36.17)	41.01 (35.68)
Percentage of highly skilled occupations	12.39 (22.48)	7.93 (16.47)	7.48 (17.85)
Percentage of females	38.27 (35.75)	36.38 (34.39)	39.25 (35.50)
Median age of the workforce (in years)	39.91 (6.82)	38.63 (7.06)	33.81 (7.04)
No. of establishments	6,123	6,198	25,787

Notes: establishments with at least 4 initial employees, private sector without agriculture and mining, standard deviations in brackets.

Table 3: Determinants of establishment exit, West Germany 1976-2008, piecewise constant exponential model, coefficient estimates

	All industries	**Manufacturing**	**Construction**	**Services**
Spinoff pulled (dummy)	-0.8407 (-31.36)***	-0.6977 (-14.33)***	-1.5389 (-18.86)***	-0.7491 (-20.59)***
Spinoff pushed (dummy)	-0.3461 (-16.34)***	-0.2229 (-5.72)***	-1.0909 (-21.52)***	-0.1900 (-6.14)***
1st year (reference)	---	---	---	---
2-3 years (dummy)	-0.1252 (-12.65)***	-0.1285 (-4.42)***	-0.2002 (-10.56)***	-0.0730 (-5.80)***
4-6 years (dummy)	-0.5196 (-46.91)***	-0.5325 (-16.80)***	-0.7974 (-31.47)***	-0.4096 (-29.94)***
7-10 years (dummy)	-0.8146 (-64.15)***	-0.8298 (-23.50)***	-1.2760 (-37.65)***	-0.6778 (-44.23)***
11+ years (dummy)	-1.0182 (-84.33)***	-1.0747 (-32.37)***	-1.5280 (-49.05)***	-0.8636 (-58.73)***
Spinoff pulled 2-3 years (dummy)	0.1573 (4.69)***	0.0018 (0.03)	0.2902 (2.87)***	0.1886 (4.21)***
Spinoff pulled 4-6 years (dummy)	0.4536 (13.46)***	0.1698 (2.63)***	0.7788 (7.63)***	0.4921 (11.09)***
Spinoff pulled 7-10 years (dummy)	0.5511 (15.24)***	0.3320 (4.85)***	0.9109 (8.04)***	0.5616 (11.82)***
Spinoff pulled 11+ years (dummy)	0.6678 (19.91)***	0.4884 (7.81)***	1.1325 (11.28)***	0.6692 (14.99)***
Spinoff pushed 2-3 years (dummy)	-0.1783 (-6.23)***	-0.3072 (-5.73)***	-0.0561 (-0.82)	-0.1372 (-3.34)***
Spinoff pushed 4-6 years (dummy)	-0.0472 (-1.56)	-0.2255 (-3.91)***	0.2839 (3.92)***	-0.0207 (-0.48)
Spinoff pushed 7-10 years (dummy)	0.0469 (1.41)	-0.1465 (-2.29)**	0.5438 (6.69)***	0.0696 (1.49)
Spinoff pushed 11+ years (dummy)	0.1624 (5.31)***	-0.0188 (-0.33)	0.7826 (10.97)***	0.1783 (4.07)***
4-5 employees (reference)	---	---	---	---
6-9 employees (dummy)	-0.0320 (-4.08)***	0.0167 (0.84)	0.0902 (5.11)***	-0.0752 (-7.78)***
10-19 employees (dummy)	-0.0807 (-8.81)***	0.0188 (0.85)	0.1664 (8.03)***	-0.1639 (-14.30)***
20-49 employees (dummy)	-0.2437 (-19.78)***	-0.0443 (-1.58)	0.1746 (6.10)***	-0.3896 (-24.94)***
50 and more employees (dummy)	-0.4177 (-21.42)***	-0.1757 (-5.06)***	0.0543 (1.10)	-0.6381 (-23.52)***

Percentage of low qualified employees	0.0006 (5.13)***	0.0018 (5.82)***	0.0009 (3.80)***	0.0001 (0.39)
Percentage of skilled occupations	-0.0020 (-18.78)***	-0.0020 (-7.31)***	-0.0013 (-6.34)***	-0.0020 (-13.71)***
Percentage of highly skilled occupations	-0.0037 (-15.07)***	-0.0027 (-3.86)***	-0.0020 (-2.30)**	-0.0040 (-14.31)***
Percentage of females	-0.0038 (-30.69)***	-0.0022 (-5.97)***	-0.0054 (-7.62)***	-0.0041 (-29.39)***
Median age of the workforce (in years)	0.0106 (22.38)***	0.0183 (16.27)***	0.0093 (8.29)***	0.0073 (12.36)***
2-digit industry fixed effects	Included	Included	Included	Included
Regional fixed effects (administrative districts)	Included	Included	Included	Included
Year fixed effects	Included	Included	Included	Included
Intercept	-2.5524 (-30.57)***	-2.9790 (-22.23)***	-1.8225 (–19.65)***	-2.2441 (-32.41)***
No. of observations	1,261,408	244,754	136,831	879,823

Notes: establishments with at least 4 initial employees, size and workforce composition refer to the initial workforce; private sector without agriculture and mining; t-values in brackets, standard errors adjusted for clustering at establishment level, ***/**/* indicates statistical significance at the 1/5/10% level.

Table 4: Determinants of establishment exit, East Germany 1994-2008, piecewise constant exponential model, coefficient estimates

	All industries	**Manufacturing**	**Construction**	**Services**
Spinoff pulled (dummy)	-0.8179 (-17.27)***	-0.7087 (-6.53)***	-1.1861 (-12.89)***	-0.6233 (-9.56)***
Spinoff pushed (dummy)	-0.4378 (-11.52)***	-0.2124 (-2.59)***	-0.9489 (-13.69)***	-0.1362 (-2.40)**
1st year (reference)	---	---	---	---
2-3 years (dummy)	-0.1696 (-9.30)***	-0.0481 (-0.81)	-0.2556 (-9.05)***	-0.1106 (-4.25)***
4-6 years (dummy)	-0.5574 (-25.50)***	-0.4607 (-6.68)***	-0.7618 (-19.64)***	-0.4436 (-15.03)***
7-10 years (dummy)	-0.8489 (-29.85)***	-0.7781 (-8.89)***	-0.9650 (-17.81)***	-0.7727 (-20.84)***
11+ years (dummy)	-1.0220 (-22.31)***	-0.7735 (-6.20)***	-1.1734 (-11.78)***	-0.9770 (-17.02)***
Spinoff pulled 2-3 years (dummy)	0.2998 (5.13)***	0.2137 (1.60)	0.4407 (3.88)***	0.2061 (2.56)**
Spinoff pulled 4-6 years (dummy)	0.5478 (9.05)***	0.6173 (4.55)***	0.6899 (5.68)***	0.3894 (4.69)***
Spinoff pulled 7-10 years (dummy)	0.7000 (10.23)***	0.3799 (2.29)**	0.8567 (6.27)***	0.6813 (7.49)***
Spinoff pulled 11+ years (dummy)	0.6156 (6.10)***	0.3365 (1.53)	0.8722 (3.97)***	0.5409 (4.02)***
Spinoff pushed 2-3 years (dummy)	0.1251 (2.56)***	-0.0444 (-0.42)	0.3717 (4.27)***	-0.0107 (-0.14)
Spinoff pushed 4-6 years (dummy)	0.2479 (4.60)***	0.0389 (0.33)	0.6410 (6.59)***	0.0654 (0.81)
Spinoff pushed 7-10 years (dummy)	0.3290 (4.94)***	0.0163 (0.11)	0.7160 (6.05)***	0.2004 (2.02)**
Spinoff pushed 11+ years (dummy)	0.3210 (2.73)***	0.0752 (0.32)	0.3952 (1.63)	0.2928 (1.77)*
4-5 employees (reference)	---	---	---	---
6-9 employees (dummy)	-0.0278 (-1.79)*	-0.0541 (-1.25)	0.1149 (4.41)***	-0.1126 (-5.24)***
10-19 employees (dummy)	-0.0982 (-5.50)***	-0.1467 (-2.95)***	0.1018 (3.45)***	-0.2059 (-8.22)***
20-49 employees (dummy)	-0.1988 (-8.28)***	-0.1184 (-1.92)*	0.1523 (3.60)***	-0.4032 (-12.21)***
50 and more employees (dummy)	-0.4173 (-10.12)***	-0.2669 (-3.12)***	0.0828 (0.93)	-0.6801 (-11.99)***

Percentage of low qualified employees	0.0009 (2.47)**	0.0008 (0.70)	0.0014 (2.42)**	0.0006 (1.06)
Percentage of skilled occupations	-0.0017 (-8.20)***	-0.0014 (-2.34)**	-0.0008 (-2.71)***	-0.0023 (-7.34)***
Percentage of highly skilled occupations	-0.0039 (-8.22)***	0.0011 (0.82)	0.0006 (0.50)	-0.0057 (-10.14)***
Percentage of females	-0.0033 (-11.85)***	-0.0010 (-1.07)	-0.0033 (-3.26)***	-0.0037 (-11.97)***
Median age of the workforce (in years)	0.0049 (5.00)***	0.0081 (2.90)***	-0.0006 (-0.32)	0.0040 (3.03)***
2-digit industry fixed effects	Included	Included	Included	Included
Regional fixed effects (administrative districts)	Included	Included	Included	Included
Year fixed effects	Included	Included	Included	Included
Intercept	-1.5550 (-12.05)***	-1.7748 (-8.82)***	-1.1270 (-12.93)***	-1.7129 (-23.17)***
No. of observations	197,437	34,053	36,318	127,066

Notes: establishments with at least 4 initial employees, size and workforce composition refer to the initial workforce; private sector without agriculture and mining; t-values in brackets, standard errors adjusted for clustering at establishment level, ***/**/* indicates statistical significance at the 1/5/10% level.

Table 5a: Determinants of establishment exit for pulled spinoffs, West Germany 1976-2008, piecewise constant exponential model, coefficient estimates

	All industries	**Manufacturing**	**Construction**	**Services**
Same industry as parent (dummy)	0.1887 (2.53)**	0.5915 (4.53)***	0.2671 (1.01)	-0.0816 (-0.82)
1st year (reference)	---	---	---	---
2-3 years (dummy)	0.0942 (1.28)	0.1831 (1.36)	0.2588 (0.93)	0.0407 (0.44)
4-6 years (dummy)	0.0369 (0.50)	-0.1500 (-1.07)	0.2652 (0.96)	0.1026 (1.14)
7-10 years (dummy)	-0.1590** (-2.03)	-0.0136 (-0.10)	0.0754 (0.26)	-0.2515 (-2.49)**
11+ years (dummy)	-0.2183 (-2.93)***	-0.2843 (-2.10)**	0.1746 (0.63)	-0.2019 (-2.13)**
Same industry as parent 2-3 years (dummy)	-0.0900 (-0.97)	-0.4080 (-2.49)**	-0.1461 (-0.46)	0.1189 (0.96)
Same industry as parent 4-6 years (dummy)	-0.1745 (-1.89)*	-0.3862 (-2.25)**	-0.2906 (-0.92)	-0.0012 (-0.01)
Same industry as parent 7-10 years (dummy)	-0.2184 (-2.20)**	-0.7425 (-4.24)***	-0.4586 (-1.36)	0.1336 (1.01)
Same industry as parent 11+ years (dummy)	-0.1459 (-1.59)	-0.5133 (-3.16)***	-0.4376 (-1.40)	0.1059 (0.87)
4-5 employees (reference)	---	---	---	---
6-9 employees (dummy)	-0.0793 (-2.17)**	-0.0323 (-0.42)	-0.2672 (-2.38)**	-0.0651 (-1.44)
10-19 employees (dummy)	-0.1113 (-2.94)***	-0.0509 (-0.67)	-0.2759 (-2.45)**	-0.1068 (-2.21)**
20-49 employees (dummy)	-0.2186 (-5.02)***	-0.1530 (-1.86)*	-0.3001 (-2.54)**	-0.2475 (-4.19)***
50 and more employees (dummy)	-0.3896 (-7.48)***	-0.3576 (-4.20)***	-0.4221 (-2.54)**	-0.4070 (-5.23)***
Percentage of low qualified employees	0.0014 (2.18)**	0.0036 (3.21)***	0.0031 (1.62)	-0.0000 (-0.03)
Percentage of skilled occupations	-0.0015 (-3.24)***	0.0001 (0.13)	0.0007 (0.56)	-0.0030 (-4.94)***
Percentage of highly skilled occupations	-0.0047 (-5.00)***	-0.0012 (-0.59)	-0.0023 (-0.57)	-0.0067 (-5.93)***
Percentage of females	-0.0008 (-1.52)	0.0013 (1.05)	0.0017 (0.49)	-0.0016 (-2.79)***
Median age of the workforce (in years)	0.0178 (9.08)***	0.0345 (8.89)***	0.0223 (3.53)***	0.0095 (3.86)***

2-digit industry fixed effects	Included	Included	Included	Included
Regional fixed effects (administrative districts)	Included	Included	Included	Included
Year fixed effects	Included	Included	Included	Included
Intercept	-3.6556 (-12.23)***	-4.5701 (-10.17)***	-4.4504 (-4.25)***	-2.6934 (-7.96)***
No. of observations	106,513	32,535	11,041	62,937

Notes: establishments with at least 4 initial employees, size and workforce composition refer to the initial workforce; private sector without agriculture and mining; t-values in brackets, standard errors adjusted for clustering at establishment level, ***/**/* indicates statistical significance at the 1/5/10% level.

Table 5b: Determinants of establishment exit for pushed spinoffs, West Germany 1976-2008, piecewise constant exponential model, coefficient estimates

	All industries	Manufacturing	Construction	Services
Same industry as parent (dummy)	0.1498 (2.05)**	0.4618 (3.79)***	0.1250 (0.59)	-0.0516 (-0.50)
1st year (reference)	---	---	---	---
2-3 years (dummy)	-0.1271 (-1.48)	0.1026 (0.74)	-0.3615 (-1.32)	-0.2387 (-1.96)**
4-6 years (dummy)	-0.3408 (-3.74)***	-0.2682 (-1.76)*	-0.1923 (-0.74)	-0.3882 (-3.06)***
7-10 years (dummy)	-0.6076 (-5.86)***	-0.5732 (-3.27)***	-0.4172 (-1.49)	-0.6407 (-4.42)***
11+ years (dummy)	-0.7390 (-7.37)***	-0.7305 (-4.25)***	-0.5221 (-2.03)**	-0.7393 (-5.11)***
Same industry as parent 2-3 years (dummy)	-0.2060 (-2.15)**	-0.6281 (-4.03)***	0.1061 (0.37)	0.0332 (0.24)
Same industry as parent 4-6 years (dummy)	-0.2222 (-2.20)**	-0.5789 (-3.38)***	-0.3709 (-1.33)	0.0472 (0.33)
Same industry as parent 7-10 years (dummy)	-0.1587 (-1.39)	-0.4280 (-2.21)**	-0.3811 (-1.26)	0.0933 (0.58)
Same industry as parent 11+ years (dummy)	-0.1218 (-1.12)	-0.3813 (-2.05)**	-0.2709 (-0.99)	0.0847 (0.54)
4-5 employees (reference)	---	---	---	---
6-9 employees (dummy)	-0.1290 (-3.71)***	-0.1848 (-2.56)**	0.0154 (0.19)	-0.1451 (-3.09)***
10-19 employees (dummy)	-0.1054 (-2.78)***	-0.1067 (-1.46)	-0.1218 (-1.39)	-0.0997 (-1.88)*
20-49 employees (dummy)	-0.1581 (-3.37)***	-0.1292 (-1.59)	-0.2814 (-2.52)**	-0.1109 (-1.60)
50 and more employees (dummy)	-0.2440 (-3.73)***	-0.1500 (-1.58)	-0.5739 (-2.57)**	-0.2747 (-2.58)***
Percentage of low qualified employees	0.0017 (2.71)***	0.0015 (1.39)	0.0000 (0.03)	0.0027 (2.92)***
Percentage of skilled occupations	-0.0015 (-3.00)***	0.0002 (0.18)	-0.0015 (-1.56)	-0.0026 (-3.63)***
Percentage of highly skilled occupations	-0.0062 (-5.07)***	0.0013 (0.45)	0.0086 (2.00)**	-0.0095 (-6.50)***
Percentage of females	-0.0024 (-4.25)***	-0.0003 (-0.26)	-0.0066 (-2.01)**	-0.0031 (-4.58)***
Median age of the workforce (in years)	0.0172 (9.61)***	0.0297 (9.14)***	0.0166 (3.57)***	0.0094 (3.81)***

2-digit industry fixed effects	Included	Included	Included	Included
Regional fixed effects (administrative districts)	Included	Included	Included	Included
Year fixed effects	Included	Included	Included	Included
Intercept	-2.9801 (-7.49)***	-3.7204 (-6.54)***	-3.8637 (-3.77)***	-2.3262 (-4.55)***
No. of observations	94,087	29,339	17,320	47,428

Notes: establishments with at least 4 initial employees, size and workforce composition refer to the initial workforce; private sector without agriculture and mining; t-values in brackets, standard errors adjusted for clustering at establishment level, ***/**/* indicates statistical significance at the 1/5/10% level.

Table 6a: Determinants of establishment exit for pulled spinoffs, East Germany 1994-2008, piecewise constant exponential model, coefficient estimates

	All industries	Manufacturing	Construction	Services
Same industry as parent (dummy)	-0.0819 (-0.66)	0.0154 (0.05)	-0.2403 (-0.91)	-0.0670 (-0.42)
1st year (reference)	---	---	---	---
2-3 years (dummy)	0.0175 (0.15)	0.1834 (0.74)	-0.2457 (-0.86)	0.0150 (0.10)
4-6 years (dummy)	-0.0234 (-0.19)	0.2516 (0.98)	-0.0203 (-0.07)	-0.1417 (-0.89)
7-10 years (dummy)	-0.1790 (-1.28)	-0.1456 (-0.47)	-0.1877 (-0.58)	-0.1927 (-1.08)
11+ years (dummy)	-0.4049 (-2.01)**	0.1884 (0.53)	-0.3534 (-0.65)	-0.7423 (-2.55)**
Same industry as parent 2-3 years (dummy)	0.1940 (1.27)	0.2077 (0.60)	0.6027 (1.76)*	0.0758 (0.38)
Same industry as parent 4-6 years (dummy)	0.1473 (0.94)	0.1844 (0.53)	0.1841 (0.54)	0.1760 (0.85)
Same industry as parent 7-10 years (dummy)	0.2780 (1.59)	0.0387 (0.09)	0.5593 (1.52)	0.2488 (1.09)
Same industry as parent 11+ years (dummy)	0.6109 (2.51)**	-0.4420 (-0.81)	1.0597 (1.81)*	0.9037 (2.65)***
4-5 employees (reference)	---	---	---	---
6-9 employees (dummy)	-0.1865 (-2.64)***	-0.2048 (-1.17)	0.1278 (0.78)	-0.2722 (-3.05)***
10-19 employees (dummy)	-0.2107 (-2.87)***	-0.2156 (-1.22)	0.0522 (0.33)	-0.3119 (-3.22)***
20-49 employees (dummy)	-0.2411 (-2.83)***	-0.4653 (-2.29)**	0.1316 (0.79)	-0.3800 (-3.13)***
50 and more employees (dummy)	-0.2104 (-1.79)*	-0.3120 (-1.58)	0.4769 (1.95)*	-0.4879 (-2.46)**
Percentage of low qualified employees	0.0038 (2.33)**	0.0002 (0.04)	0.0044 (1.37)	0.0043 (2.00)**
Percentage of skilled occupations	-0.0019 (-2.01)**	-0.0053 (-2.27)**	0.0017 (0.94)	-0.0034 (-2.63)***
Percentage of highly skilled occupations	-0.0075 (-4.25)***	-0.0079 (-1.84)*	0.0043 (0.87)	-0.0103 (-4.87)***
Percentage of females	0.0001 (0.11)	-0.0007 (-0.22)	0.0013 (0.32)	-0.0004 (-0.33)
Median age of the workforce (in years)	0.0072 (1.78)*	0.0066 (0.64)	0.0108 (1.10)	0.0044 (0.87)

2-digit industry fixed effects	Included	Included	Included	Included
Regional fixed effects (administrative districts)	Included	Included	Included	Included
Year fixed effects	Included	Included	Included	Included
Intercept	-2.7532 (-5.97)***	-3.2005 (-3.73)***	-3.0653 (-4.41)***	-1.8785 (-5.51)***
No. of observations	19,132	4,485	3,185	11,462

Notes: establishments with at least 4 initial employees, size and workforce composition refer to the initial workforce; private sector without agriculture and mining; t-values in brackets, standard errors adjusted for clustering at establishment level, ***/**/* indicates statistical significance at the 1/5/10% level.

Table 6b: Determinants of establishment exit for pushed spinoffs, East Germany 1994-2008, piecewise constant exponential model, coefficient estimates

	All industries	**Manufacturing**	**Construction**	**Services**
Same industry as parent (dummy)	0.1055 (0.90)	-0.0351 (-0.17)	0.1432 (0.60)	0.2536 (1.38)
1st year (reference)	---	---	---	---
2-3 years (dummy)	0.0037 (0.03)	-0.1494 (-0.64)	0.3277 (1.23)	-0.0253 (-0.12)
4-6 years (dummy)	-0.0581 (-0.41)	-0.1471 (-0.58)	0.1717 (0.60)	-0.0457 (-0.21)
7-10 years (dummy)	-0.2332 (-1.29)	-0.8371 (-2.31)**	0.4412 (1.35)	-0.1306 (-0.47)
11+ years (dummy)	-0.6647 (-1.83)*	-0.2545 (-0.49)	-0.3864 (-0.50)	-1.3061 (-1.76)*
Same industry as parent 2-3 years (dummy)	-0.0247 (-0.16)	0.2215 (0.81)	-0.2583 (-0.88)	-0.0805 (-0.34)
Same industry as parent 4-6 years (dummy)	-0.2333 (-1.44)	-0.0314 (-0.11)	-0.3524 (-1.11)	-0.3201 (-1.28)
Same industry as parent 7-10 years (dummy)	-0.0746 (-0.37)	0.6983 (1.73)*	-0.5443 (-1.53)	-0.2765 (-0.89)
Same industry as parent 11+ years (dummy)	0.1791 (0.45)	0.2952 (0.50)	0.0744 (0.09)	0.5754 (0.72)
4-5 employees (reference)	---	---	---	---
6-9 employees (dummy)	-0.0070 (-0.10)	0.1338 (0.92)	-0.0693 (-0.60)	-0.0088 (-0.08)
10-19 employees (dummy)	-0.0525 (-0.72)	0.0536 (0.33)	-0.1721 (-1.43)	-0.0131 (-0.11)
20-49 employees (dummy)	0.0532 (0.60)	0.2541 (1.51)	0.1146 (0.68)	-0.1014 (-0.72)
50 and more employees (dummy)	-0.1945 (-1.33)	-0.2855 (-1.17)	-0.6837 (-1.78)*	0.0777 (0.39)
Percentage of low qualified employees	0.0005 (0.27)	0.0013 (0.35)	0.0053 (1.58)	-0.0018 (-0.58)
Percentage of skilled occupations	-0.0009 (-0.99)	0.0009 (0.44)	0.0006 (0.45)	-0.0029 (-2.00)**
Percentage of highly skilled occupations	-0.0037 (-1.78)*	0.0134 (2.44)**	0.0119 (2.26)**	-0.0100 (-3.68)***
Percentage of females	-0.0012 (-0.96)	0.0046 (1.40)	0.0014 (0.37)	-0.0033 (-2.28)**
Median age of the workforce (in years)	-9.75e-06 (-0.00)	0.0036 (0.38)	0.0134 (1.70)*	-0.0092 (-1.41)

2-digit industry fixed effects	Included	Included	Included	Included
Regional fixed effects (administrative districts)	Included	Included	Included	Included
Year fixed effects	Included	Included	Included	Included
Intercept	-2.0051 (-3.10)***	-2.0504 (-2.51)**	-2.2762 (-4.22)***	-1.3946 (-3.43)***
No. of observations	15,675	4,415	3,772	7,488

Notes: establishments with at least 4 initial employees, size and workforce composition refer to the initial workforce; private sector without agriculture and mining; t-values in brackets, standard errors adjusted for clustering at establishment level, ***/**/* indicates statistical significance at the 1/5/10% level.

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