



# JENA ECONOMIC RESEARCH PAPERS



# 2008 – 076

## **The Direct Employment Effects of New Businesses in Germany Revisited – An Empirical Investigation for 1976 - 2004**

by

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[www.jenecon.de](http://www.jenecon.de)

ISSN 1864-7057

The JENA ECONOMIC RESEARCH PAPERS is a joint publication of the Friedrich Schiller University and the Max Planck Institute of Economics, Jena, Germany. For editorial correspondence please contact [markus.pasche@uni-jena.de](mailto:markus.pasche@uni-jena.de).

Impressum:

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The Direct Employment Effects of New Businesses in Germany  
Revisited –  
An Empirical Investigation for 1976 - 2004

Yvonne Schindele\*      Antje Weyh†

October 2008

**Abstract**

Based on an improved and extended database, the Establishment History Panel, we extend the analysis of Fritsch & Weyh (2006) by investigating the development of employment in German start-up cohorts for the period 1976 to 2004. We confirm the typical pattern of an initial increasing and then soon decreasing number of employees in start-up cohorts. Furthermore, we provide some of the first evidence for the "liability of aging" phenomena in Germany. Older firms face a relatively high risk of failure. Although only the largest 25% of the surviving entries grow in terms of employment, after 25 years the number of employees in these relatively large businesses strongly declines.

JEL-Classification: D21, L10, L26, L29, M13

Keywords: Employment change, new firms, start-up cohorts, liability of aging

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## 1 Introduction

The question of whether new firms create jobs remains to be answered. Several studies come to the conclusion that only a rather small proportion of new businesses actually create jobs (Storey 1994, 113-119, Boeri & Cramer 1992, Wagner 1994 and Fritsch & Weyh 2006)<sup>1</sup>. In Germany, there is evidence that the number of employees in a certain cohort rises in the first year only and then declines below the initial level. However, this pattern may differ considerably between industries, regions, and years. Fritsch & Weyh (2006) found relatively low survival rates and employment of start-ups in the service sector; however, Engel & Metzger (2006, 87) found comparatively high values in manufacturing and service industries classified as technologically advanced or high-tech. Furthermore, Weyh (2006, 64-68) reports differences between agglomerations, moderately congested areas, and rural areas in Western Germany.

Compared to earlier studies on the evolution of start-up cohorts, our analysis has the advantage of following, for the first time, cohorts over a remarkably long span – 29 years. We are thus able to extend the analysis of Fritsch & Weyh (2006) across a considerably longer time period. Whereas several studies (e.g. Brüderl & Schüssler 1990, Geroski et al. 2007 or Fritsch 2004) show that new firms are characterized by a relatively high risk of failure during the first years of existence (the "liability of newness"), other authors find that older firms face a relatively high likelihood of being closed down.<sup>2</sup> Due to the long time period available for our analysis, we are the first to be able to detect such an "old age" phenomenon for German start-ups. Our analysis of entry cohorts from 1976 to 2004 confirms the pattern as described above. The number of employees rises in the first years of existence and then steadily decreases to about 50% of the initial level by the end of our observation period. We see that early entries from the 1980s appear to be more successful than late entries. After the first five or seven years (depending on industry and region), nearly 50% of the new firms are out of business; 29 years after start-up, only 15% still exist. With regard to the hazard rates, we found a flat u-shaped pattern with relatively high hazard rates for the young establishments, indicating that the risk of closure is particular high in the first years after foundation. In the medium term, hazard rates become

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<sup>1</sup>For a review of the evidence, see Geroski et al. (2007) and Fritsch et al. (2006).

<sup>2</sup>Agarwal & Gort (1996), Aldrich & Auster (1986), Carroll & Hannan (2000), Jovanovic (2001) and Ranger-Moore (1997).

stable. After about 18 years, the likelihood of closure rises again, without strong differences between industries. Another interesting finding is that only the largest 25% of the surviving businesses grow, but after 25 years, the number of employees in these businesses declines sharply. The contribution that the start-up cohorts made to total employment in 2004 over the whole period is twice as high in services than in manufacturing. Taking our lead from Fritsch & Weyh (2006) we proceed as follows. After a description of our database and some measurement issues, we present the evolution of 29 start-up cohorts for Western Germany. Section 4 sets forth facts about the size distribution and employment concentration over time. Finally, we look at how several cohorts contribute to total employment in the last year of our observation period.

## 2 Data and measurement

Information on the evolution of start-up cohorts and on overall employment is taken from the Establishment History Panel. This database is an improved and extended version of the database used by Fritsch & Weyh (2006). It provides information about all establishments throughout Germany that have at least one employee required to make social security contributions as of June 30 of a given year. The observation period for Western Germany is 1976 to 2004.<sup>3</sup> The data source of the Establishment History Panel is the Employee and Benefit Recipient History file, in which the data on individuals are aggregated to the establishment level using the establishment numbers (Spengler 2008). Along with the important advantage of having a much longer time period for our analysis, we also make use of additional information for several variables. For example, the database gives us current information about the first and last year of appearance in the Benefit Recipient History file. Furthermore, we can distinguish between the number of full-time equivalents versus full-time, part-time, and marginal part-time employees. For the purpose of this paper, we concentrate on full-time equivalents.<sup>4</sup> In addition,

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<sup>3</sup>Although the Establishment History Panel is available for the years from 1975 to 2005, we exclude the first and the last year. The first year of observation is problematic in that it is shown as the first year of appearance for all establishments regardless whether some businesses started before 1975. We also exclude the last year of our analysis (2005) because the employees are not fully registered yet.

<sup>4</sup>The share of part-time employees in total employment in the cohorts amounts to 17% in 2004.

the Establishment History Panel is always up-to-date in terms of political reforms in the German districts. Overall, we have at our disposal a database that provides information about the number and status of employees in 1.3 to 2.5 million establishments per year. Because the database records only businesses with at least one employee other than the owner, start-ups without any employees are not included. This leads to a slight underestimation of the direct contribution of new business formation to employment. However, new businesses enter the database as soon as they have their first employee.<sup>5</sup> Furthermore, we separate original start-ups from spin-offs, outsourcing, and reorganizations by excluding new entities with more than 20 employees in the first year of their existence. As a result, a considerable number of new subsidiaries of large firms are not included in the start up-cohorts. We perform the analysis for all private-sector industries taken together as well as for manufacturing and services separately.<sup>6</sup> To identify the general development patterns of entry cohorts, we aggregate all cohorts with information for a certain year and calculate average values. Since we are also interested in the survival and mortality of different cohorts, a cohort survival rate is defined as the share of new businesses that survived up to a certain year after start-up. The hazard rate is measured as the share of new businesses that exited the market in a year  $t$  given that they survived until  $t - 1$ . Other indicators, such as the number of employees at different percentiles of the size distribution and the concentration of employment in the largest businesses of the cohort, are also provided. Finally, we report the employment share of different yearly start-up cohorts in total employment at the end of our period of analysis in 2004.

### 3 New business survival and employment development

As a first impression of new firm formation, Figure 1 shows the evolution of start-up activity in Western Germany over the period from 1976 to 2004.

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<sup>5</sup>There may be some misspecification in the data because the year of hiring a first employee is taken as the time of start-up even if the establishment has already existed before without any employee subject to obligatory social insurance or with marginal part-time employees before 1999.

<sup>6</sup>The primary and public sector are always excluded due to different market mechanisms in such sectors.

Table 1 presents the average values of the number of start-ups, their initial size, and the share of start-ups with more than one employee. On average, 93,897 new establishments are formed each year when looking at all private-sector industry as a whole, of which 23% are in manufacturing and 77% in the service industry. Although the shares are relatively stable over time, the number of start-ups varies between 66,148 and 115,859. The average initial size is 2.05 employees, which is larger in manufacturing (2.76) than in services (1.84).<sup>7</sup>

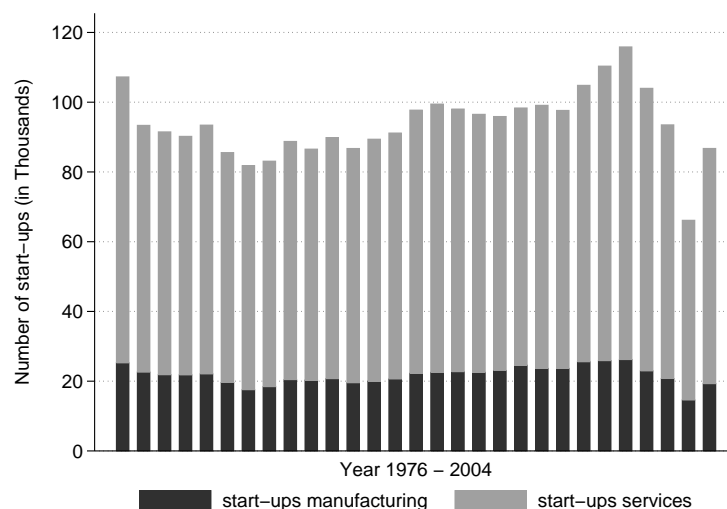


Figure 1: Number of start-ups

Looking at the evolution of employment, as well as at hazard and survival rates, in different entry cohorts, especially for those that are older than 18 years, some new findings can be added to the results of Fritsch & Weyh (2006). In Figure 2 the individual cohorts are represented by thin dotted lines and the thicker line gives the average value over all cohorts for which information in the respective year is available. Since all reliable observations end in the year 2004, the basic year of a cohort can be identified by the length of the respective line.<sup>8</sup> To compare the evolution of employment between

<sup>7</sup>Compared to Fritsch & Weyh (2006), the results are a little different because of the more precise and more complete database.

<sup>8</sup>For example, the start-ups of the year 1978 are represented by the 27 long thin dotted lines.

Table 1: Average number of start-ups, initial employment and share of start-ups with more than one employee in yearly cohorts from 1976 to 2004<sup>a</sup>

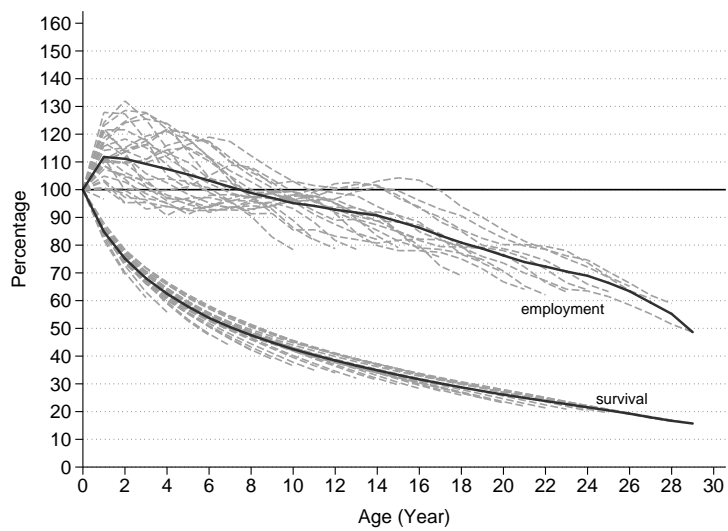
	Number of start-ups	Average initial size	Share with more than one employee
All private industries	93,897 (9,705)	2.05 (0.13)	34.79 (2.62)
Manufacturing	21,760 (2,610)	2.76 (0.14)	46.66 (2.54)
Services	72,137 (7,247)	1.84 (0.16)	31.21 (2.96)

<sup>a</sup>Standard deviation in parentheses.

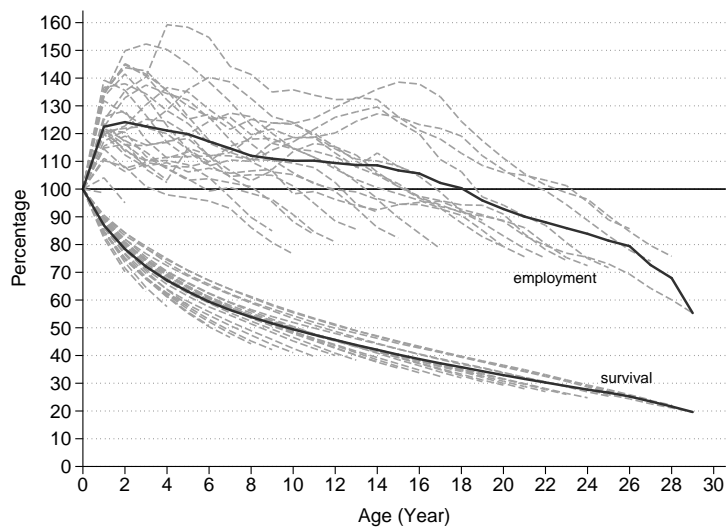
cohorts, we set the number of employees in the start-up year to 100%.

In general, the early start-up cohorts tend to be more successful in terms of employment than the start-up cohorts of later years. Furthermore, we can confirm the overall pattern discussed in Section 1 – the number of employees in a certain cohort increases in the first years only and then decreases to below the initial level. After about eight years, employment falls below the initial level and after 29 years only half the number of employees still have jobs in all private-sector industries. Since most of the start-up activity takes place in the service sector, the employment development in services is quite similar to the results for the private sector as a whole. The results for manufacturing are somewhat different. The number of employees in the manufacturing start-up cohorts stays higher than the initial level for a longer period of time than it does in the services sector. From year 18 on (which could not have been observed by Fritsch & Weyh 2006), employment declines until it reaches 55% in year 29. The manufacturing start-ups of the early years are also more successful than those in services, in that peak employment is about 160% of the initial level as compared to 130% for services. In services, the remaining 50% of the still employed after 29 years work in just 15% of the initial cohort plants, i.e., only 15% of all newly founded business cohorts survive the entire observation period. In manufacturing, nearly 20% endure the 29 years.

In a detailed analysis of the cohort-specific hazard rates (see Figure 3), we confirm the "liability of newness" phenomenon noted in many other empirical analyses. The hazard rates for young businesses are relatively high, indicating a high risk of failure in the first years of existence. For the next



All private sectors



Manufacturing

Figure 2: Evolution of employment and survival rates in entry cohorts

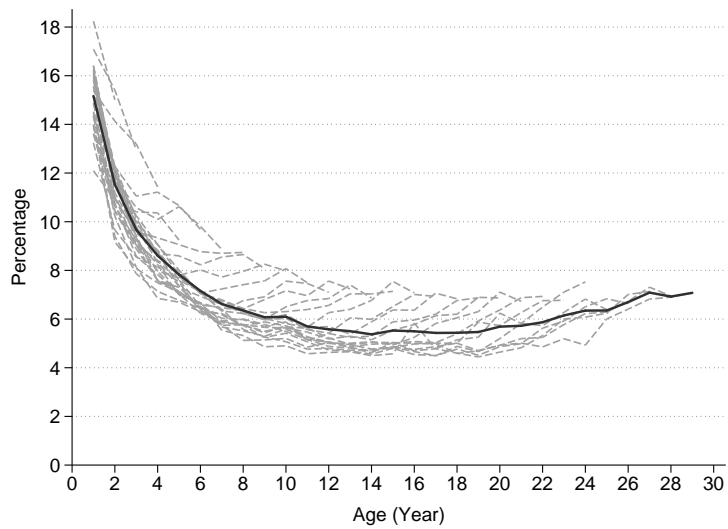
years, the hazard rates first decline and then remain constant. After about 18 years, the hazard rates start increasing again, indicating that the likelihood of a business being closed becomes greater from this age on. Thus, our long observation period allows us to provide the first German evidence for the "liability of aging" phenomenon (Figure 3). Several theories regarding this phenomenon can be found in the literature. For example, Barron et al. (1994) and Ranger-Moore (1997) distinguish between the "liability of obsolescence," in which an erosion of technology, products, business concepts, and management strategies occurs over time, and the "liability of senescence," which has to do with the sclerotic inflexibility of long-established organizations. Considering that most businesses fail after about 20 years, the problem of finding a successor willing to take over the business might also be a reason.<sup>9</sup> Overall, we find higher hazard rates in services than in manufacturing. Regarding the survival rates, we note that only very few newly founded businesses survive. Only about 49% of new businesses in manufacturing survive the first 10 years and only 20% make it through the entire observation period of 29 years. In service industries, 40% survive the first 10 years and only 15% survive the whole period.

## 4 The size distribution of new businesses and the concentration of employment

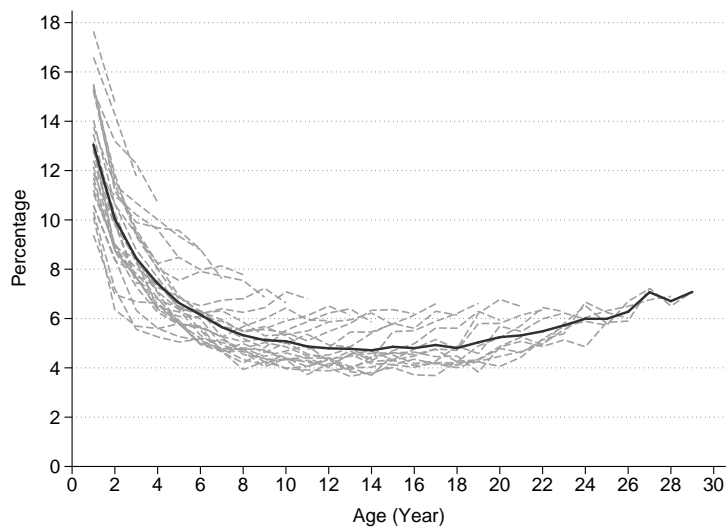
Since only a few of the surviving businesses grow and create jobs, it is interesting to look at the size distribution within entry cohorts over the whole observation period of 29 years. Figure 4 shows different percentile lines and provides information about the number of employees in the largest 5%, 10%, 25%, and 50% of the surviving businesses. As Fritsch & Weyh (2006) previously demonstrated, at least 50% of the entries start with only one employee since the median for initial employment is one. Regarding the largest 5% of the start-ups, we find that the businesses in manufacturing start with 11 employees; the number for services is seven. Furthermore, surviving businesses in manufacturing tend to grow larger than those in services. However, only

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<sup>9</sup>Since the identification number of establishments in the dataset is personally bound to the owner, a takeover of a business is always registered as a new business. Therefore, we are not able to distinguish between businesses that need to be closed down because a successor cannot be found and businesses that continue to exist with a new owner. Therefore, there might be a slight overestimation of the increasing hazard rates after about 18 years.



All private sectors



Manufacturing

Figure 3: Hazard rates in entry cohorts

the largest 25% of the surviving entries grow with an average growth rate of 150%.<sup>10</sup> In addition, we find that the 25% largest surviving businesses reach their maximum after about 25 years. Afterward, there is a dramatic decline until the end of our observation period. Indeed, after nearly 20 years, only a few cohorts are considered, but these still cover a whole industry life cycle period. Therefore, we can assume with a high probability that this is not an observation specific only to these cohorts. In fact, this situation can be viewed as a predecessor to the liability of aging phenomenon in the sense that surviving businesses lose efficiency and become less competitive and, therefore, reduce the size of their workforce prior to eventually exiting the market completely.<sup>11</sup> To shed some light on this dramatic decline of employment in large businesses, we also differentiate employment growth and survival, as well as hazard rates, by the average size of the businesses. The results in Table A.1 in the Appendix support the findings in Figure 4 as the largest 5% of all businesses show strongly (not monotonically) increasing employment until the 13th year after foundation and then a similar magnitude in decline, although the survival rates of the 5% largest businesses are always the largest over all observed percentiles.

The results concerning the development in entry cohorts suggests a concentration of employment in only few of the start-ups (Figure 5). After 10 years, about 23% of the jobs are concentrated in the largest 1% of the initial start-ups. Forty-five percent of employment is in the largest 5% and more than 82% of the employees work for the largest 25% of the initial start-ups. Over time there is a continuously increasing employment concentration for the largest 25% of surviving businesses. However, a pronounced increase in concentration (nearly 10 percentage points) is found only in the first year after start-up. Looking at the two industry sectors separately, we observe a much lower concentration for manufacturing during the first years of existence. Over time, the concentration of the two industries slightly diverges over the years.

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<sup>10</sup>Looking at the first graph of Figure 4 shows that the number of employees in the largest 25% surviving businesses grow from eight employees to 20 employees, yielding a growth rate of 150%.

<sup>11</sup>As mentioned before, the sharp decline after 20 years can also be explained by business takeovers or to the problem of finding a successor that force some businesses to exit the market.

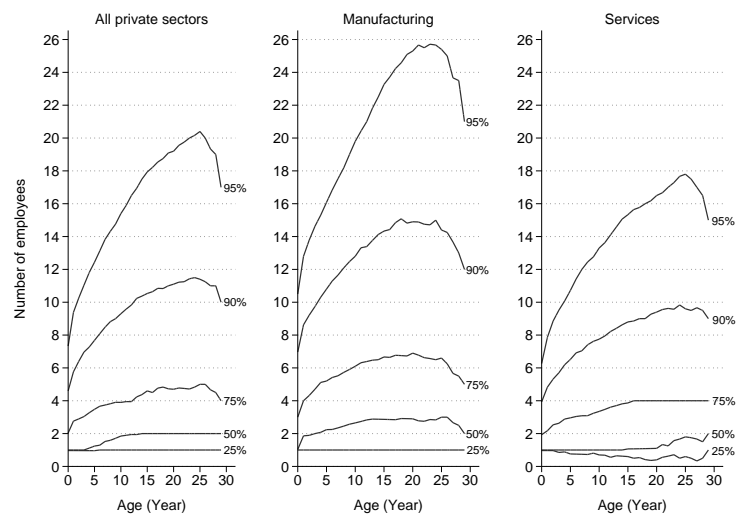


Figure 4: Development of the size distribution in entry cohorts (percentiles)

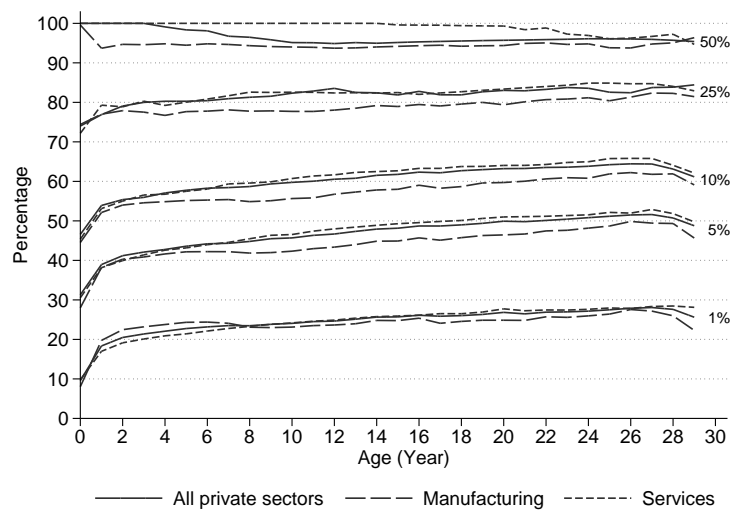


Figure 5: Employment concentration in the largest businesses by age of cohort

## 5 The contribution of recent start-ups to current employment

So far, we have focused our analysis on the evolution of employment in entry cohorts as well as on their survival. However, since the question of whether new businesses contribute to employment is of high interest, especially in the political realm, we now investigate the contribution of different entry cohorts to overall employment. The employment share of each of the 29 entry cohorts in total employment amounts to about 37% for all private industries. Since most start-ups occur in the service sector, the share is higher in services (49%) than in manufacturing (25%). Over time, the contribution of new businesses to overall employment in 2004 increases and is more pronounced in services than in manufacturing (see Figure 6), i.e., the service industry consists of more younger establishments that contribute to overall employment. Returning to our size discussion, the average employment share of the five largest businesses in each cohort amounts to nearly 20% of all private-sector industry employment (manufacturing: 12%; services: 27%). In short, the surviving older cohorts have more employees.

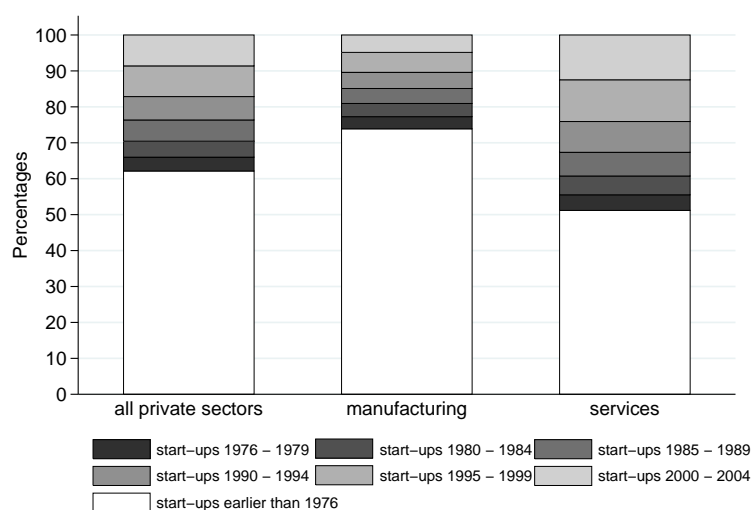


Figure 6: Share of cohort employment in surviving businesses (in percent)

## 6 Conclusion

Our analysis of entry cohorts from 1976 to 2004 has discovered that early entry cohorts tend to be more successful in terms of employment than the start-ups of later years. Furthermore, we confirm the typical pattern of a first increasing and then decreasing number of employees in start-up cohorts ("liability of newness"). Our long observation period allowed us to uncover the first evidence of the "liability of aging" phenomenon for Germany. After about 18 years, hazard rates start to increase, that is, the risk of closure increases, and this is generally true across all industries. Since only a few of the surviving businesses grow and create jobs, we looked at the size distribution and average employment concentration. We found that only the largest 25% of the entries grow in terms of employment, with an average growth rate of 150%. But after 25 years, the number of employees in the largest 25% of the surviving businesses declines sharply. This situation, which may be predecessor to the "liability of aging" phenomenon, is a result of strongly declining employment in the largest 5% of all businesses from the 13th year of their existence on, although the survival rate is comparably larger at this age and the hazard rates lower. Understanding this phenomenon better will involve econometric analysis, an intended goal of our ongoing research. Although the observation period for Eastern Germany is much shorter than for Western Germany, it would be worthwhile to explore this topic in that setting, as well.

## Appendix

Table A.1: Average employment growth, survival as well as hazard rates in yearly cohorts from 1976 to 2004

		start-	after . . . years					
		up	5	10	15	20	25	29
Employment								
All	$\leq p50$	100	38,10	24,16	16,46	11,00	7,59	4,34
	$> p50, \leq p75$	100	73,39	56,25	44,06	34,48	27,06	19,41
	$> p75, \leq p90$	100	92,16	78,61	66,58	53,49	46,27	37,26
	$> p90, \leq p95$	100	104,92	96,16	81,26	67,04	57,21	47,18
	$> p95$	100	263,36	294,50	243,18	222,54	200,79	174,35
Manufacturing	$\leq p50$	100	56,78	42,33	32,38	24,22	18,31	13,01
	$> p50, \leq p75$	100	88,19	74,55	63,72	52,65	43,85	32,52
	$> p75, \leq p90$	100	95,12	85,65	75,58	62,25	53,03	46,15
	$> p90, \leq p95$	100	105,21	101,92	81,72	67,92	58,22	45,36
	$> p95$	100	427,46	448,42	315,21	296,26	265,89	235,62
	$\leq 50$	100	32,90	19,81	13,14	8,69	5,97	3,93
	$> 50, \leq p75$	100	69,49	50,76	38,98	28,97	21,81	15,04
Services	$> p75, \leq p90$	100	88,35	72,67	59,87	48,41	41,64	31,81
	$> p90, \leq p95$	100	102,42	90,38	76,56	63,35	54,37	45,33
	$> p95$	100	229,05	258,20	234,37	212,44	193,00	165,62
Survival								
All	$\leq p50$	100	50,24	33,90	24,26	17,22	11,71	6,93
	$> p50, \leq p75$	100	62,26	46,42	36,56	29,49	23,38	18,03
	$> p75, \leq p90$	100	68,29	54,23	44,48	36,54	30,99	25,49
	$> p90, \leq p95$	100	72,30	58,77	48,83	40,92	34,38	29,09
	$> p95$	100	78,78	67,64	57,48	49,83	42,02	35,74
Manufacturing	$\leq p50$	100	57,52	42,33	32,24	24,35	17,96	11,90
	$> p50, \leq p75$	100	67,33	54,56	45,69	38,82	32,38	24,66
	$> p75, \leq p90$	100	68,49	56,60	48,19	40,84	34,71	30,88
	$> p90, \leq p95$	100	69,25	57,39	48,19	40,41	34,23	29,74
	$> p95$	100	78,79	68,58	58,95	51,79	43,00	35,96
Services	$\leq 50$	100	47,25	31,15	21,93	15,50	10,45	6,61
	$> 50, \leq p75$	100	63,29	45,82	35,80	27,90	21,29	15,60
	$> p75, \leq p90$	100	67,66	52,25	42,02	34,77	29,26	23,79
	$> p90, \leq p95$	100	72,29	57,73	47,06	39,21	32,69	27,96
	$> p95$	100	80,46	68,69	58,19	49,85	42,18	36,03

to be continued . . .

Table A.1 continued:

		start-	after ... years					
		up	5	10	15	20	25	29
Hazard								
All	$\leq p50$	.	9,70	7,97	7,53	8,47	10,74	17,63
	$> p50, \leq p75$	.	8,00	5,99	5,59	5,97	7,02	11,36
	$> p75, \leq p90$	.	6,37	4,88	4,64	4,71	5,39	8,20
	$> p90, \leq p95$	.	5,62	4,63	4,26	4,45	5,45	6,42
	$> p95$	.	4,52	3,67	3,89	3,98	4,41	4,69
Manufacturing	$\leq p50$	.	8,14	6,57	6,65	7,98	9,34	16,36
	$> p50, \leq p75$	.	6,28	4,38	4,50	4,76	5,87	9,15
	$> p75, \leq p90$	.	5,74	4,30	3,91	4,09	4,94	6,67
	$> p90, \leq p95$	.	5,50	4,33	4,25	4,26	4,01	3,12
	$> p95$	.	4,32	3,60	3,39	3,79	4,54	3,63
Services	$\leq 50$	.	10,30	8,31	7,74	8,54	11,07	17,36
	$> 50, \leq p75$	.	8,27	6,65	5,92	6,18	7,48	11,73
	$> p75, \leq p90$	.	6,87	5,38	5,00	5,12	5,48	8,55
	$> p90, \leq p95$	.	5,94	4,92	4,86	4,68	5,30	6,52
	$> p95$	.	4,50	3,78	4,05	4,24	5,10	6,03

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