Regional Patterns and Determinants of the Success of New Firms in Western Germany

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1 Introduction

The spatial variation of the amount of newly founded businesses has already been present in scientific literature for some time (most recently: Armington/ Acs 2002). But until now much less attention has been attracted towards the spatial differences of new firm survival. In spite of this, this question is of great relevance. Newly founded firms are mostly seen as central for regional economic growth and structural change. Therefore they are target of many policy measures on federal and regional level or even by the employment offices. Very often the well known "liability of newness" (Freeman/ Hannan 1983) is not taken into proper account. One reason for there having been comparatively little research activity to date is certainly the fact that there are hardly any suitable data-sets that can provide information about the spatial differentiation of the survival chances. Lehmann (1994), for instance, was able to make a classification at district level of new-firm formation rates and growth rates as well as survival rates for eastern Germany.

In terms of regional economics the question as to whether there is a connection between the number of new firms in a region, or the regional new-firm formation rate, and the chances of survival is an important one. Sternberg (2000: 202) assumes that young firms continue to benefit from an environment that is positive for new firms in the first years following the start-up. He expects that *"in the context of a process that reinforces itself, [...] regional clusters of new firms [may] develop in which, as a result of agglomeration advantages and other positive external effects associated with the spatial closeness, new firms develop more favourably in economic terms than they do outside this cluster"* (ibid.). If there is such a connection then regions that show

high rates of new-firm formation can be expected to have high survival rates, too. However, in regions where a lot of new firms are set up, there will also be considerable competition for the often similar niches that new and young firms try to fill. The stronger competition could therefore also be a reason for a negative relationship between the new-firm formation rate and the survival rate.

2 Data Source

The „IAB Establishment Register" serves as data source for the number and development of newly founded firms in Germany. The IAB Establishment Register is derived from the employment statistics register of the German Federal Labour Office (*Bundesanstalt für Arbeit, BA*) and covers all firms with at least one employee liable to social security[1]. The register includes not only single units but branch plants as well. Longitudinal data on each establishment is available covering the number of employees in June of each year, the industry and the location. So it is possible to describe the development of employment of each unit.

Under the assumption that new establishment-numbers in the German Employment Statistics may be regarded as indicating newly founded establishments and that disappearing numbers represent closures, the establishment file of the SIS provides the opportunity of analysing establishment dynamics in the economy. In fact, the start-up of a new establishment with employees that have to contribute to compulsory social insurance will usually[2] lead to the inclusion of a new establishment number. And in the case of a closure, the number will normally disappear.[3]

3 Is there a spatial connection between new-firm formation rates and survival rates?

For assessing the survival chances a period of five years has developed as a common comparison framework in the literature. Because the data basis is too weak for regional analyses in eastern Germany. The following observations are therefore restricted to western Germany. Here it was possible to follow new firms from 1983/84.

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[1] This dataset is described extensively in Keeble/ Potter (1990: 131ff).

[2] It will not lead to a new number if the new establishment belongs to a firm with an existing establishment of the same industry in that municipality and if the parent firm wants to subsume these establishments under one number.

[3] For a detailed description of exeptions from this see Fritsch/ Brixy (2003)

Figure 1 shows the new-firm formation rates calculated on the basis of the workforce (in 1000: left-hand axis) and the proportion of the new-firm cohort that survived at least five years (five-year survival rate, right-hand axis). The observation period of five years inevitably reduces the series of available cohorts by five. At the start of the observation period the five-year survival rate stood at approximately 48 %, it then increased until 1988/89 to about 51 % and then fell back to 47 %. The simultaneous representation of new-firm formation rates and survival rates shows an interesting and important statistical correlation: in large new-firm cohorts, young businesses obviously have poorer chances of surviving the first five years than is the case in smaller cohorts. This supports the “competition thesis” explained above.

< fig. 1 about here >

The observed phenomenon is not particularly new. Some authors refer to the well substantiated positive relationship between the formation of new firms and the closures of young businesses as a “revolving door effect” (cf. Geroski 1991; Audretsch 1995: 149-165). The competitive pressure among the young firms, which, owing to their age, are generally still small and have little market experience, is especially strong in large new-firm cohorts. It seems reasonable to assume that new firms struggle for market shares principally with other young businesses and less with firms that are already established on the market.

The regional economic structure has a considerable influence on new-firm formation activity. By far the most new firms are set up in the rather short-lived area of consumption-orientated services. Only one in ten new firms is in the manufacturing industry. However, it is especially these new manufacturing firms that are credited with having particular potential for the development of the regional economy. The same is true of business-related services; they, too, are of great importance for regional development. Furthermore in both of these sectors the survival rates of the young businesses are especially high. For this reason three categories are always formed in the following: overall, manufacturing and business-related services.

The correlation between the intensity of new-firm formation and the survival rates of young businesses calculated on the basis of 74 western German standard statistical regions (Raumordnungsregionen) shows only a weak negative correlation across all sectors ($r = - 0.32$). Such an effect does not exist at all for the manufacturing industry ($r = - 0.06$), which makes it clear that the negative correlation for all sectors can be

attributed to the large number of new firms in the services sector. A clearly negative relationship can also be found for the business-related services (r = - 0.60). There is obviously a number of factors that determine the relationship between new firms and their survival. What is of interest first of all here is the empirically ascertainable relationship between the level of the new-firm formation rate and the survival of the firms on a regional basis.

A high regional rate of new-firm formation can probably be regarded as desired and is therefore to be assessed as positive. The more firms are founded, the greater the chances are that some of them prove to have a promising future and make a substantial contribution to the prosperity of the region in which they are located. They raise the competitive pressure, thus intensifying the market selection and consequently improving the efficiency of the market.

Assessing a high regional survival rate is more difficult. In principle a large proportion of surviving businesses among the new firms is certainly to be assessed as positive. It can be judged as an indication of good planning and of the new firms being of high quality. A high survival rate can, however, also be a sign of low competitive pressure on the part of established firms or other new firms.

A simple approach for analysing the relationship between new firms and their survival chances is to combine the characteristics of “above-average or below-average new-firm formation rate” and “above-average or below-average survival rate”. This makes it possible to categorise the regions into one of four classes (cf. Fig. 2).

Regions with an above-average amount of new-firm formation activity are certainly to be regarded in principle as active regions. In combination with a low survival rate they are characterised by strong competition, whilst the combination with high survival rates can point both to differences in the industry structure and to the new firms being of high quality.

< fig. 2 about here >

A below-average rate of new-firm formation is a sign of the economy lacking potential for renewal. In connection with high survival rates it can be assumed that in addition competition from established businesses is comparatively weak. This is an indication of efficiency deficits and an insufficient market selection in the regions.

Regions in which both the rate of new-firm formation and the survival rate are below average obviously offer poor basic conditions for young firms and are to be classified as problem areas.

The four combinations of characteristics result in a typical spatial distribution pattern for western Germany. The group with above-average new-firm formation rates and survival rates includes the more immediate and in part the broader area around Hamburg, and the Rhine-Main region, too, is surrounded over a large area by four standard statistical regions of this type. The same constellation occurs as a cluster in south-western Germany in the northern Black Forest (Nordschwarzwald), the southern Upper Rhine (Oberrhein) and the High Rhine (Hochrhein). The regions Allgäu and Danube/Bavarian Forest (Donau/Bayerischer Wald) are only isolated occurrences of this type.

Most of western Germany can be assigned to the two middle groups, each with one above-average and one below-average characteristic. Here it stands out that the regions with low rates of firm formation but above-average survival rates are located primarily in Bavaria to the north of Munich, and in large parts of Baden-Württemberg. But also eastern Westphalia and southern Lower Saxony come in this group. Some of the cases are structurally weak regions along the former border with East Germany and the Czech Republic, though major economic regions such as Stuttgart, Nuremberg, Ingolstadt, Bielefeld and Braunschweig/Wolfsburg are also represented in this group. In the case of the latter regions there are grounds for supposing that due to their comparatively one-sided economies they must be regarded as having only limited potential for renewal and therefore as not being very dynamic.

The regions in which both values are below average include a broad strip that runs from west to east from the Lower Rhine across the northern part of the Ruhr area to northern Hesse. However, the city-states of Hamburg, Bremen with Bremerhaven, as well as the Hanover and Osnabrück areas, too, come under this category. Southern Germany is represented with this type in only three regions, which are less important in economic terms. Above all in the case of the large western and northern German economic locations the question arises as to whether, in addition to their economic-structure characteristics, the firms in these areas lack the flexibility needed for adapting to changes in demand conditions as a result of their very long-established networks between large enterprises and their medium-sized suppliers. Grabher

(1993) points to the almost “feudal relationships of dependence between the dominating large enterprises and the regional supplier industries” (ibid. p. 750). A closely woven network of relationships can in many ways hinder economic innovations and structural changes. Networks with such negative effects surely do not provide a favourable environment for young businesses.

4 The explanation of spatial distributions of firm formation rates and survival rates by means of regression calculations

4.1 The dependent and independent variables

The determinants of the spatial differences in the rates of firm formation have already been the subject of many studies (e.g. Fritsch 1992; Audretsch, Fritsch 1994; Gerlach, Wagner 1994, Keeble, Walker 1994, Sutaria 2001 and most recently Armington, Acs 2002). In contrast, there is hardly any literature that focuses on the spatial differences in the survival rates in Germany. The often opposing spatial patterns of new-firm formation rate and survival rate (e.g. Brixy, Grotz 2002) gives rise to the supposition that regional characteristics which stimulate the formation of new firms in a region have a more dampening effect on the survival chances of the new firms. In order to obtain a deeper understanding of the relationship between regional rates of firm formation and the regional survival rate, it would seem best to estimate both variables in analogous models. In this way it is possible to test what impact the same regional characteristics have on the two variables.

The calculations are made for different groups of industries, and the standard statistical regions serve as spatial units. The independent variables are selected largely following the studies cited above. On the one hand this guarantees the comparability of the results obtained, but on the other hand the choice of new or alternative characteristics is considerably restricted due to the availability of data.

The rate of new-firm formation is estimated in separate models: for all industries, for manufacturing and for business-related services, each for the years 1987-1997. The business-related services are of great importance for the economic development of the regions. As Marshall (1988, p. 56) showed, they increase the innovation capacity of industry considerably.

In order to have available longer times series for the estimates of the survival rates, a period of three years was taken as a basis when calculating the rate. In this way it

was possible to calculate the models for explaining the survival rates for the new-firm formation years of 1987 to 1994.

The estimates serve first and foremost to check in the model, too, the relationship between new-firm formation rates and survival rates. Therefore the firm formation rates and survival rates are not only used as dependent variables but also as independent explanatory variables. This means that the corresponding survival rate goes into the estimate of the incidence of new-firm formation as an independent variable and vice versa the corresponding new-firm formation rate goes into the estimates of the survival rate. In both of the approaches negative coefficients are to be expected.

The data-set shows a panel structure (one observation per year). Thus corresponding panel models are used. In the case of the incidence of new-firm formation this is a count data model which is based on a negative binomial distribution. A panel model was also estimated for the survival rates. Both of the models take into account fixed effects (regions) and use robust estimators following the Huber/White/Sandwich procedure.

Factors with a possible influence on the regional share are manifold. Usually they are categorised into three classes. First, indicators for the level of the regional demand. Second, indicators for the regional reservoir of entrepreneurs (supply-side) and third, indicators for structural differences between regions other than industry-structure and size.

4.1.1 Indicator of regional demand

The regional demand is of great importance for newly founded firms. Most of them trade on regional and local markets only. This is especially true for firms in the service-sector which contain more than 50% of all founded firms. As indicator of the regional demand during the analysed period only the development of the number of employees is available on a regional level. Therefore the one year lagged development of the number of employees is included in the estimations.

The change of the level of employment can stimulate or hinder the development of newly founded firms (see i.e.Keeble & Walker 1994). A positive trend fosters the regional demand and improves the economic prospects of the newly founded firms. That increases the motivation of entrepreneurs to found new firms and raises the prospects for survival of the new firms. In case that the growing number of employ-

ees is connected with an increase in population (in-migration), then this indicator has a supply-side influence as well. Young and good educated people are most likely to migrate. Hence with a positive migration balance the number of possible entrepreneurs increases even more. But prospering regions offer attractive employment-alternatives to possible entrepreneurs. Therefore the opportunity-costs for setting up a new business rise with the economic success of a region. This could lead to a negative correlation between the development of employment and the regional share. The bivariate correlation-coefficients show no significant effect. This could be because both possible relationships offset a correlation.

4.1.2 Indicators for the regional reservoir of entrepreneurs

The state of the regional labour-market is important for two reasons. It has an influence on the amount of the number of possible entrepreneurs and it characterises the environment in which the setting-up of a new business takes place. To assess the size of the pool of likely entrepreneurs the qualifications of the people is of great importance. According to a study conducted by Brüderl, Preisendörfer & Ziegler (1996) in the greater Munich region, the share of entrepreneurs that hold a university-degree is 23%. This is distinctly more than the average employee (16%). This result is similar to a lot of other studies (see Storey 1994 and literature mentioned there). The level of qualification of entrepreneurs is always higher than the average.

Spatial data on qualification of the whole labour force is not available for this period. Therefore we took the qualifications of employees liable to social insurance and the unemployed together and calculated the share of university-educated people on all.

The rate of unemployment is mostly seen as a sign of quantitative and structural problems of the labour market (Fritsch 1992, Gerlach & Wagner 1994, Storey 1994). Problems of the regional labour markets lead to lower levels of spending power and hence lower levels of demand. Therefore a negative influence on the value of the regional share can be expected. On the other hand one can argue that a unfavourable situation on the labour market is connected with low opportunity-costs because of a lack of alternatives. This might result in ”entrepreneurs of need”(Bögengenhold & Staber 1990, Gerlach & Wagner 1994), that means people which put up their own businesses because they see no other way to get work. But empirical studies did not prove this connection, there was no evidence for a higher share of entrepreneurs un-

der the unemployed (Brüderl, Preisendörfer & Ziegler 1996, Preisendörfer 1999: 54, Fritsch & Falk 2002). But it can be expected that such ”entrepreneurs of need” occur more often in times with raising unemployment. For this reason the one year lagged rate of change in unemployment is also included in the estimations.

4.1.3 Indicators for structural differences between regions

Besides the number of potential entrepreneurs there are habitual factors that are much more difficult to measure. In parts these are based on regional traditions and attitudes that gave the cause for the ”incubator-thesis”. This assumption states that persons employed in smaller firms are more likely to set up a business of their own. It is thought that smaller firms allow a deeper insight into the running of a firm, whereas work in larger firms is more specialised. To measure this effect, the share of employees working in small firms is integrated in the estimations.

Another important structural-indicator are the population-density. It is used to assess the effect of agglomeration. To regions that have a positive regional share belong presumably those too, that are known as ”innovative regions”. Newly founded firms are pioneers with the development and use of innovations. To quantify the regional innovative potential, two indicators are calculated. First the share of natural scientists and engineers is taken. If this share is more than the average, it is assumed that a regional level of innovations is accordingly higher than the average, too. But for the regional entrepreneurial potential it is – due to the ”incubator-thesis – more important if the natural scientists and engineers are working in smaller firms. Audretsch (1995) introduced the so called ”technologic-regime” as an indicator for the innovative potential of the small-firms-sector of industries. This approach is used for regions in a similar way (Audretsch & Fritsch 2002). So the regional share of natural scientists and engineers working in SME is taken into the estimations. The higher its value, the higher the importance of the small-firm-sector for innovative activities in the regions and the higher is the entrepreneurial character of the regions.

4.1.4 Controlling for spatial autocorrelation

Spatial autocorrelation leads to inefficient estimators. So the significance of the coefficients can not be calculated. Two variables are integrated to deal with this problem. First the mean of the regional share in the regions neighbouring each regions. This indicator should have a positive influence with the depending variable, because it can

be expected that nearer regions have more in common than those further away. This indicator should therefore estimate the quantity of spatial autocorrelation. The second variable contains the means of the absolute values of the residuals of the neighbouring regions. With the help of this indicator it shall be measured if there are factors that are not considered but that influence these regions together.

4.2 Interpretation of the regressions for explaining the new-firm formation rates and survival rates

In order to avoid multicollinearity several models are estimated in each case (eight for the firm formations and nine for the survival rates. The results of the individual regression models are shown in summary form in Table 1. The detailed results can be found in the appendix to the chapter (Tables A 1 – A 6).

1: Summary of the results of the panel regressions with fixed effects

Independent variables	New-firm formation models			Survival rate models		
	all industries	man. industry	business services	all industries	man. industry	business services
New-firm formation rate	-	-	-	neg.**	n.s.	neg.**
Survival rate	neg. **	n.s.	neg. **	-	-	-
Population density	pos.**	pos.**	pos.**	neg. **	neg. **	neg. **
Development of employment	pos.**	pos.**	pos.**	pos. **	pos. **	pos. **
Unemployment rate	n.s.	n.s.	n.s.	neg. **	neg. **	neg. **
Development of the unemploy-ment rate	neg.** (partially)	neg.** (partially)	neg.** (partially)	neg.** (partially)	neg. *	neg. **
Proportion of highly-qualified workers	pos.**	pos.**	pos.**	neg. **	neg. **	neg. **
Employees in R&D	pos.**	pos**	pos.**	neg. **	neg. **	neg. **
Proportion of small businesses	neg. **	neg. **	neg. **	neg. **	neg. **	neg. **
Technological regime	neg. **	neg. **	neg. **	n.s.	n.s.	n.s.
Spillover effect	n.s.	neg.*	neg.*	pos. **	n.s.	pos. *
Residuals	n.s	n.s.	n.s.	n.s.	n.s.	n.s.

** highly significant influence (1% level)
* significant influence (5% level)
n.s. not significant
- not included in the model

The multivariate estimates, too, result mainly in negative correlations between the number of firms founded and the survival rates. They are, however, more pronounced in the models for explaining the survival rates than in the analogous firm-formation models. Furthermore in both cases there is no correlation in the manufacturing industry. However, as the correlation in the models for all industries is high, there is obviously a negative relationship in the services industries. In the sub-sector of business-related services a correspondingly strong negative correlation is also found.

The thesis that young firms continue to benefit afterwards from the environment that promoted their establishment, therefore applies at most in the manufacturing industry, but not in the services sector, which shows intensive firm-formation activity. Here it is more the influence of strong competition that can be seen. In the result this should lead to the surviving firms being especially efficient and thus having a significant growth potential. Brixy (1999: 116) was able to prove such a correlation for eastern Germany. There it was found that in districts with low survival rates the growth rates of the young firms that did survive were above average.

A high level of agglomeration has a positive influence on the number of new firms founded in all industries. In the survival rates models on the other hand a highly significant negative influence of the variables is detectable in all industries. Young firms in agglomerated regions have a lower survival expectation than those in rural areas. It seems reasonable to put this down to differences in costs (rents, wages) between urban and rural areas, which lead firms to the breakeven point more rapidly. But also differences with regard to the intensity of the competition could be of importance. A greater level of agglomeration means that firms in the same industry are closer together in spatial terms. That is why it is easier for customers in highly agglomerated regions to change their supplier than it is for customers in less highly agglomerated ones.

The level and development of the unemployment rate and the development of employment fundamentally reflect the economic development of regions. The level of unemployment has no significant impact on the number of new firms founded but it does have a clear negative impact on the chances of the firms surviving. The development of unemployment on the other hand tends to have a negative impact in all the models. If the quality of the pool of labour (qualification level or proportion of R&D employees) is controlled for, then the model gains explanatory power overall and the negative correlation with the development of the unemployment rate becomes highly significant.

The two unemployment indicators and the development of employment show opposing patterns, which does not come as a surprise. The always positive influence of the development of employment on the firm formation activity with a simultaneous negative influence of the development of unemployment shows the importance of the economic development for the willingness to set up new businesses. In bad times the

propensity to set up a new firm is relatively low. There are therefore no indications of a push-effect as a result of impending unemployment ("new firms from sheer need"). An unfavourable economic development or situation also reduces the survival chances of the young firms, which can surely be seen in connection with insufficient demand.

The qualification level of the workers proves to be the most important explanatory variable for the number of new firms founded. This was operationalised by two variables: the proportion of highly qualified workers and the proportion of employees in R&D[4]. These are important variables for the survival rates, too, and are always included. Both indicators are also "agglomeration indicators" to a great extent; this means that they have considerably higher values in the more highly agglomerated regions. It is therefore no surprise that, like the population density, they are included in the models for the number of new firms with a positive sign and in the survival rates model with a negative sign. However, whilst in the survival rates model the t-values of population density, proportion of highly qualified workers and proportion of R&D employees are roughly equal, in the new-firm formation models the qualification variables are clearly more significant than the population density variable (t-values in Tables A1-A3 in the appendix). Whilst in the survival rates models therefore it remains unclear whether these variables have an endogenous influence, it can be seen that the qualification level of the workers is of great importance for the creation of new firms, which can not be explained solely by the concentration of employment.

The proportion of small firms in a region is intended to be an indicator for the "incubator thesis". In contrast to the expectations the indicator is included with a negative sign, however. This result comes as a surprise and conflicts with the results of other studies (for a summary see Storey 1994: 67). But most of the empirical analyses use a new-firm formation rate as a dependent variable in accordance with the labour market or ecological approach. This can result in considerable illusory correlations which are ruled out by the count data model used here[5]. The negative correlation

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[4] The exceptionally high coefficients of these variables can be put down to the very small proportions of scientists and engineers among all workers in the regions.

[5] This is also confirmed by other calculations in which a new-firm formation rate was calculated with the same independent variables. In these estimates the proportion of workers employed in small firms was included with a positive sign.

with the incidence of new-firm formation could be explained by the comparatively large proportions of small firms in less agglomerated regions.

The survival rates, too, fall as the significance of the small firms increases, irrespective of the industry. In this case it is surprising as there is a high negative correlation (-0.76) between the proportion of employees in small firms and the population density. Like other “agglomeration indicators”, however, the population density was also included in the estimates with a negative sign. The also highly significant correlation between the incidence of small firms and the survival rate shows that in addition to the agglomeration effects, the size of the enterprise also has clear effects. Exactly what these effects are, however, remains unclear. It could be presumed that young firms compete to a greater extent with other (perhaps also young) small firms. Thus the competition would tend to be stronger for new firms in regions with a small-firm structure and consequently the survival chances would be poorer.

The indicator which is intended to measure the importance of the small-firm sector for research and development, technological regime, is included in the estimates of the incidence of new-firm formation with a negative sign. Although this does not correspond with the theoretical expectations, it is not surprising as a result of the high bivariate correlation with the proportion of workers employed in small firms (r=0.74). It therefore seems obvious to refer, in this case too, to the center-periphery difference in new-firm formation activity. The two variables do not correspond entirely, however, which is shown by the technological regime not being included significantly in any of the survival rates models. This could be put down to the fact that in this indicator opposing factors are expressed and thus balance each other out. The significance of the small firms is higher above all in the less agglomerated regions in which highly qualified scientists and engineers are under-represented.

The spillover effect is not significant in all of the new-firm formation models, but is positive and highly significant in the survival rates models. Therefore there is an indication of spatial autocorrelation only for the survival rates. The residual variable is, as expected, not included significantly in any estimate.

5 Summary and conclusions

Whereas up to now it has always been the number of newly founded firms that was prominent, in this chapter the further development of the young firms is also examined. Here the main focus of interest is the relationship between the regional rates of new-firm formation and the firms' chances of survival. Is it possible to confirm the thesis that in regions in which comparatively many new firms are founded there is a generally favourable environment for new firms which also has a positive effect on the survival chances of the young firms?

As could be shown, this seems to be the case only in the manufacturing industry. For the new firms overall and for the services sector there is a negative correlation between the rate of new-firm formation and the regional survival rate. This means that in regions where few new firms are set up these firms have greater survival chances. This relationship can be found primarily in the multivariate models, in other words when other important structural variables are controlled.

For a regional structural policy above all in the services sector, what should matter is therefore not only to encourage as many new firms as possible; the empirical results for western Germany show that as the rates of new-firm formation increase, so too do the death rates of the young businesses. As this relationship varies according to the industry, it is efficient to pay great attention to the industry spectrum and the competition situation, in other words to the ability of the young firms to assert themselves on the market. However, high survival rates can also be a sign of a lack of competition and poor regional dynamics.

The models for estimating the new-firm formation rates and survival rates make clear the negative relationship with the new-firm formation rate which was mentioned earlier, which points to a high level of competitive pressure in particular among the young businesses. In the new-firm formation rates models, many of the independent variables have the opposite signs to the survival rates models. This applies in particular for the impact of the agglomeration level, in other words the settlement structure, and for the qualification level of the workers. The location factors that are conducive to the formation of new firms in the services sector have the opposite effect on the survival chances of the young firms. This points to a high level of competitive pressure from the firms in this sector, which quickly pushes firms that do not prove themselves out of the market again. In the manufacturing industry there is no direct

negative relationship between the incidence of new-firms and the survival rate, but here, too, the effects of the level of agglomeration and the qualification level of the workers point in different directions in both approaches. It therefore seems reasonable to suppose that this is not a sign of low competitive pressure in this sector but more an effect of the time framework for the survival rates, which at three years is relatively short. In the manufacturing industry the barriers to market entry are higher; setting up a new firm requires on average considerably more planning and more capital. Factors, therefore, which are known to have a positive influence on the duration of survival of the young firms. That is why it is quite possible that if even longer time-series were evaluated, a negative correlation would appear between the regional rate of new-firm formation and the survival rate.

The present studies must be augmented by statements about the labour market effect of the surviving firms. In this way it is possible to determine more precisely the quantitative and qualitative aspects of the renewal of the economy through new firms.

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Appendix:

Table. A 1: Results of the panel regression with fixed effects for all industries

Independent variables	New-firm formation models (all industries)							
	I	II	III	IV	V	VI	VII	VIII
Change in the unemployment rate	-0.002 (-1.82)	-	-	-0.001 (-0.40)	-0.002 (-1.92)	-0.004** (-4.36)	-0.004** (-3.70)	-0.001 (-0.61)
Survival rate	-0.029* (-2.09)	-	-0.029* (-2.19)	-0.055** (-3.33)	-0.050** (-2.82)	-0.008 (-0.71)	-0.027 (-1.92)	-
Population density	0.588** (5.67)	0.594** (5.80)	0.592** (5.76)	-	-	-	-	0.574** (5.53)
Residuals	0.000 (0.10)		0.000 (0.10)	-0.000 (-0.27)	0.000 (0.25)	0.000 (0.34)	0.000 (0.64)	-
Unemployment rate	-	-0.011 (-0.61)	-	-	-	-		
Development of employment	-	-	0.022** (2.67)	-	-	-		
Proportion of small firms	-	-	-	-6.186** (-5.98)	-	-		
Technological regime	-	-	-		-0.036** (-5.84)	-		
Proportion of highly qualified workers	-	-	-	-	-	0.260** (8.90)		
Employees in R&D	-	-	-	-	-	-	47.640** (7.85)	
Spillover effect	-	-	-	-	-	-		0.045 (0.54)
Wald chi²	36.89**	35.03**	48.38**	41.60**	39.22**	82.57**	65.71**	34.67**

Negative-binomial regression. Heteroskedasty robust estimators in accordance with the Huber-White-Sandwich procedure. 518 cases each.
In brackets: z-values. * coefficient significant at the 5% level, ** at the 1% level. -: variable not taken into account
Stata 7.0: : nbreg, robust cluster (standard statistical regions)

Table. A 2: Results of the panel regression with fixed effects for the manufacturing industry

Independent variables	New-firm formation models (manufacturing industry)							
	I	II	III	IV	V	VI	VII	VIII
Change in the unemployment rate	-0.002* (-2.28)	-	-	-0.001 (-0.46)	-0.002 (-2.23)	-0.005** (-4.57)	-0.004** (-4.63)	-0.002* (-2.05)
Survival rate	-0.001 (-0.23)	-	-0.002 (-0.37)	-0.014 (-1.82)	-0.015* (-2.12)	-0.001 (-0.23)	-0.012 (-1.63)	-
Population density	0.517** (5.29)	0.520** (5.63)	0.522** (5.39)	-	-	-	-	0.521** (5.37)
Residuals	0.000 (0.34)		0.000 (0.33)	-0.000 (-0.19)	0.001 (0.44)	0.001 (0.52)	0.001 (0.74)	-
Unemployment rate	-	-0.026 (-1.41)	-	-	-	-		
Development of employment	-	-	0.024** (2.98)	-	-	-		
Proportion of small firms	-	-	-	-5.356** (-5.41)	-	-		
Technological regime	-	-	-		-0.032** (-5.75)	-		
Proportion of highly qualified workers	-	-	-	-	-	0.201** (6.86)		
Employees in R&D	-	-	-	-	-	-	37.672** (6.43)	
Spillover effect	-	-	-	-	-	-		-0.006 (-0.01)
Wald chi²	31.72**	37.10**	40.72**	42.47**	44.77**	59.16**	59.12**	32.00**

Negative-binomial regression. Heteroskedasty robust estimator in accordance with the Huber-White-Sandwich procedure. 518 cases each.
In brackets: z-values * coefficient significant at the 5% level, ** at the 1% level. -: variable not taken into account
Stata 7.0: : nbreg, robust cluster (standard statistical regions)

Table. A 3: Results of the panel regression with fixed effects for business-related services

Independent variables	New-firm formation models (business-related services)							
	I	II	III	IV	V	VI	VII	VIII
Change in the unemployment rate	-0.001 (-0.95)	-	-	0.001 (0.46)	-0.002 (-0.96)	-0.005** (-4.07)	-0.005** (-3.29)	0.001 (1.18)
Survival rate	-0.023** (-2.72)	-	-0.025** (-2.95)	-0.042** (-4.76)	-0.036** (-3.37)	-0.004 (-0.66)	-0.017** (-2.44)	-
Population density	0.791** (6.33)	0.821** (6.74)	0.796** (6.43)	-	-	-	-	0.817** (6.44)
Residuals	-0.000 (-0.48)		0.000 (0.49)	-0.001 (-1.22)	-0.000 (-0.32)	0.001 (0.20)	0.001 (0.42)	-
Unemployment rate	-	-0.035 (-1.41)	-	-	-	-		
Development of employment	-	-	0.024* (2.24)	-	-	-		
Proportion of small firms	-	-	-	-8.445** (-7.41)	-	-		
Technological regime	-	-	-		-0.050** (-6.72)	-		
Proportion of highly qualified workers	-	-	-	-	-	0.347** (10.70)		
Employees in R&D	-	-	-	-	-	-	65.507** (8.89)	
Spillover effect	-	-	-	-	-	-		-0.396 (-0.75)
Wald chi²	82.20**	50.17**	59.76**	80.59**	61.73**	140.27**	96.93**	59.37**

Negative-binomial regression. Heteroskedasty robust estimator in accordance with the Huber-White-Sandwich procedure. 518 cases each.
In brackets: z-values * coefficient significant at the 5% level, ** at the 1% level. -: variable not taken into account
Stata 7.0: : nbreg, robust cluster (standard statistical regions)

Table. A 4: Survival rates: results of the panel regression with fixed effects for all industries

Independent variables	Survival rates models								
	I	II	III	IV	V	VI	VII	VIII	IX
Change in the unemployment rate	-0.032** (-5.39)	-	-	0.000 (-0.02)	-0.030** (-4.81)	0.002 (0.31)	-0.011 (-1.66)	-0.014* (2.21)	-0.023 (3.90)
Population density	-15.544** (-6.60)	-24.076** (-8.38)	-17.952** (-7.13)	-	-	-	-	-4.756 (-1.61)	
Residuals	0.077 (0.37)		0.100 (0.48)	0.275 (1.30)	0.176 (0.82)	0.156 (0.80)	-0.000 (-0.02)	-	0.220 (1.09)
Unemployment rate	-	-0.410** (-5.37)	-	-	-	-			
Development of employment	-	-	0.202** (3.62)	-	-	-			
Proportion of small firms	-	-	-	-67.722** (-4.44)	-	-			
Technological regime	-	-	-		-0.062 (-0.89)	-			
Proportion of highly qualified workers	-	-	-	-	-	-2.594** (-9.50)			
Employees in R&D	-	-	-	-	-	-	-635.959** (-7.84)		
Spillover effect	-	-	-	-	-	-	-	0.491** (5.74)	
New-firm formation rate	-	-	-	-	-	-	-	-	-2.142** (-7.76)
R^2 (overall)	0.01	0.01	0.01	0.01	0.02	0.02	0.00	0.03	0.21!!

In brackets: t-values * coefficient significant at the 5% level, ** at the 1% level. -: variable not taken into account
Stata 7.0: xtreg, fe

Table. A 5: Survival rates: results of the panel regression with fixed effects for the manufacturing industry

Independent variables	Survival rates models								
	I	II	III	IV	V	VI	VII	VIII	IX
Change in the unemployment rate	-0.074** (-5.84)	-	-	-0.018 (-1.01)	-0.072** (-5.57)	-0.027 (-1.87)	-0.046** (-3.31)	-0.073** (-4.90)	-0.071** (-5,41)
Population density	-13.671** (-2.72)	-27.950** (-4.72)	-20.544** (-3.98)	-	-	-	-	-13.190** (-2.45)	
Residuals	-0.058 (-0.36)		-0.045 (-0.28)	0.037 (0.23)	-0.006 (-0.04)	-0.015 (-0.10)	-0.034 (-0.21)	-	-
Unemployment rate	-	-0.749** (-4.85)	-	-	-	-			
Development of employment	-	-	0.613** (6.07)	-	-	-			
Proportion of small firms	-	-	-	-106.728** (-4.46)	-	-			
Technological regime	-	-	-		-0.090 (-0.67)	-			
Proportion of highly qualified workers	-	-	-	-	-	-2.894** (-5.79)			
Employees in R&D	-	-	-	-	-	-	-701.851** (-4.47)		
Spillover effect	-	-	-	-	-	-	-	0.013 (0.14)	
New-firm formation rate	-	-	-	-	-	-	-	-	2.103 (0.87)
R^2 (overall)	0.06	0.06	0.05	0.00	0.02	0.04	0.01	0.06	0.02

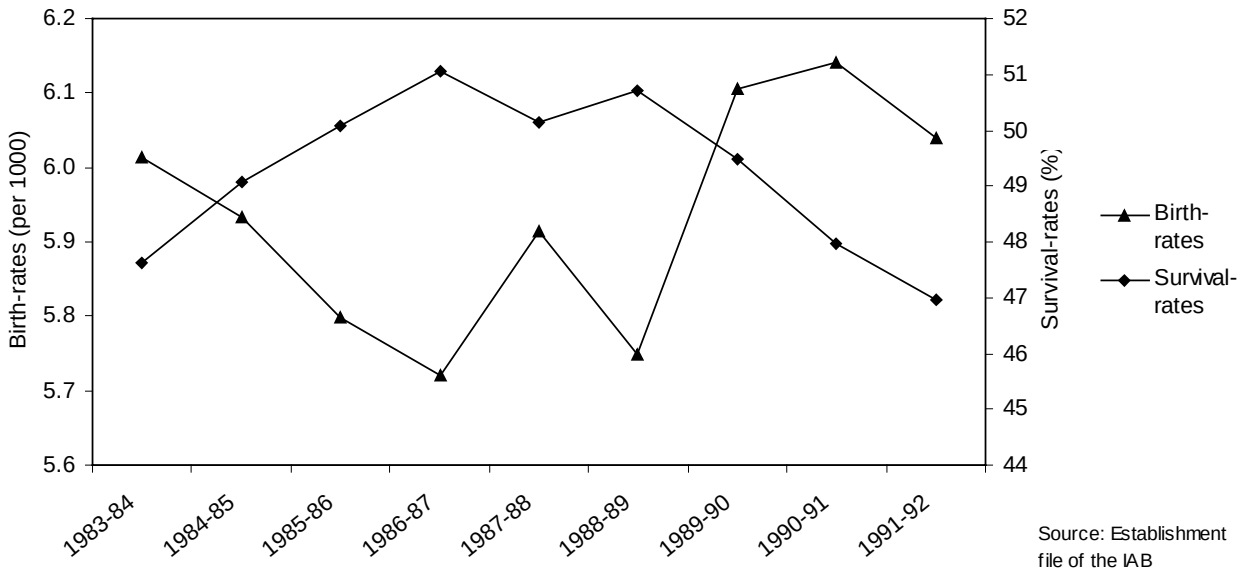
In brackets: t-values * coefficient significant at the 5% level, ** at the 1% level. -: variable not taken into account
Stata 7.0: xtreg, fe

Table. A 6: Survival rates: results of the panel regression with fixed effects for business-related services

Independent variables	Survival rates models								
	I	II	III	IV	V	VI	VII	VIII	IX
Change in the unemployment rate	-0.089** (-7.40)	-	-	-0.046** (-2.62)	-0.086** (-6.79)	-0.031* (-2.20)	-0.048** (-3.60)	-0.074** (-5.28)	-0.073** (-5.83)
Population density	-30.106** (-6.26)	-48.760** (-8.58)	-38.069** (-7.69)	-	-	-	-	-24.711** (-4.61)	
Residuals	-0.058 (-0.35)		-0.022 (-0.13)	0.039 (0.23)	0.034 (0.20)	-0.043 (-0.26)	-0.077 (-0.46)	-	-
Unemployment rate	-	-0.969** (-6.54)	-	-	-	-			
Development of employment	-	-	0.715** (7.36)	-	-	-			
Proportion of small firms	-	-	-	-81.929** (-3.45)	-	-			
Technological regime	-	-	-		-0.126 (-0.95)	-			
Proportion of highly qualified workers	-	-	-	-	-	-3.608** (-7.45)			
Employees in R&D	-	-	-	-	-	-	-1033.88** (-6.81)		
Spillover effect	-	-	-	-	-	-	-	0.178* (2.16)	
New-firm formation rate	-	-	-	-	-	-	-	-	-11.530** (-5.57)
R^2 (overall)	0.05	0.04	0.04	0.00	0.02	0.08	0.05	0.05	0.19

In brackets: t-values * coefficient significant at the 5% level, ** at the 1% level. -: variable not taken into account
Stata 7.0: xtreg, fe

Fig.1: Birth-rates and Survival-rates: a temporal comparison*



* Birth-rates per 1000 employees
Survival-rates: Share of firms which survive at least 5 years in every period

Fig. 2:

Connection between birth-rates and survival-rates in western Germany