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Small Business Mortality in Germany: A Comparison Between Regions and Sectors

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ABSTRACT

Small Business Mortality in Germany: A Comparison Between Regions and Sectors[*]

Does geographic region or industry differences matter more in determining the likelihood of survival ? To answer this question, we compare the exit rates of new business firms for two German cities across a broad range of manufacturing and non-manufacturing sectors. Based on all business firms registrations and deregisterations for Berlin and Munich between 1981 until 1988, the variation in exit rates is hypothesized to be the result of differences in size, legal form and industry type (i.e., manufacturing or non-manufacturing). We find that geographic region and industry differences both play a significant role in influencing the death probability. Furthermore, the results show that size and legal form influence the exit rate in a similar manner, but industry effects are substantial across regions and within sectors.

ZUSAMMENFASSUNG

Sterberisiko von Kleingewerbeunternehmen in Deutschland: Ein Vergleich zwischen Regionen und Branchen

Üben regionale Faktoren oder Industriecharakteristika einen stärkeren Einfluß auf die Überlebenswarscheinlichkeit von Unternehmen aus? Um diese Frage zu beantworten, vergleichen wir Austrittsraten von neugegründeten Unternehmen des verarbeitenden und nichtverarbeitenden Gewerbes in zwei deutschen Städten. Die Untersuchung basiert auf den Firmenanmelde- und abmeldedaten für Berlin und München zwischen 1981 und 1988. Die Forschungshypothese lautet: Die Sterberaten werden durch die Unternehmensgröße, die Rechtsform und durch den Industrietyp (verarbeitendes bzw. nichtverarbeitendes Gewerbe) beeinflußt. Wir fanden heraus, daß die regionalen Faktoren und die Industriemerkmale einen signifikanten Einfluß auf die Sterbewahrscheinlichkeit haben. Außerdem zeigen die Ergebnisse, daß die Unternehmensgröße und die Rechtsform einen Einfluß auf die Austrittsraten haben, aber die Industrieeffekte sich erheblich nach den Regionen und den Wirtschaftssektoren unterscheiden.

[*] We wish to thank Jana Rückert for her computational assistance. All errors remain our responsibility.

I. Introduction:

In the past, a wave of growing empirical literature in industrial organization has emerged which shed light on the industry dynamics. Several studies (see Geroski and Schwalbach 1991) reported on the research related to the extent, causes and consequences of firm entry into the market. More recently, Geroski (1995) as well as Audretsch and Mata (1995) provided evidence that one of the major conclusions from entry studies is that the process of entry does not end with entry itself. Rather, it is what happens to new firms subsequent to their entry that sheds considerable light on industry dynamics. The greatest obstacle in analyzing the post-entry performance of firms has been the lack of longitudinal data bases that identify the actual start-up and closure dates of new firms.

Several studies have analyzed the post entry performance of new firms and their determinants. Hall (1987) found that the survival rate of new entrants is low, but that the survival probability is positively related to firm size and age. Phillips and Kirchoff (1989) showed that the probability of survival increases with firm age. They also found that survival rates varied by industry, with manufacturing showing the greatest average survival rate. Dunne et al. (1989) showed that plant failure rates decline with size and age as do the growth rates of surviving plants. One of their conclusions was found in their analysis of post-entry performance was that the (entering) firms most likely to survive and grow were firms that were diversifying into other industries. Audretsch (1991) examined the question of survival in order to identify the extent to which new-firm survival varies across a broad range of manufacturing industries, along with the determinants of new-firm survival. He found that not only is the survival probability differentiated systematically between firms but also between industries. Wagner (1994) analyzed post-entry performance of manufacturing industries, and found that entrants face a high risk of failure, and that risk tended to increase during the first years and decrease afterwards. Furthermore, the study showed no clear-cut nexus between start-up size and probability of survival. Audretsch and Mahmood (1994; see also Mahmood 1992) used a longitudinal data base of manufacturing establishments and found that the presence of high scale economies, a highly technological environment and a relatively small initial start-up size tended to elevate the exposure of risk. Their 1995 study showed that establishment-specific characteristics played an important role in shaping the exposure to risk confronting new establishments. Mata and Portugal (1994) found that new firm failure rate varies negatively with firm's start-up size, the number of plants operated by the firm and the industry growth rate, and positively with the extent of entry in the industry. Storey and Wynarczyk (1995) examined factors influencing the survival/non survival of business start-ups, and provided evidence of talent indicators which determine whether or not business will survive. Audretsch (1995) used the theory of firm selection and industry evolution[1] (Javanovic, 1982) to deduce major hypotheses about the factors shaping the post-entry performance of new firms, and the factors determining new-firm growth and survival.

[1] Jovanovic (1982) provides a theory of selection and industry evolution, i.e. firms learn about their efficiency as they operate in the industry. The firms may begin at a small- even suboptimal scale of output- and then, if merited by subsequent performance, expand. Those firms that are successful will grow, whereas those that are not successful will remain small and may ultimately be forced to exit from the industry if they are operating at a suboptimal scale of output.

Almost all of the studies mentioned above focus their analysis on manufacturing industries only. However, none of these studies provide any empirical evidence as to whether firm survival varies across regions or between manufacturing and non-manufacturing industries[2]. The purpose of this paper is to analyze the extent to which firm survival varies across a broad range of manufacturing and non-manufacturing industries aswell as between regions, alongwith the determinants of survival probability. The following section describes the data, variables and estimation technique. Section III presents the empirical results, and finally, the last section provides the conclusions.

II. Data and Methods:

The present study is based on all business registrations and deregistrations for Berlin and Munich in the period from 1981 to 1988. In Germany, people or firms who want to start a new business first have to register at the local Chamber of Commerce to get a trade license. If the business stops operation, the owner is then required to deregister it. With the friendly support of the Berlin and Munich Chambers of Commerce for Industry and Trade, we were able to obtain information on 55,843 registrations for Berlin and on 64,935 registrations for Munich. It is important to note that our registrations are only for manufacturing, trade and service sectors. Crafts, agri-business, physicians, architects, and lawyers are not included in the data set. The data contain only rudimentary information on new firms: the dates of registration and an (eventual) deregistration, the branch of industry, the number of persons the founder expects to employ in the first year (including him/herself), and the legal form. This restricts our analysis in that we can only analyze the effects of three variables: industry, size, and legal form. Exit rate effect of other variables are reported in the work of Brüderl et al. (1992, 1996; see also Brüderl and Preisendörfer, 1996).

Dummy variables are constructed for industry, size and legal form (see Table 1). For our analysis we condensed the very detailed branch classification into 16 branch-dummies. It can be seen that overall only a small percentage of the new firms are founded within manufacturing. In Berlin, however, these firms are somewhat more frequent. The single most frequent branch in both cities is retail trade, and then the ordering differs. In Berlin restaurants take second place, whereas in Munich consulting services take second. Concerning the number of employees, it must be noted that the majority of the founders did not give any information about this number at the time of registration. We did not drop these cases, but used them as a reference group for size effects. The results of our multivariate analysis will show that these founders probably had no employees at all, and did not answer this question, because they assumed that it did not apply to them. Finally, we use a dummy for firms that, in addition to business registration, had to be commercially registered as well. These are mostly firms with limited liability (GmbH). We did not distinguish further between the different types

[2] A large literature exists concerning empirical evidence on new firm formation and regional development. (See Fritsch , 1992; Audretsch and Fritsch, 1994; Harhoff, 1995), See also Danson (1995): Special issue on firm formation and regional economics development.

of commercially registered firms, because additional analysis showed that all types had roughly similar survival chances.

Our dependent variable[3] is dichotomous and constructed from the information on registration and deregistration dates. It takes the value of one if a firm has survived and zero otherwise. It would have been desirable to use the information on the timing of these events and perform event history analyses on the data. This had been done in earlier work with the Munich data (Brüderl and Schüßler, 1990). However, for the Berlin data, deregistration dates were not very reliable since many firms did not deregister upon stopping operation. In 1988 the Chamber of Commerce began a purging action, whereby most of these "Karteileichen"(inactive members) were deregistered. Unfortunately, for these cases, only the purging date was recorded and not the actual end date. Therefore, we could not use the information on timing for our analysis. We use only the binary information if the firm was deregistered at the end of 1988. As can be seen from Table 1, 32% firms were deregistered in Berlin and 46% in Munich .

This huge difference in the overall exit rate is a first hint that business environments within a country show much regional variation. The much lower exit rate for Berlin might be due to its status as an enclave city during those years.

We used probit-regression methods to estimate the effects of our dummies on the probability of death. We report marginal effects at the mean of all covariates. Our estimates, therefore, represent the difference in the death probability between the particular group and the reference group (consulting service) evaluated at the mean of the other covariates.

Finally, some remarks on the overall quality of registration data are in order. Because of the legal obligation to register, we believe that virtually all new firms founded in this period are in our data set. As mentioned above, the information on deregistrations seems much less reliable. Both Chambers of Commerce, however, carried out purging action during our observation period. Therefore, we believe that the simple information of whether a firm has deregistered at the end of 1988 is not distorted too much. Another point is the presence of "fake" businesses. It is well known that some people register a new firm mainly for tax purposes. We have no indication as to how many firms constitute this type of business, but additional evidence on the Munich data (gathered via a survey of sample registrations) indicates that at least 11% of the registrations are such "fake" businesses (cf. Kiefl, 1993). These are not "real" businesses and their presence in our data might distort the results.

[3] Our dependent variable is (0): failure or (1): survival by definition, OLS estimation would produce inefficient variances of the estimated coefficient. We follow the procedure by Judge et al. (1980) to avoid this statistical inefficiency.

III. Empirical Results:

Figures 1a and 1b presents some survivor functions compiled and plotted using the life table method[4]. The survivor function gives, for each time point, the proportion of those establishments which are still alive at the time period t. In Figures 1a and 1b we see the survivor functions of five industries (textile, wholesale trade, transportation, insurance and electric), selected from the whole industry pool since we were unable to plot all industries together. The most important observation from the figures is that the survivor functions for all five industries declined over time: this general pattern being consistent for all industries and in both regions. The dispersion of the survivor functions for these five industries differs for both regions for at least the first four years: after which, the dispersion becomes wider for the Berlin region. In general, dispersion is much larger for industries in Munich as compared with the industries in Berlin. Among the five industries, the electric industry shows the highest proportion of survivors. Almost 50% of the firms in this industry, in both regions, survived after eight years. The survival rate of the other four industries differs within the region as well as across the two regions. The proportion surviving for all five industries varies from between 30 to 50 % after eight years. Schasse (1992) estimated survival rates for Lower Saxony, and found that almost 50 % of the new firms survived after a ten year time period. This result is quite consistent with our estimates for Berlin and Munich.

Table 2 shows the results of our probit-regressions on the probability of exit (at the end of 1988) of new business firms in Berlin and Munich. The most striking observation from the table is that the effects of size and legal form are very similar in both cities, whereas the industry effect differs substantially between the two cities. The size variable shows quite a similar pattern. In both regions the death probabilities decrease as the firm size increases (i.e., the more employees a firm has, the lower the probability of death). This pattern is fairly regular for Berlin firms. For Munich the probability of exit is not lower for firms with only one employee, but from then on larger firms clearly have an advantage. This finding is quite consistent with the earlier results of Brüderl and Schüssler (1990). They show that the size variable might have an influence in shaping the exposure to the risk, and find that the values of the maximum rate decline monotonically with size. This result is also consistent with Albach (1991), in which he analysed a cohort of 100 German stock companies for the time period 1953-1960, and showed that smaller firms (less than two million shareholder´s equity) exihibited unstable growth rates as compared with the larger firms. Mahmood (1992) also showed that by increasing start-up size, the exposure to risk confronting the establishment can be reduced and this differs between low and high-tech industries.

A pattern consistent for both cities is the much lower death probability for commercially registered firms than for simple tradesmen (-27 percentage points in Berlin and -40 in Munich). Our result is not consistent with Harhoff et al. (1995), where they investigate the effects of liability limitations in the form of particular legal form, and find that liability

[4] For this figure we use the (unreliable) information on the timing of death.

limitations are correlated with above-average employment growth and a higher risk of insolvency.

We observe differences within the industry, this can be first seen in the manufacturing sector between the two regions. Of the five manufacturing sectors, we observe a higher probability of death for the electric and textile manufacturing sectors of Berlin, whereas all coefficients of the manufacturing sector for Munich are positive and statistically significant, indicating a lower death probability. For the construction sector, Berlin shows a positive but statistically insignificant coefficient, whereas for Munich the coefficient is positive and highly statistically significant indicating a lower death probability.

If we look at the retail, wholesale trade and trade intermediary sectors, we observe that all coefficients are positive and statistically significant. This suggest that those firms operating in these sectors are confronted with a higher mortality rate. This result shows a similarity for both regions. The transportation sector differs between the two cities, if we look at the negative and significant coefficient for Berlin and a positive significant coefficient for Munich. The firms operating in the credit and insurance sector are confronted with a higher risk in Munich then in Berlin as the positive significant coefficient shows. The restaurant business shows a high mortality in both Berlin and Munich. Personal and education services are exposed to a higher risk in Munich than in Berlin. Harhoff and Woywode (1995) distinguish between market characteristics for the branches, and find a variation in survival rates for these branches. Audretsch and Mahmood (1994, 1995) show that different industry and firm characteristics -such as the technological environment and the extent of scale economies - exist between branches, and have a significant influence on the survival chances of new business. They did not consider the regional aspects. Sabel and Weiser (1994) estimated the hazard rates and found differences among branches.

Table 3 reports the death probabilities by industry for both cities calculated from the results of the probit regressions in order to show the ranking of the industries. The reference point is a death probability of 39.2% for consulting services (this is the total sample mean). We observe from this table that the industry ranking substantially differs between the two cities. In Berlin transportation firms show the lowest death risk, whereas in Munich they show a relatively high exit probability. This might be due to the "island" location of Berlin which favors transportation firms. In contrast the highest risk in Munich is faced by the firms in 'other manufacturing' whereas in Berlin the firms confront the highest risk exposure in wholesale trade. In Munich, consulting firms (the reference group) are the most stable ones. Next follow some service industries: Credit and insurance, personal services, other services. Manufacturing firms in Munich, however, are among those with the highest risks, whereas they do relatively well in Berlin. This hints towards the role of Munich as a service center where service firms obviously find profitable niches. Trade firms have a high mortality rate in both cites (with the exception of trade intermediaries in Munich). Also similar are the relatively high mortality rates for restaurants in both cities. The results from these tables suggests that industry differences are significantly strong in manufacturing and service sectors between the two cities, whereas they are similar in the trade sector.

IV. Conclusions

This study examines the exit probability of new firms in two German cities, and shows that variation exists across manufacturing and non-manufacturing industries as well as between regions. Our results are consistent with the theory of firm selection and industry evolution (Jovanovic, 1982). The empirical evidence of this paper suggests some similarities between regions: the pattern of the size and legal form effects on the probability of exit are very similar. Furthermore, it was shown that exit probabilities substantially differed between industries in both regions. However, the pattern of these industry effects is very different: for instance, whereas manufacturing firms do relatively well in Berlin they have very high exit probabilities in Munich. This indicates that market conditions in the same industry differ between regions. Therefore, it does not seem to be advisable to gather market data on a national level. The actual market environments faced by firms from the same industry might differ very much with the region. In this study, we showed only that variation exists between industry type and regions, but we were not able to provide any explaination for this variation. Future research is needed to include some real firm and industry specific variables in order to show their impact on the likelihood of survival.

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Table 1: Data Description

	Berlin	Munich
Firm deaths	31.8%	45.5%
Branch of industry		
Steel manufacturing	1.1%	0.5%
Electric manufacturing	1.7%	1.0%
Wood manufacturing	1.0%	0.9%
Textile manufacturing	0.9%	0.7%
Other manufacturing	1.1%	0.4%
Construction	4.6%	1.5%
Wholesale trade	8.7%	12.6%
Trade intermediary	4.2%	3.9%
Retail trade	24.4%	22.7%
Transportation	5.0%	9.9%
Credit and insurance	5.0%	5.5%
Restaurant	11.7%	6.8%
Personal services	2.8%	4.5%
Education services	5.3%	3.6%
Consulting service	11.2%	17.5%
Other service	11.3%	8.0%
Persons employed (in the first year, including founder)		
Not reported	88.6%	75.5%
1 Person	2.3%	13.2%
2 Persons	2.5%	4.6%
3 Persons	1.5%	2.0%
4-9 Persons	2.9%	3.0%
More than 9 Persons	2.2%	1.7%
Legal form		
Simple tradesman	70.2%	81.9%
Firm in commercial register	29.8%	18.1%
N	55,843	64,935

The respective reference group is printed in bold.

Table 2: Probit-regressions on probability of death

	Berlin	Munich
Constant	-0.105* (0.006)	-0.092* (0.005)
Branch of industry		
Steel manufacturing	0.001 (0.023)	0.131* (0.031)
Electric manufacturing	-0.036 (0.019)	0.095* (0.022)
Wood manufacturing	0.035 (0.021)	0.108* (0.022)
Textile manufacturing	-0.046* (0.023)	0.214* (0.025)
Other manufacturing	0.098* (0.021)	0.282* (0.035)
Construction	0.010 (0.012)	0.186* (0.017)
Wholesale trade	0.113* (0.009)	0.193* (0.008)
Trade intermediary	0.077* (0.011)	0.079* (0.011)
Retail trade	0.045* (0.007)	0.152* (0.006)
Transportation	-0.057* (0.011)	0.159* (0.008)
Credit and insurance	-0.047* (0.011)	0.025* (0.010)
Restaurant	0.021* (0.008)	0.190* (0.009)
Personal services	-0.014 (0.013)	0.084* (0.010)
Education services	-0.010 (0.011)	0.095* (0.012)
Other service	-0.030* (0.009)	0.084* (0.009)
Persons employed		
1 Person	-0.168* (0.018)	0.011 (0.006)
2 Persons	-0.145* (0.017)	-0.030* (0.010)
3 Persons	-0.126* (0.022)	-0.024 (0.016)
4-9 Persons	-0.203* (0.018)	-0.096* (0.015)
More than 9 Persons	-0.211* (0.021)	-0.111* (0.020)
Legal form		
Firm in commercial register	-0.265* (0.006)	-0.402* (0.007)
N	55,843	64,935
McFadden pseudo-R^2	0.081	0.079

* significant on the 5%-level. Standard errors in parentheses. The reported coefficients are marginal effects at the mean of all covariates.

Table 3: Probability of Death by Industry

	Berlin	Munich
Steel manufacturing	39.2% (8)	52.3% (9)
Electric manufacturing	35.3% (4)	48.6% (6)
Wood manufacturing	43.2% (12)	50.0% (8)
Textile manufacturing	34.2% (3)	60.5% (15)
Other manufacturing	50.4% (15)	67.0% (16)
Construction	40.4% (10)	57.8% (12)
Wholesale trade	52.1% (16)	58.5% (14)
Trade intermediary	48.0% (14)	47.1% (3)
Retail trade	44.3% (13)	54.4% (10)
Transportation	33.0% (1)	55.1% (11)
Credit and insurance	34.1% (2)	41.7% (2)
Restaurant	41.5% (11)	58.2% (13)
Personal services	37.7% (6)	47.6% (4)
Education services	38.0% (7)	48.7% (7)
Consulting service	39.2% (8)	39.2% (1)
Other service	35.9% (5)	47.6% (4)

Estimated from the results of the probit regressions presented in Table 2. The reference point is Consulting Services. Included in parentheses is the rank of the industry.