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Establishment Survival in East and West Germany: A Comparative Analysis

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Abstract

Using a large administrative dataset, this paper compares the development of new establishments' survival chances in East and West Germany for the period 1994 – 2008. A central question is whether convergence with respect to survival rates between East and West Germany can be observed. Using methods of survival analysis, I find that new establishments' survival chances do not differ strongly between East and West Germany at the beginning of the observation period. In 1998 and 1999 the exit hazard increases strongly in East but not in West Germany, which is likely to be due to a change in the subsidy policy affecting East Germany. Since the turn of the millennium, the difference in establishments' exit hazard between East and West Germany becomes smaller, indicating that there is convergence with respect to establishments' survival chances.

Zusammenfassung

Anhand umfangreicher administrativer Daten vergleicht diese Studie die Entwicklung der Überlebenschancen neu gegründeter Betriebe in West- und Ostdeutschland für die Jahre 1994 bis 2008. Eine zentrale Frage lautet dabei, ob eine Angleichung der Überlebensraten zwischen West- und Ostdeutschland zu beobachten ist. Anhand von Methoden der Verweildaueranalyse kommt die Studie zu dem Ergebnis, dass sich die Überlebenschancen neu gegründeter Betriebe zu Beginn des Beobachtungszeitraums nicht stark zwischen West- und Ostdeutschland unterscheiden. In den Jahren 1998 und 1999 steigt die Schließungswahrscheinlichkeit in Ostdeutschland stark an, in Westdeutschland jedoch nicht, was vermutlich auf eine Änderung der Subventionspolitik für Betriebe in Ostdeutschland zurückzuführen ist. Seit der Jahrtausendwende nimmt der Unterschied in den Schließungswahrscheinlichkeiten zwischen West- und Ostdeutschland ab, was auf eine Angleichung der Überlebenschancen hindeutet.

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1. Introduction

The German reunification in 1990 and the subsequent transformation of East Germany from a state-directed to a market economy after 40 years of socialism came along with several major challenges for all parties involved – be they policy makers, firms, or employees. When opening the markets it became evident that East German firms were not competitive at all. Their capital stock was antiquated and productivity was very low. Suddenly they faced enormous competitive pressure that they were often not able to withstand. In 1990, industrial production in East Germany collapsed dramatically and many workers that were employed in formerly state-owned firms lost their jobs due to firm exits or employment reductions that were a consequence of privatization.[1] Therefore, entry and survival of new firms played an important role with respect to the economic transformation and development of East Germany. This paper thus compares the development of new establishments' survival chances in East Germany, an economy undergoing a transformation process, and West Germany, a long-established market economy.

Empirical studies that compare firms' survival prospects in East and West Germany exist only for the 1990s or focus on very few entry cohorts. This paper contributes to the literature by analyzing the development of new establishments' survival chances in East and West Germany for the period 1994 – 2008, thus comprising 15 cohorts of startups. As studies for the 1990s (Fritsch, 2004; Brixy / Grotz, 2004) find that the survival prospects of new establishments in East Germany deteriorated during that period, a central question is whether this trend continued or whether convergence between East and West Germany with respect to survival rates can be observed. For the empirical analysis I use a large administrative dataset that is generally similar to the data used in previous studies by Fritsch (2004) and Brixy / Grotz (2004) but which, in contrast, makes it possible to identify entries and exits more reliably based on a worker flow approach.

The paper proceeds as follows: Section 2 puts the situation in East Germany after reunification in a theoretical context, provides an overview of the relevant state aid programs, and reviews previous empirical literature. In Section 3 the dataset and the procedure to identify entries and exits are described. Section 4 provides descriptive evidence on establishment survival in East and West Germany and in Section 5 the determinants of establishment exit are examined econometrically. Section 6 concludes.

[1] See, e.g., Fels / Schnabel (1991) or Paqué (2010) for a more comprehensive treatment of various economic aspects of German reunification.

2. Background and related literature

Especially in the early years after reunification, the conditions faced by new firms in East Germany differed strongly from those in West Germany. Not least because many formerly state-owned firms had to exit the market, the number of suppliers in many markets was initially quite low. In this context, the theory of density dependence, which is part of organizational ecology (see, e.g., Carrol/Hannan, 2000), states that there is a U-shaped relationship between the density (i.e. the number of organizations) in a population and the probability of failure. If the density in a population is very low, failure rates are high due to a lack of legitimation. As density grows failure rates first decline and then rise again due to increasing competition. More specifically, Carrol/Hannan (1989) argue that the density at the time of entry has persistent effects on organizations' mortality risk because newly founded organizations are particularly sensitive to environmental conditions.

Applying this theoretical approach to the case of East Germany, one can expect that the low density increased the survival chances of firms in East Germany that were founded relatively early after reunification (Fritsch, 2004; Brixy/Grotz, 2004). Deficits in legitimation do not seem to be relevant in the East German case since a greater variety of products and services was highly desired which made it easy for new firms to successfully enter the market (Brixy/Grotz, 2004).

Besides the low density in the early years after reunification, various subsidies were granted in order to improve the economic situation in East Germany, since economic convergence between East and West Germany was a major goal of economic policy. It can be assumed that these subsidies had substantial effects on firm survival in East Germany. Besides public investments in infrastructure, the promotion of economic development in East Germany mainly focused on the stimulation of private investment and new firm formation. Relevant state aid programs were established after reunification in 1990 and are partly still in place (see e.g. Paqué, 2010, 92 f.). One can distinguish four major policy measures to promote economic activity in East Germany:

According to the Investment Subsidy Law (*Investitionszulagengesetz*) investment subsidies were provided for firms in East Germany. Subsidy rates changed several times since the program started in 1991. Between 1991 and 1998, the general subsidy rate was reduced from initially 12 percent of the investment costs to 5 percent. In 1999, it was raised to 10 – 15 percent and from 2010 onwards it was reduced step by step to finally 2.5 percent in 2013. For small and medium-sized firms subsidy rates were always higher than the general subsidy rate. From 1999 onwards, subsidies were restricted to investments in the manufacturing sector and manufacturing-related services. The program expired by the end of 2013.

In addition, investment grants within the context of the Joint Task for the Improvement of the Regional Economic Structure (*Gemeinschaftsaufgabe zur Verbesserung der regionalen Wirtschaftsstruktur*) have been provided. In contrast to investment subsidies according to the Investment Subsidy Law, there has been no legal entitlement to receive the grant. Details concerning the decision which firms to support have been in the responsibility of the federal states. The program is still at work.

Another important measure to stimulate investment was the Development Area Law (*Fördergebietsgesetz*) which allowed for bonus depreciations of 50 percent (1991 – 1996) resp. 40 percent (1997 – 1998) on investments in East Germany. The program was not restricted to specific economic sectors. It expired by the end of 1998.

Finally, cheap credits, grants, and public guarantees, mainly financed by funds from the European Recovery Program (ERP), have been provided. Although these programs have not been exclusively available in East Germany, the conditions for firms in East Germany have been more favorable than for their West German counterparts, which is still the case.

While various subsidies and the low density in the early years after reunification presumably increased new firms' survival chances in East Germany compared to West Germany, one should also note that the socialist regime of the former GDR systematically undermined self-employment and entrepreneurial activity, which is why self-employment rates in East Germany were much lower than in West Germany in the early years after reunification (Fritsch et al., 2012; Paqué, 2010). One can assume that people in East Germany often did not have the skills and knowledge how to establish and manage their own firms which made it difficult for East German entrepreneurs to successfully compete with West German firms that had more experience in coping with the competitive pressure in a market economy.

Empirical studies that compare firms' survival prospects in East and West Germany are relatively scarce and focus mainly on the 1990s.[2] Investigating survival rates of the entry cohorts 1993 – 1998, Fritsch (2004) finds that the survival chances of those cohorts that entered early after reunification were relatively good in East Germany compared to West Germany but declined for subsequent cohorts. While survival rates for the entry cohorts 1993 and 1994 are clearly higher in East Germany, they do not differ much between East and West Germany for the cohorts 1995 – 1997. For firms that entered in 1998 he finds that their survival rates are clearly lower in East Germany. The survival rates of entries in West Germany remained relatively constant over the period

[2] There is a substantial international literature on the survival chances of newly founded firms. For surveys see Geroski (1995) or Caves (1998). For Germany most studies focus on West Germany or single federal states (e.g., Wagner, 1994; Boeri / Bellmann, 1995; Fritsch et al., 2006; Brixy / Grotz, 2007; Strotmann, 2007; Schindele / Weyh, 2011).

of observation. Similar evidence for entry cohorts between 1991 and 1995 is provided by Brixy/Grotz (2004). Heckmann/Schnabel (2006) find a higher probability of survival in East Germany for firms that were founded in 1995 and 1996. For young firms founded between 2005 and 2007 Egeln et al. (2010) find a higher probability of exit due to bankruptcy in East Germany while the probability of exit due to other reasons does not differ significantly between East and West Germany.

Taken together, the existing empirical evidence shows that survival chances of firms that were founded shortly after reunification were relatively good, even better than in West Germany, and deteriorated for subsequent entry cohorts during the 1990s. With respect to more recent entry cohorts the evidence is far from conclusive. The good survival chances of the early entry cohorts in East Germany may be due to the low density in many markets (Fritsch, 2004), as well as various subsidies that were provided in order to improve the economic situation in East Germany.

3. Data

For the following analysis I 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 1975–2010 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).[3] 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 "Employment History" (BeH) – at the establishment level. The BHP contains information on industry[4], 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.

[3] Berlin, including West Berlin which belonged to West Germany before reunification, is regarded as part of East Germany in this study. To make sure that the results are not driven by this classification, I conducted a robustness test removing Berlin from the sample which did not affect the results.

[4] 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.

Since every establishment is allocated a unique identification number which normally does not change, one can 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 they report for the first time having employees who are liable to social security.[5] Analogously, establishments are considered to be exits in the year when they appear in the data for the last time. For establishments in East Germany that already appear in the data in 1993 one does not know whether they entered in 1993 or earlier. Thus, it is possible to identify entries for the first time 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.[6]

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.[7] To solve this problem I use extension files on establishment histories provided by the Research Data Center that are based on the work by Hethey-Maier / Schmieder (2013) who analyzed worker flows between establishment numbers in the underlying personal level data.[8] 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

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5 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.

6 Exits are considered ultimately in 2008 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 this is not a problem for West Germany since entries in 1994 did not appear in the data since 1975. For East Germany it should be noted that establishments that are regarded as entries in 1994 did not appear in the data in the three preceding years.

7 For a more detailed description of the problems concerning the identification of entries and exits, see Brixy / Fritsch (2002).

8 Since 1999 marginal part-time workers are included in the BLH and therefore also in the BHP data set. For time-consistency those employment relationships were dropped in the analysis of Hethey-Maier / Schmieder (2013) that makes use of personal level data. For the identification of establishments' entries and exits I follow their approach. However, as I do not have access to the worker-level data, I am 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, I decided not to exclude all establishments with marginal workers from the sample.

and it is therefore not possible to distinguish between different types of entry. Newly appearing establishments with less than four employees are therefore always regarded as true entries. Among entrants with more than three initial employees I exclude establishments in which 30 or more percent of the initial workforce was employed together in the same establishment in the year before and in which this group of workers, i.e. the maximum clustered inflow, made up more than 80 percent of that establishment's, i.e. the predecessor's, workforce. These cases are labeled "ID changes" or "unclear" by Hethey-Maier/Schmieder (2013), based on whether a meaningful interpretation is possible or not. The remaining categories, namely "new establishments (mid & big)", "new establishments (fuzzy)", "Spinoffs pulled" and "Spinoffs pushed", are considered to be true entries (see Appendix Table 1 for the number of entries by year).[9]

Spinoffs are 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. They are regarded as "pulled" if the predecessor continues and as "pushed" if the predecessor exits. New establishments (mid & big) are entries in which less than 30 percent of the initial workforce was employed in the same establishment in the year before. These startups are likely to be founded without a parent firm. The remaining category with the maximum clustered inflow making up between 30 and 80 percent of a new establishment's initial workforce, which is labeled "fuzzy" by Hethey-Maier/Schmieder (2013), may contain both spinoffs and startups without a parent firm.[10]

Concerning the identification of exits, if establishment A exits in period t and more than 80 percent of that establishment's workforce is employed in establishment B in t+1, it is likely that establishment A does not cease to exist. Depending on whether B is a new or an existing establishment, the disappearance of establishment A is regarded as "ID change" or "takeover", respectively. In some cases a meaningful interpretation is not possible. These cases, which are labeled "unclear" by Hethey-Maier/Schmieder (2013), are excluded. A more detailed description how these extension files are used to identify true exits is provided by Fackler et al. (2013).[11]

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[9] A potential problem of the data is that it is not possible to distinguish between new firms (i.e. legal units) and newly established branch plants. This, however, should not be a serious problem for this investigation. As 86 percent of all establishments (i.e. local units) in Germany are separate firms comprising only one establishment (Koch/Krenz, 2010), one can expect that new establishments are also new firms in most cases.

[10] I also conducted a robustness test applying a more rigorous definition of entries, namely regarding only small entrants with less than four initial employees and new establishments (mid & big) as true entries and restricting the sample to establishments with maximum 20 initial employees. Removing implausibly large entrants additionally reduces the probability of observing formations of branch plants rather than new firms (see Fritsch/Brixy, 2004). Running this robustness test did not change the main insights.

The following empirical analysis is usually restricted to newly founded establishments for several reasons: First, new firms are regarded as particularly important with respect to economic development. Second, for East Germany I do not know the exact age of establishments that already appeared in the data in 1993. Among these establishments it is also not possible to distinguish clearly between those that were founded after reunification and those that already existed during the socialist regime of the former GDR. In order to compare new establishments' survival chances between East and West Germany the sample is restricted to establishments that were founded (i.e., that reported having employees who are liable to social security for the first time) between 1994 and 2008. The sample is further restricted to the private sector, i.e., the public sector and other non-profit sectors are excluded from the analysis. I 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) that goes beyond the policy measures to foster economic development in East Germany.

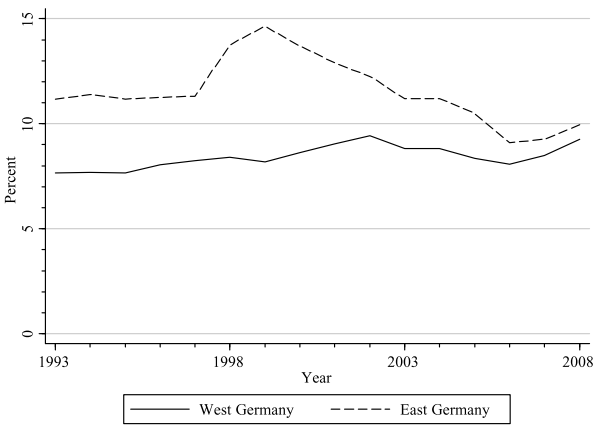
4. Descriptive evidence

Although the main focus of this study is on newly founded establishments, I start my empirical investigation by comparing average annual exit rates (related to all establishments, not only new entrants) in East and West Germany for the period 1993 – 2008 in order to get a first impression of the survival patterns. The respective figures are depicted in Figure 1. In 1993 the "initial transformation shock" (Fritsch 2004, 532) was over and the situation in East Germany was more stable than immediately after reunification.

In West Germany annual exit rates have developed relatively stable without huge fluctuations between 1993 and 2008. The probability of exit increased slightly and is quite high in 2002, a year that falls in the economic downturn from 2001 to 2003. The high exit rate of more than nine percent in 2008 may be due to the Great Recession in 2008 / 09 but it should be interpreted with care since one cannot rule out that the number of exits is overestimated a the current edge (see Section 3). In East Germany the picture is somewhat different. Start-

[11] The measurement of exits may be affected by the fact that only establishments with employees who are liable to social security are included in the data. Since new establishments do not enter the BHP until they hire employees, it is not possible to observe exits of establishments that exit before hiring employees. This leads to an underestimation of the number of exits. Establishments are regarded as exits when they stop having employees who are liable to social security. Since establishments can also continue without employees, this can lead to an overestimation of the number of exits. Taken together, the direction of the bias that results from the fact that only establishments with employees are included in the data is theoretically unclear. A similar problem applies to entries.

ing with the years 1993 to 1997 the exit rate is always about eleven percent, roughly three percentage points higher than in West Germany which is likely to be due to composition effects, in particular a higher share of young establishments in East Germany. In the years 1998 and 1999 the probability of exit increases dramatically, reaches its maximum of 14.6 percent in 1999, and decreases afterwards. From the year 2000 onwards the exit rates in East and West Germany seem to converge since the difference becomes smaller over time and is less than one percentage point in 2007 and 2008.



Notes: private sector without agriculture and mining.

Figure 1: Annual exit rates, 1993 – 2008

The fact that exit rates in East Germany rise exceptionally in 1998 and 1999 is remarkable. Since a similar development cannot be observed in West Germany it is likely that this is due to a policy change affecting firms in East but not in West Germany. A potential reason for this development is the expiration of the Development Area Law *(Fördergebietsgesetz)* by the end of 1998. Since the Development Area Law was one of the most expensive policy measures that aimed on improving the economic situation in East Germany one can expect that its expiration in 1998 considerably raised firms' capital costs and reduced their liquidity and profitability, thus affecting the decision whether to stay in the market or not. With respect to business investment, Eichfelder/ Schneider (2013) report that the bonus depreciations according to the Development Area Law had strong effects on both the volume and the probability of investment. Since declining investment reduces aggregate demand it can be expected that the profitability of establishments that were not directly affected by the expiration of the Development Area Law also worsened which might have led to an increasing number of closures.

Now focusing on newly founded establishments, Table 1 provides descriptive evidence on establishment survival in East and West Germany from a cohort perspective. It shows Kaplan-Meier survival estimates (see e.g. Kalbfleisch/Prentice 2002, 14–19) for the entry cohorts 1994 to 2008. In West Germany, the survival chances of newly founded establishments have worsened slightly over time in the short and the long run, but the development is quite stable. For establishments that entered between 1994 and 1999 the survival rates are always greater than 80 percent after one year, greater than 60 percent after three years, and still greater than 50 percent after five years. For subsequent entry cohorts the respective figures are always below 80, 60, and 50 percent. In East Germany, the one-year survival rates for establishments that entered between 1994 and 1997 are very similar to those in West Germany while the three-, five, and ten-year survival rates are lower and worsened over time. The following three cohorts 1998–2000 exhibit the overall lowest survival rates but from 2001 onwards new establishments' survival chances become better again. For establishments that entered between 2006 and 2008 the survival functions are very similar in East and West Germany. This is also confirmed by log-rank and Wilcoxon tests (see Kalbfleisch/Prentice, 2002, 20–23) which do not indicate significant differences in the survival functions on the one percent level for the entry cohorts 2006–2008. For earlier entry cohorts, the survival functions always differ significantly on the one percent level between East and West Germany.

Table 1

Survival rates of newly founded establishments after 1, 3, 5 and 10 years by year of entry (in percent), 1994–2008

Year of entry	West Germany				East Germany			
	1 year	3 years	5 years	10 years	1 year	3 years	5 years	10 years
1994	80.35	63.07	52.73	36.83	81.66	62.99	51.20	32.71
1995	80.95	62.48	52.32	35.92	81.05	61.27	48.49	31.10
1996	80.15	62.07	51.43	35.26	79.27	58.15	45.39	29.78
1997	80.22	62.47	51.05	35.18	79.32	58.23	45.63	30.08
1998	81.21	63.10	51.17	35.55	71.90	50.60	39.55	25.95
1999	81.10	62.02	50.35	34.84	68.00	46.98	36.89	24.12
2000	79.40	58.68	47.72	—	71.83	50.21	40.32	—
2001	78.86	58.45	47.90	—	74.80	52.79	42.06	—
2002	77.47	58.31	48.45	—	75.72	53.77	43.77	—
2003	78.20	59.40	48.44	—	76.27	54.48	44.46	—
2004	77.83	58.95	47.22	—	75.53	55.29	44.50	—
2005	78.53	59.28	—	—	76.67	58.24	—	—
2006	78.84	58.05	—	—	78.79	58.27	—	—

Year of entry	West Germany				East Germany			
	1 year	3 years	5 years	10 years	1 year	3 years	5 years	10 years
2007	77.87	—	—	—	78.08	—	—	—
2008	75.95	—	—	—	75.66	—	—	—

Notes: Kaplan-Meier survival estimates, private sector without agriculture and mining.

This evidence is similar to what Fritsch (2004) found for the entry cohorts 1993 – 1998. It is consistent with the view that firms in East Germany that entered relatively early benefited from the low density, i.e. the number of firms in a market, but also from various subsidies, and therefore exhibited higher survival rates than subsequent entry cohorts. It is further remarkable that new establishments' survival chances in East Germany worsened considerably for entries in 1998 – 2000 compared to earlier cohorts and that the long run survival rates for the cohorts 1994 – 1997 are also clearly lower than in West Germany. These results are therefore consistent with the view that the expiration of the Development Area Law in 1998 has increased establishments' mortality risk in East Germany. The results for entry cohorts from 2001 onwards show that establishments' survival chances converged between East and West Germany.

5. Econometric analysis

In this section the results of a multivariate analysis are presented in order to see whether the results from the descriptive analysis still hold when controlling for several variables that influence the probability of exit. I estimate the probability of establishment exit using semi-parametric Cox proportional hazards models (see, e.g., Cameron / Trivedi 2005, 592 – 597). The major advantage of this model is its flexibility since it does not make any assumption about the shape of the baseline hazard, i.e. the relationship between the hazard rate and establishment age (resp. analysis time measured in years) when all other covariates are zero. Applying different estimation methods, namely a discrete time proportional hazards model (complementary log-log) or a piecewise constant exponential model, does not affect the results.

I analyze the development of establishments' exit hazard in East and West Germany from a time and a cohort perspective. In the first case year dummies are included in the model and interacted with a dummy variable which is one if the establishment was founded in East Germany and zero otherwise. In the second case the procedure is almost the same but instead of the year dummies I include cohort dummies (i.e. year of entry). In this model I additionally include real GDP growth rates at the level of federal states to control for business cycle fluctuations, as well as an interaction term with the dummy for East Germany to take into account that the effect of business cycle fluctuations on establishments' exit hazard might differ between East and West Germany. In the first

model aggregate business cycle fluctuations are captured by the year dummies and it is therefore not necessary to include an additional business cycle indicator. As further control variables I include initial establishment size, i.e., the number of employees at the time of entry (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 skilled occupations,[12] and of females, as well as the median age), and two-digit industry fixed effects.[13] The variables for establishment size and workforce composition are also interacted with the dummy for East Germany in order to take account of potential differences in the determinants of establishment exit between East and West Germany.[14]

Estimation results are presented in Table 2 for the model with year fixed effects and in Table 3 for the one with cohort fixed effects. In order to illustrate the developments over time graphically, hazard ratios (more specifically the products of the relevant hazard ratios from Tables 2 and 3) for East and West Germany are displayed in Figures 2 and 3, respectively. In both figures the year resp. cohort 1994 in West Germany constitutes the reference (with a hazard ratio of one). I also ran estimations separately for the manufacturing, construction, and service sector. A graphical representation of the results can be found in Appendix Figures 1a–c for the model with year fixed effects and 2a–c for the one with cohort fixed effects.

Starting with the model incorporating year fixed effects (Table 2 and Figure 2) one can see that the exit hazard of new establishments in both East and West Germany has developed similar to the average exit rates (related to all establishments) depicted in Figure 1. In West Germany the development can largely be attributed to business cycle fluctuations. The peak in 2002 with the hazard rate being 20 percent higher than in 1994 might be due to the economic downturn from 2001 to 2003 and the high exit hazard at the end of the observation period in 2008, where it is about 26 percent higher than in 1994, might be due to the Great Recession in 2008/09. However, the latter explanation should be treated

12 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.

13 See Appendix Table 2 for descriptive statistics of explanatory variables.

14 Prantl (2003) investigates potential differences in the determinants of firm survival between East and West Germany and differentiates between involuntary exit due to bankruptcy and voluntary exit due to other reasons. Inter alia she finds that small firms in East Germany, in contrast to West Germany, do not face a higher risk of voluntary exit than large firms.

with caution since one cannot rule out that the number of exits is overestimated at the current edge (as already stated in Section 4). In East Germany the exit hazard rises slightly between 1994 and 1997 but the difference between East and West Germany is relatively small in these years with maximum 10.5 percent in 1997. In 1998 and 1999 the hazard rate in East Germany rises strongly, probably due to the expiration of the Development Area Law by the end of 1998, remains on a high level in 2000 and decreases afterwards. The difference to West Germany between 1998 and 2000 is always greater than 30 percent and the maximum difference is reached in 1999 with 47.8 percent. Until 2006 the exit hazard for establishments in East Germany decreases and rises again at the end of the observation period which, as in West Germany, might be due to the Great Recession. Comparing East and West Germany during the years 2001 to 2008, one can see that the difference in establishments' exit hazards becomes smaller, being between eight end twelve percent from 2002 to 2005 and less than four percent from 2006 onwards. In 2006 and 2007 the difference is statistically not significant.

Table 2

Determinants of establishment exit with year fixed effects, 1994 – 2008, Cox proportional hazards model, hazard ratios

Variable	Baseline effect (≙ West Germany)	Interaction effect with dummy for East Germany
East Germany (dummy)	0.9702 (–1.55)	—
Year 1994 (reference)	—	—
Year 1995 (dummy)	0.9756 (–2.16)**	1.0777 (3.77)***
Year 1996 (dummy)	1.0245 (2.23)**	1.1051 (5.27)***
Year 1997 (dummy)	1.0303 (2.81)***	1.1392 (7.01)***
Year 1998 (dummy)	0.9952 (–0.46)	1.3530 (17.06)***
Year 1999 (dummy)	0.9542 (–4.53)***	1.5229 (24.31)***
Year 2000 (dummy)	1.0562 (5.40)***	1.3724 (18.24)***
Year 2001 (dummy)	1.1221 (11.48)***	1.2441 (12.50)***
Year 2002 (dummy)	1.2004 (18.33)***	1.1358 (7.27)***
Year 2003 (dummy)	1.1387 (12.90)***	1.1144 (6.11)***
Year 2004 (dummy)	1.1347 (12.59)***	1.1505 (7.92)***
Year 2005 (dummy)	1.0928 (8.80)***	1.1398 (7.33)***
Year 2006 (dummy)	1.0772 (7.38)***	1.0227 (1.24)
Year 2007 (dummy)	1.1237 (11.66)***	0.9997 (–0.02)
Year 2008 (dummy)	1.2576 (23.20)***	0.9897 (–0.58)
1 – 3 employees (dummy)	1.4112 (78.37)***	0.9874 (–1.57)
4 – 6 employees (reference)	—	—

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Table 2 (continued)

Variable	Baseline effect (≙ West Germany)	Interaction effect with dummy for East Germany
7–9 employees (dummy)	0.9067 (–11.91)***	1.0636 (4.19)***
10–19 employees (dummy)	0.8722 (–16.77)***	1.0658 (4.40)***
20 and more employees (dummy)	0.6946 (–35.67)***	1.1038 (5.42)***
Percentage of low qualified employees	1.0006 (13.77)***	0.9999 (–1.26)
Percentage of skilled occupations	0.9981 (–57.45)***	1.0007 (12.17)***
Percentage of highly skilled occupations	0.9979 (–31.81)***	1.0006 (5.39)***
Percentage of females	0.9987 (–39.28)***	1.0001 (1.24)
Median age of the workforce (in years)	1.0042 (30.16)***	0.9989 (–4.23)***
2-digit industry fixed effects	Included	
No. of observations	5,044,443	

Notes: newly founded establishments, 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.

Notes: private sector without agriculture and mining, reference: West Germany 1994 (hazard ratio=1), Cox proportional hazards model, see Table 2 for the corresponding regression results.

Figure 2: Hazard ratios of newly founded establishments by year, 1994–2008

By and large, similar developments can be observed when looking at the manufacturing, construction, and service sector separately (see Appendix Figures 1a-c). The difference in establishments' exit hazards between East and West Germany is quite small at the beginning of the observation period, it is largest after the expiration of the Development Area Law, and becomes smaller towards the end of the observation period. Whereas establishments in the manufacturing and construction sector always face a higher exit hazard in East Germany, in the service sector, interestingly, a higher hazard rate in East Germany can be observed only for the years 1998 – 2001.

The results of the multivariate analysis with cohort fixed effects, which are presented in Table 3 and Figure 3, are very similar to those in the descriptive analysis (presented in Table 1). Starting with West Germany one can see that new establishments' survival chances worsened slightly over time. Looking at the hazard ratios for East Germany it is visible that establishments that entered between 1994 and 1997 have the overall lowest exit hazards among all entry cohorts in East Germany. Although the hazard rates for these entry cohorts are 11 to 18 percent higher than in West Germany the difference is never significant on the one percent level. The cohorts 1998 and 1999 again exhibit the overall highest hazard rates with the difference between East and West Germany being 26.9 percent for the 1998 cohort and 31.1 percent for the 1999 cohort. For subsequent entry cohorts the exit hazard becomes smaller and the development appears quite stable from 2000 onwards. For establishments that entered in 2002 or later the difference in the hazard rates between East and West Germany is less than 10 percent and the exit hazard is also sometimes lower in East Germany. For entry cohorts from 2001 onwards, the difference in the exit hazards does not differ significantly between East and West Germany. This indicates that new establishments' survival chances have converged between East and West Germany.

Table 3

Determinants of establishment exit with cohort fixed effects, 1994 – 2008, Cox proportional hazards model, hazard ratios

Variable	Baseline effect (≙ West Germany)	Interaction effect with dummy for East Germany
East Germany (dummy)	1.1817 (2.38)**	—
Cohort 1994 (reference)	—	—
Cohort 1995 (dummy)	0.9991 (–0.14)	0.9924 (–0.55)
Cohort 1996 (dummy)	1.0227 (2.06)**	0.9814 (–1.02)
Cohort 1997 (dummy)	1.0329 (4.56)***	0.9454 (–6.54)***
Cohort 1998 (dummy)	1.0247 (3.04)***	1.0743 (2.60)***

Continued next page

Table 3 (continued)

Variable	Baseline effect (≙ West Germany)	Interaction effect with dummy for East Germany
Cohort 1999 (dummy)	1.0837 (7.92)***	1.1092 (3.37)***
Cohort 2000 (dummy)	1.1465 (11.91)***	0.9637 (–1.83)*
Cohort 2001 (dummy)	1.1425 (14.11)***	0.9336 (–4.54)***
Cohort 2002 (dummy)	1.1436 (13.64)***	0.9108 (–6.55)***
Cohort 2003 (dummy)	1.1473 (10.47)***	0.9048 (–6.66)***
Cohort 2004 (dummy)	1.1968 (11.09)***	0.8866 (–7.00)***
Cohort 2005 (dummy)	1.1979 (13.42)***	0.8416 (–5.80)***
Cohort 2006 (dummy)	1.2414 (11.77)***	0.8260 (–5.71)***
Cohort 2007 (dummy)	1.2956 (17.89)***	0.8058 (–7.00)***
Cohort 2008 (dummy)	1.2946 (13.67)***	0.8534 (–3.25)***
1 – 3 employees (dummy)	1.4226 (36.91)***	0.9832 (–1.50)
4 – 6 employees (reference)	—	—
7 – 9 employees (dummy)	0.9058 (–15.44)***	1.0662 (5.32)***
10 – 19 employees (dummy)	0.8716 (–15.12)***	1.0686 (2.92)***
20 and more employees (dummy)	0.6953 (–21.17)***	1.1032 (3.79)***
Percentage of low qualified employees	1.0007 (9.03)***	0.9998 (–1.11)
Percentage of skilled occupations	0.9981 (–37.43)***	1.0006 (5.32)***
Percentage of highly skilled occupations	0.9980 (–15.17)***	1.0005 (1.91)*
Percentage of females	0.9987 (–16.52)***	1.0001 (0.41)
Median age of the workforce (in years)	1.0039 (9.92)***	0.9992 (–1.43)
Real GDP growth (percent)	0.9774 (–8.26)***	0.9963 (–0.75)
2-digit industry fixed effects	Included	
No. of observations	5,044,443	

Notes: newly founded establishments, 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 federal state level, ***/**/* indicates statistical significance at the 1/5/10% level.

A broadly similar picture emerges when looking at the results for three economic sectors separately (Appendix Figures 2a-c). However, the results show that the relatively good survival chances for the entry cohorts 1994 – 1997 in East Germany, which can be observed in Figure 3, are mainly driven by the service sector. For entries in the manufacturing and construction sector the exit hazard is on average substantially higher in East Germany. An increasing exit hazard in East Germany for establishments that entered in 1998 resp. 1999 and

Notes: private sector without agriculture and mining, reference: West Germany 1994 (hazard ratio=1), Cox proportional hazards model, see Table 3 for the corresponding regression results.

Figure 3: Hazard ratios of newly founded establishments by cohort (year of entry), 1994 – 2008

convergence with respect to the hazard rates since the turn of the millennium can be observed for all economic sectors.

Turning to the effects of further covariates on establishments' exit hazard, one can see from both models (Tables 2 and 3) that the exit hazard decreases with initial establishment size. This relationship is referred to as the "liability of smallness" (Aldrich/Auster, 1986) and is often regarded as a stylized fact in the literature (see e.g. Geroski, 1995). For example, establishments in West Germany with initially 1 – 3 employees face a 41 – 42 percent higher exit hazard than establishments with 4 – 6 employees. In East Germany the relationship between initial establishment size and the exit hazard seems to be slightly weaker, but this should not be over-interpreted since the coefficients of the respective interaction terms are statistically not significant in some robustness tests. One can rather conclude that the relationship between initial establishment size and the probability of exit is very similar in East and West Germany.

Concerning the composition of the initial workforce the results show that establishments with a better qualified workforce are less likely to exit which is in line with existing empirical evidence (e.g., Geroski et al., 2010; Fackler et al., 2013). One can further see that a higher share of females in the initial workforce is associated with a lower exit hazard. This is in line with empirical results by Weber/Zulehner (2010) showing for Austria that firms with females among their first hires are less likely to exit. They argue that gender diversity is crucial concerning the success of newly founded firms. In addition, this result

might reflect that – if discrimination is costly – discriminatory employers are more likely to exit due to lower profitability (Weber / Zulehner, 2014). Concerning the age structure the results point to a positive relationship between the median age of the initial workforce and the exit hazard. On the one hand the experience of older workers might be helpful for young firms, on the other hand older workers are often less willing to take risks and might therefore be not the right ones to successfully implement new business ideas (Koch et al., 2013). According to my results the second effect seems to be more important. The coefficients of the interaction terms between the workforce composition variables and the dummy for East Germany show that some of these effects seem to be slightly weaker in East Germany but the statistical significance of the interaction terms sometimes changes when running robustness tests. This suggests that the composition of the initial workforce, just as establishment size, plays a very similar role with respect to establishment survival in East and West Germany.

Furthermore, one can see from the model with cohort fixed effects (Table 3) that favorable macroeconomic conditions make it easier for establishments to survive. The growth rate of real GDP has a significant negative effect on establishments' exit hazard. The coefficient of the interaction term with the East Germany dummy is not significant, suggesting that new establishments' survival chances are similarly affected by business cycle fluctuations in East and West Germany.

The main insights of this study still hold when performing several robustness tests. In order to additionally reduce the probability of observing formations of branch plants rather than new firms I applied a more rigorous definition of entries, namely regarding only small entrants with less than four initial employees and new establishments (mid & big) as true entries (see also Section 2) and restricting the sample to establishments with maximum 20 initial employees. Since West Berlin, which is regarded as part of East Germany in this study but which belonged to West Germany already before reunification, might be a very special case which potentially biases the results I ran a robustness test removing Berlin from the sample. I further applied different estimation methods, namely a discrete time proportional hazards model (complementary log-log) and a piecewise constant exponential model. The picture is also the same when running the analyses separately for single selected entry cohorts. The results of these robustness tests are available on request.

6. Conclusion

Using a large administrative dataset, this paper has compared the development of new establishments' survival chances between East and West Germany for the period 1994 to 2008. The empirical analysis has revealed the following

insights: First, establishments' survival chances in East Germany were relatively good during the early years after reunification with no big differences to their West German counterparts, especially in the service sector. This suggests that they benefited from a low market density (Fritsch, 2004; Carrol/Hannan, 1989) and from various subsidies. Second, the exit hazard increased strongly in 1998 and 1999 in East but not in West Germany. This indicates that a change in the subsidy policy for East Germany by the end of 1998, namely the expiration of the Development Area Law (*Fördergebietsgesetz*), a policy measure which aimed on stimulating investment by means of generous bonus depreciations (see e.g., Eichfelder/Schneider, 2013), has reduced the liquidity and profitability of establishments in East Germany which resulted in a higher number of closures. Third, since the turn of the millennium the difference in establishments' exit hazard between East and West Germany has become smaller and towards the end of the observation period it is often no longer statistically significant.

Concerning the aim of economic convergence between East and West Germany the recent development of new establishments' survival chances reported here sounds like a good message. The economic situation in East Germany seems to have stabilized and improved so far that establishments in East Germany face survival prospects that do not differ significantly from those of their West German counterparts. Relatedly, Fritsch et al. (2012) report that self-employment rates have converged between East and West Germany. This is an important aspect in the transformation process since the socialist regime of the former GDR systematically undermined self-employment and entrepreneurial activity (Fritsch et al., 2012; Paqué, 2010). With respect to the economic development in East Germany one can therefore assert that some success has been achieved. At the same time one should keep in mind that firms in East Germany still receive more subsidies than their West German counterparts (Paqué, 2010, Bundesministerium der Finanzen, 2013). It thus remains an open question how firms in East Germany would perform without that higher level of subsidization.

One should also note that more than 20 years after reunification, the overall economic situation in East Germany is still not equal to that in West Germany. In 2012 per capita GDP in East Germany was still about 30 percent lower than in West Germany and East Germany still faces several problems such as a high level of unemployment and a strongly ageing society.[15] This suggests that a lot of work remains to be done until the economic conditions in East Germany achieve a level which is comparable to that in West Germany.

[15] See, e.g., Ragnitz (2009) for a detailed evaluation of the economic situation in East Germany 20 years after the fall of the Berlin wall.

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Appendix

Notes: private sector without agriculture and mining, reference: West Germany 1994 (hazard ratio=1), Cox proportional hazards model, further covariates as in Table 2, results are available on request.

Figure A1a: Hazard ratios of newly founded establishments by year, 1994 – 2008, manufacturing

Notes: private sector without agriculture and mining, reference: West Germany 1994 (hazard ratio=1), Cox proportional hazards model, further covariates as in Table 2, results are available on request.

Figure A1b: Hazard ratios of newly founded establishments by year, 1994 – 2008, construction

Notes: private sector without agriculture and mining, reference: West Germany 1994 (hazard ratio=1), Cox proportional hazards model, further covariates as in Table 2, results are available on request.

Figure A1c: Hazard ratios of newly founded establishments by year, 1994 – 2008, services

Notes: private sector without agriculture and mining, reference: West Germany 1994 (hazard ratio=1), Cox proportional hazards model, further covariates as in Table 3, results are available on request.

Figure A2a: Hazard ratios of newly founded establishments by cohort (year of entry), 1994–2008, manufacturing

Notes: private sector without agriculture and mining, reference: West Germany 1994 (hazard ratio=1), Cox proportional hazards model, further covariates as in Table 3, results are available on request.

Figure A2b: Hazard ratios of newly founded establishments by cohort (year of entry), 1994–2008, construction

Notes: private sector without agriculture and mining, reference: West Germany 1994 (hazard ratio=1), Cox proportional hazards model, further covariates as in Table 3, results are available on request.

Figure A2c: Hazard ratios of newly founded establishments by cohort (year of entry), 1994 – 2008, services

Table A1

Number of entries by year

Year	West Germany	East Germany
1994	51,904	27,634
1995	52,496	24,945
1996	51,860	21,391
1997	51,801	20,116
1998	54,330	28,655
1999	64,304	30,239
2000	61,128	22,017
2001	58,142	19,590
2002	53,882	17,876
2003	50,416	16,798
2004	52,911	15,883
2005	54,049	15,718
2006	53,945	15,068
2007	55,787	15,336
2008	54,426	14,692
Total	821,381	305,958

Notes: private sector without agriculture and mining.

Table A2

Descriptive statistics, 1994 – 2008

Variable	West Germany		East Germany	
	Mean	Std. Dev.	Mean	Std. Dev.
No. of employees	4.7496	23.2397	4.3601	17.2945
Percentage of low qualified employees	11.7474	27.9453	6.1979	20.6308
Percentage of skilled occupations	50.2021	44.5366	47.4700	44.7240
Percentage of highly skilled occupations	7.6037	23.3894	8.1543	23.9768
Percentage of females	48.5168	43.6825	48.6766	44.5463
Median age of the workforce (in years)	35.5888	9.7883	36.3633	9.7192
No. of establishments	821,381		305,958	

Notes: newly founded establishments, private sector without agriculture and mining, variables refer to the initial workforce.