The Contribution of New Businesses to Regional Employment – An Empirical Analysis of the Direct Employment Effects

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Abstract

We investigate regional differences in the contribution of newly founded businesses to regional employment. This is labeled the direct employment effect of new businesses. The analysis is at the spatial level of West German planning regions for the period 1984-2002. We find rather pronounced differences for the direct employment effect across regions. Regression analyses for explaining these differences show that the start-up rate, the education level of the regional workforce, and an entrepreneurial character of the regional technological regime have a positive impact on the direct employment effects of new businesses. The overall effect of population density is negative but the marginal effect is positive for regions beyond a certain threshold. Our results suggest that, all in all, the success of the new businesses is not at the expense of the incumbents but that direct and indirect employment effects of new businesses are positively interlinked.

JEL classification: L 26, M13, O1, O18, R11

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1. Aims and scope[1]

One of the great policy debates of recent years deals with the question whether new firm start-ups or large established firms are the engines of job creation. Two strands of argumentation can be identified in the literature. In his early work Schumpeter (1911/34) argued that the creative destruction triggered by start-ups of new firms may result in superior performance with regard to innovation and growth. In his subsequent work he reversed his view by suggesting that large establishments are more conducive to economic development (Schumpeter, 1942). Results of recent empirical research suggest that both sides may be correct (Fritsch, 2008). It has been shown that new businesses directly contribute to employment by creating jobs. But they also may have indirect effects by inducing innovation and employment in the established large firms. The magnitude of these direct and indirect effects may, however, vary across regions and over time (Audretsch and Fritsch, 2002; Fritsch and Schroeter, 2007; Fritsch and Noseleit, 2008b).

This paper analyzes regional differences of the direct contribution that new businesses make to employment. We want to investigate how pronounced are these regional differences are how these differences can be explained by region-specific characteristics? Our aim is to further the understanding of regional employment dynamics and particularly the role of new businesses for regional development. The underlying data relate to West-Germany in the 1984-2002 time period. The length of this time series also allows us to investigate the stability of the direct employment effects of new businesses over time. The following section (section 2) provides an overview of the empirical evidence on the development of new businesses. In section 3 we introduce the data and basic definitions and give an overview on regional differences of the direct employment effect of new businesses (section 4). In section 5 we discuss factors that may be responsible for differences of the employment contribution of new

[1] We are indebted to Florian Noseleit and Viktor Slavtchev for helpful comments on an earlier version of this paper.

businesses across regions. The indicators and estimation procedure are discusses in section 6 and the results of the empirical analysis are reported in section 7. Section 8 concludes.

2. The development of new businesses and their contribution to employment

The evolution of employment in start-up cohorts is characterized by two main developments. First, a considerable fraction of the new businesses fail and have to exit the market rather soon (Boeri and Cramer, 1992; Wagner, 1994; Fritsch and Weyh, 2006). Second, those new businesses which survive may grow and create jobs. The resulting net-effect depends on the magnitude of these two developments. Empirical studies have shown that new firms are characterized by a relatively high risk of failure particularly during the first years of their existence.[2] Main reasons for such a *liability of newness* are the problems of setting up an organizational structure and getting the new unit working efficiently enough to hold pace with competitors. In particular, this includes establishing relationships with customers and suppliers as well as acquiring suitable personnel. Another reason for the relatively high vulnerability of entries for closure is that many of the new businesses have to survive a considerable period of time before they are able to earn their first profit. Because new firms tend to start at a relatively small scale, this liability of newness may as well be a *liability of smallness* (Aldrich and Auster, 1986). Such a vulnerability of small units for closure could be explained by their rather limited endowment with resources that leave them only relatively poor chances to survive economic problems.

A key result of studies of employment in start-up cohorts is that only a rather small proportion of the new businesses do create considerable amounts of jobs (Storey, 1994, 113-119; Boeri and Cramer, 1992; Wagner,

[2] For a review of the evidence see Geroski, Mata and Portugal (2007), Fritsch, Brixy and Falck (2006) as well as Fritsch and Weyh (2006).

1994; Fritsch and Weyh, 2006).[3] In most cases, the number of employees in a certain cohort rises just in the first year and then soon declines. After a few years, cohort employment tends to fall below the initial level. This pattern may, however, differ considerably between industries, regions and years. While survival rates and employment of start-ups in the service sector tend to be relatively low (Fritsch and Weyh, 2006; Weyh, 2006), they are often found to be comparatively high in industries that are classified as technologically advanced or high-tech (Engel and Metzger, 2006). Weyh (2006) reports some differences between agglomerations, moderately congested and rural areas in West Germany. Quite pronounced regional differences in the development of entry cohorts could particularly be found between East and West Germany (Fritsch, 2004).

Adding up the remaining employment in the 18 yearly West German entry cohorts of the 1984-2002 period Fritsch and Weyh (2006) found that the share of total private sector employment in the year 2002 made about 25 percent. This share was nearly three times higher in services (32 percent) than in manufacturing (12 percent).[4] This indicates that the sector to which the start-ups occur obviously plays an important role.

3. Data and measurement

Our information about the evolution of start-up cohorts and overall employment is taken from the establishment file of the German Social Insurance Statistics, as described and documented by Fritsch and Brixy (2004). This database comprises information about all establishments that have at least one employee subject to obligatory social insurance. Due to the fact that the database records only businesses with at least one employee, start-ups consisting solely of owners are not included. This

[3] Storey (1994, 119) estimates that over a period of ten years „ … approximately 4 per cent of firms create approximately half the new jobs."

[4] The analyses in this paper use the same data base as Fritsch and Weyh (2006) and Weyh (2006). See section 4 for details.

leads to a slight underestimation of the contribution of new business formation to employment. However, new businesses enter the data base as soon as they hire their first employee.[5]

The German Social Insurance Statistics is entirely on the level of establishments and does not allow for separating new firms from new plants and new branches which are created by existing firms. In order to avoid distortions caused by new large subsidiary plants of incumbent firms, new establishments with more than 20 employees in the first year of their existence are not counted as start-ups.[6] A detailed analysis of our database reveals that these data do reflect the new business formation activity relatively well. Currently, the information on West Germany is available for the period 1984-2002.

We use two different indicators for measuring the direct effects of start-ups on employment. The first of these indicators is the employment share of the start-up cohorts after two years. This is meant to represent the *initial direct employment effect* of new businesses. We consider the employment of the second year because this may be regarded as the point in the development of new businesses where they have reached their intended initial size. The second indicator is the sum of employees in all start-up cohorts of the previous ten years (*t=0 to t-9*) in relation to total employment in the current year (*t=0*).[7] This indicator accounts for the result of earlier studies which have shown that the effect of new businesses on employment evolves over a period of ten years (see Fritsch, 2008, for a review of the evidence). We label this indicator the *total direct employment*

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[5] There may be some misclassification 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 for a longer period of time. The share of such cases is, however, rather small (see Fritsch and Brixy, 2004).

[6] The share of new establishments in the data with more than 20 employees in the first year is rather small (about 2.5 percent).

[7] Example: The total direct effect in the year 2002 is the sum of employees in the start-up cohorts of the years 1993 – 2002 in the year 2002 divided by total employment in the year 2002. The initial direct effect in the year 2002 is the employment of the start-up cohorts of the years 2001-2002 in the year 2002 divided by total employment in 2002.

effect of new businesses. Both measures show the degree of newness of employment in the regional economy, or, to use Alfred Marshall's (1920) analogy of the economy to a wood, the share of the young trees.

The spatial framework of the analysis concentrates on the West German planning regions (*Raumordnungsregionen*). Planning regions consist of at least one core city and the surrounding area. The advantage of planning regions in comparison to districts (*Kreise*) as spatial units of analysis is that they can be regarded as functional units in the sense of traveling to work areas and that they account for economic interactions between districts. Planning regions are slightly larger than what is usually defined as a labor market area. In contrast to this, a district may be a single core city or a part of the surrounding suburban area[8].

We restrict the analysis to West Germany for two reasons. First, while data on start-ups for West Germany are currently available for the time period between 1984 and 2002, the time series for East Germany is much shorter and starts in the year 1993. Second, many analyses show that the developments in East Germany in the 1990s were heavily shaped by the transformation process to a market economy and, therefore, it represents a rather special case that should be analyzed separately (e.g., Fritsch, 2004; Kronthaler, 2005). The Berlin region had to be excluded due to changes in the definition of that region after the unification of Germany in 1990. For historical reasons, the cities of Hamburg and Bremen are defined as planning regions even though they are not functional economic units. In order to avoid possible distortions, we merged these cities with adjacent planning regions.[9] Therefore, we have 71 regions in our sample. Employment in the public sector as well as start-ups and employment in agriculture are excluded because of different market mechanisms in these sectors, e.g. high subsidies in the agricultural sector

[8] See German Federal Office for Building and Regional Planning (2003) for the definition of planning regions and districts.

[9] Hamburg has been merged with the region of Schleswig-Holstein South and Hamburg-Umland-South. Bremen has been merged with Bremen-Umland.

4. Overview on direct employment effects

There is a remarkable variation of the magnitude of direct employment effects of new businesses across regions (table 1). While the minimum value for the total direct employment effect for all private industries is 11.83 the maximum value is more than twice as high. For the initial direct effect the maximum value (6.94) is even more than three times larger than the

Table 1: Descriptive statistics of the direct employment effects[10]

Variable	Mean	Median	Minimum	Maximum	Standard deviation
All private industries					
Total direct effect					
- overall	16.95	16.68	11.83	25.80	2.78
- between			12.50	25.27	2.74
- within			14.86	20.97	0.57
Initial direct effect					
- overall	3.41	3.38	1.88	6.94	0.71
- between			2.48	5.70	0.65
- within			2.44	6.54	0.29
Manufacturing					
Total direct effect					
- overall	7.41	7.28	3.86	18.24	2.09
- between			4.35	12.67	1.95
- within			3.23	15.49	0.81
Initial direct effect					
- overall	1.27	1.19	0.52	10.71	0.51
- between			0.72	2.42	0.37
- within			0.36	9.85	0.35
Services					
Total direct effect					
- overall	24.67	24.81	18.69	31.81	2.53
- between			19.19	31.01	2.46
- within			21.53	26.91	0.62
Initial direct effect					
- overall	5.48	5.42	3.67	8.48	0.80
- between			3.93	7.26	0.69
- within			3.85	7.14	0.41

[10] Between: regional average values over the period of observation; within: average yearly values over all regions. The within transformation demeans the data compared to the values of figure 1 because it is calculated by subtracting the group mean and adding the overall mean to the series.

minimum (1.88). Not surprisingly, the average total effect of the new businesses, i.e. the share of employees in businesses that are up to ten years old, is always larger than the average initial effect, the employment share of businesses in up to two year old establishments. Both effects tend to be considerably more pronounced in services than in manufacturing what is probably a result of the higher level of start-up activity in the service sector.[11] Another important observation is that the variation across space (*between* regions) tends to be much larger than the variation over time (*within*). As can be seen in figure 1 the total direct employment effect of new businesses is rather constant in the different years.

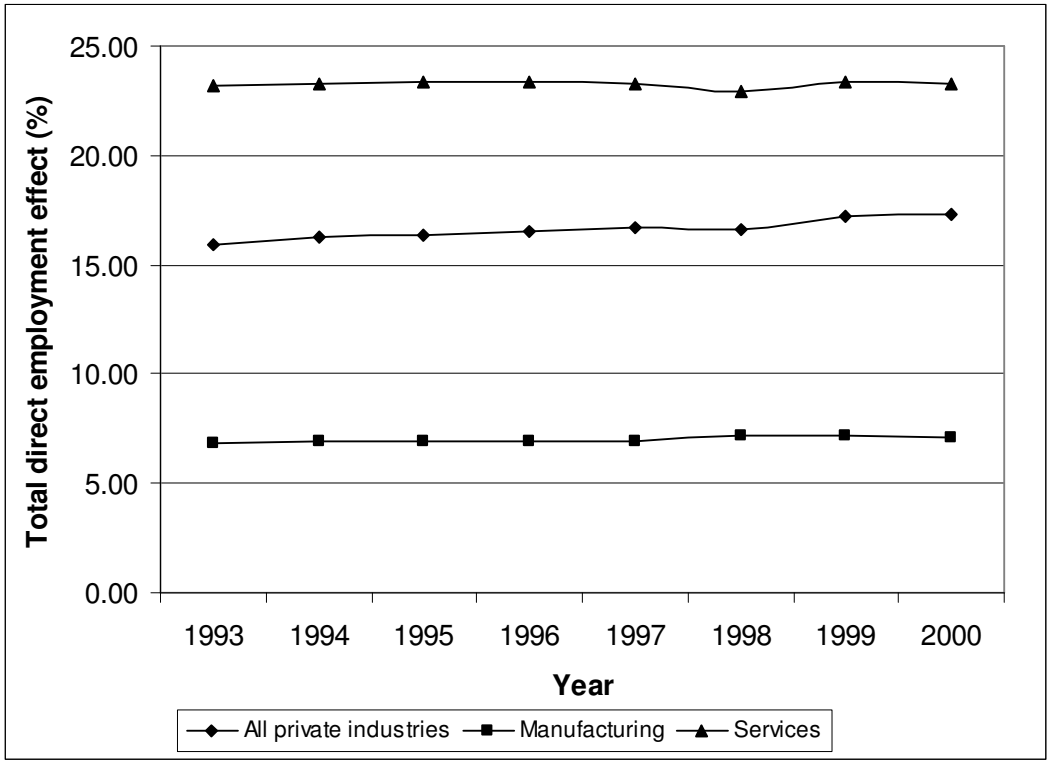

Figure 1: Total direct employment effect of new businesses over time

The regional distribution of the total direct employment effects in all private industries in West Germany for the years 1993 to 2002 (figure 2)

[11] The average yearly number of start-ups in services per 1,000 employees during the period of analysis is around 6 times higher as compared to the manufacturing sector.

shows that regions with relatively high direct employment effects are concentrated in the northern part of the country while this contribution of new businesses to employment is relatively low in the regions around Stuttgart and in some of the regions north of Munich. While there is a considerable degree of correspondence between the spatial pattern for the whole private sector and for manufacturing (figure 3) the picture for the service sector (figure 4) is quite different.[12]

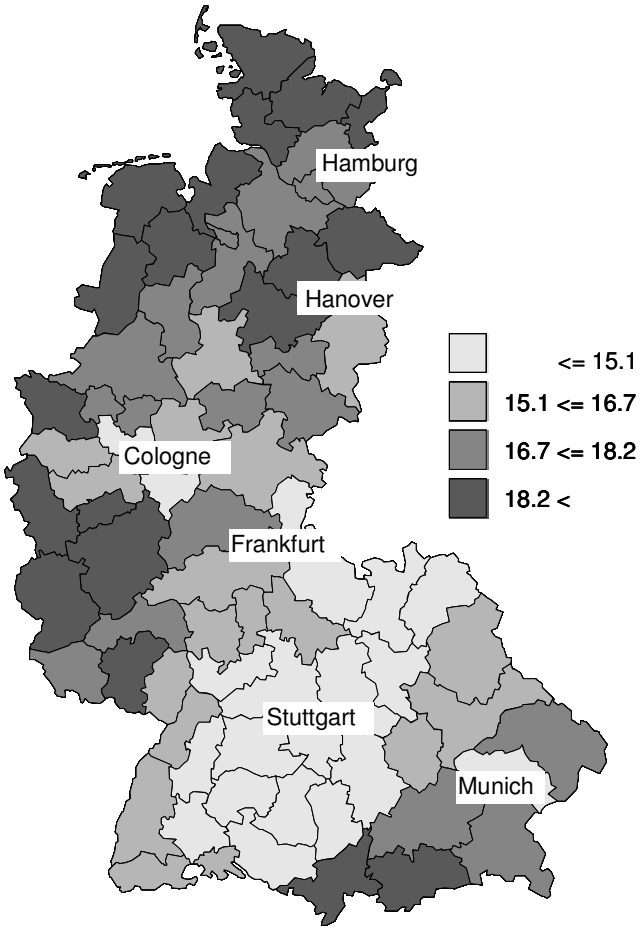

Figure 2: Spatial distribution of total direct employment effects in West Germany – mean values 1993 to 2002 (all private industries)

[12] The correlation coefficient for the values of the whole private sector and for manufacturing is 0.86. For the relationship between the whole private sector and services it is only 0.44.

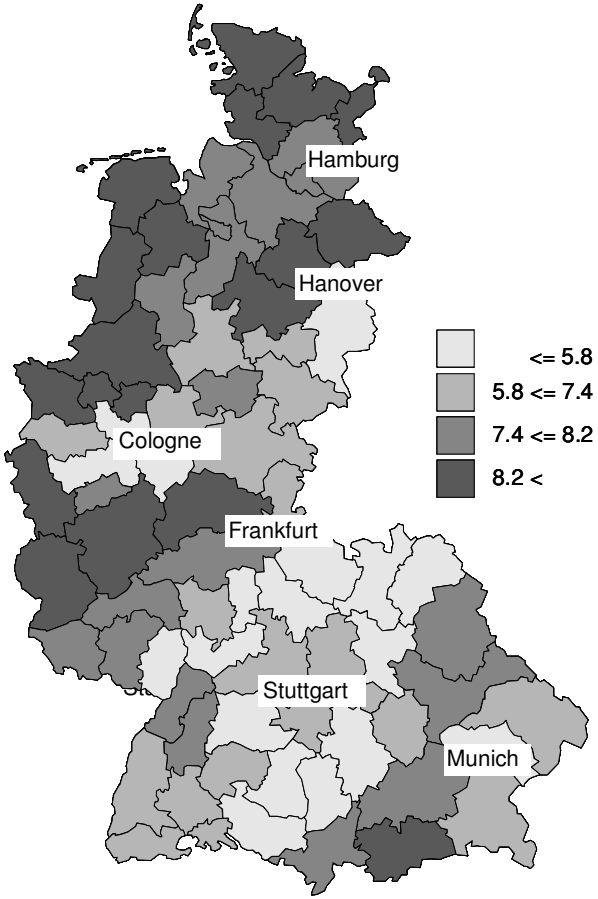

Figure 3: Spatial distribution of total direct employment effects in West Germany – mean values 1993 to 2002 (manufacturing)

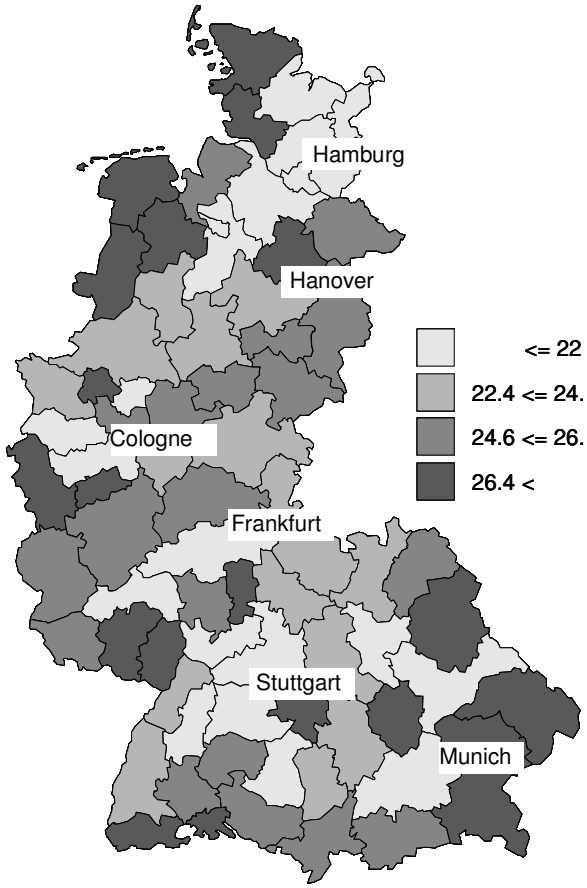

Figure 4: Spatial distribution of total direct employment effects in West Germany – mean values 1993 to 2002 (services)

5. What determines the direct contribution of new businesses to regional employment?

The share of regional employment in new businesses depends on three factors:

- The regional level of new business formation. The more new businesses are set up in a region the higher the employment share that can be expected in newly established units.
- The success of the new businesses. The more successful the new businesses are the larger their employment share.
- The development of the incumbent businesses. Relatively high employment growth in incumbent businesses leads to a relatively low employment share of new businesses. Moreover, success of the incumbents may be at the expense of the newcomers and can in this way result in a relatively small direct employment effect of the start-ups.

Our empirical model focuses on these three factors.

The success of new businesses may depend on internal factors as well as on the characteristics of their environment. The internal success factors of new businesses pertain to their *quality* which is given by issues such as the qualification of the entrepreneur[13], the amount and quality of resources which are mobilized for the new business, the marketing strategy that is pursued as well as the innovativeness of the goods and services supplied. One may, therefore, expect that the higher the quality of an entry the greater are its survival chances and the more pronounced is the direct employment effect.

Many of these internal success factors may critically depend on characteristics of the regional environment. For example, since new businesses are set up close to the founders' residence (Stam, 2007), a high qualification of the regional workforce may lead to a relatively high share of start-ups which are run by qualified individuals. Availability of

[13] Wagner and Sternberg (2004) provide evidence for an unequal spatial distribution of entrepreneurial qualification, spirit and talent in Germany.

labor with appropriate qualification in a region may also be an important input for new businesses. Moreover, the regional knowledge base, the presence of academic research institutions as well as the innovativeness of other firms in the region, i.e., the presence of knowledge spillovers, may be rather important factors shaping the innovativeness of regional start-ups (Audretsch, Lehmann and Keilbach, 2006). However, since the incumbent firms in the respective region also benefit from qualified labor and knowledge spillovers, these factors do not necessarily lead to higher survival chances and growth of the newcomers but may also stimulate the development of the incumbents.

Contestability of market positions and survival chances of entries may be well shaped by the type of technological regime that dominates the industry and region (Audretsch, 1995, 39-64; Winter, 1984). In an entrepreneurial regime where small firms play an important role in innovation processes, it should be easier for newcomers to seriously challenge the incumbents than under the conditions of a routinized regime in which the large firms have the innovative advantage. Accordingly, new business formation can be expected to play a prominent role in industries or regions that are characterized by an entrepreneurial regime while they should be much less important in an industry or region with a routinized regime. Empirical examples demonstrate that there may exist considerable regional differences in the character of the technological regime within an industry at a certain point of time (Saxenian, 1994).

The observation that economic activity tends to be clustered in space (Audretsch and Feldman, 2003; Porter, 1998) suggests that there are agglomeration economies relevant for the location of new businesses and that these advantages compensate for the negative effect of higher costs (e.g. rents, wages) and of competition from other firms located in the vicinity. Advantages of setting up a new business in a large agglomeration could include the availability of large, differentiated labor markets and specialized services, easy access to research institutions, the spatial proximity to large numbers of customers as well as to other firms in the industry that may facilitate knowledge spillovers. While there is evidence

that survival chances of start-ups in agglomerations are comparatively low (Fritsch, Brixy and Falck, 2006; Weyh, 2006), the surviving new businesses seem to grow at a relatively high rate (Weyh, 2006). In her analysis of West Germen regions, Weyh (2006) finds that entry cohorts in agglomerations show a better performance with regard to employment than the cohorts in non-agglomerations. With regard to the overall effect of new businesses formation on employment Fritsch and Mueller (2004, 2008) and Fritsch and Schroeter (2007) have found that the impact is stronger in areas with high population density. A problem for empirical analyses emerges from the fact that measures of spatial concentration, e.g. population density, which are commonly used as indicators for such agglomeration effects, tend to be closely correlated with other variables such as qualification of the workforce. This correlation may make the identification of the impact of agglomeration economies and diseconomies difficult.

All these arguments and observations suggest that the direct contribution of new business formation to employment is not at all identical in all regions. Indeed, we should expect considerable differences. The employment share of new business should be relatively large in regions with a high level of start-up activity, with abundant resources, a high qualification level of the workforce and an entrepreneurial character of the technological regime. Population density may be positively related to employment in new businesses because large cities tend to have large and differentiated input-markets and are characterized by a relatively high qualification level of the labor force. However, intensive competition on the input- as well as on the output market in agglomerations may make it rather difficult for the new businesses to be successful.

6. Indicators and estimation procedure

6.1 Definition of variables

The indicator for the total direct employment effect is the share of employees in the start-up cohorts of the recent ten years in region *i* in year

t on overall employment. The initial direct employment effect is measured as the share of employees in the start-ups of the recent two years.

In order to test which variables may be responsible for the direct employment effect we used following variables (see table 2):

- *The start-up rate* measures the number of new businesses over the size of workforce in the respective region (labor market approach). In order to control for the fact that the composition of industries does not only vary considerably across regions, but that the relative importance of start-ups and incumbent enterprises also varies systematically across industries (Audretsch and Fritsch, 1999) we calculated a sector-adjusted start-up rate[14]. This sector adjusted number of start-ups is defined as the number of new firms in a region that can be expected to be observed if the composition of industries was identical across all regions. Thus, the measure adjusts the original data by imposing the same composition of industries on each region (Audretsch and Fritsch, 2002). In order to account for the empirical finding that new business formation of the previous ten years may be relevant for regional employment we use the average sector adjusted start-up rate of the last ten years.
- A high *population density* indicates the advantages as well as the disadvantages of being located in an agglomeration. There is a considerable degree of correlation between population density and a number of further regional characteristics such as qualification of the workforce, regional income level, and labor productivity. Population density can, therefore, be regarded as a 'catch all'-variable for the local

[14] For example, start-up rates are higher in service industries than in manufacturing industries. This means that the relative importance of start-ups and incumbents in a region is confounded by the composition of industries in that region. This would result in a bias of overestimating the level of entrepreneurial activity in regions with a high composition of industries where start-ups play an important role, and underestimating the presence of entrepreneurship in regions with a high composition of industries where new firm start-ups are relatively unimportant. To correct for the confounding between the regional composition of industries with the relative importance of start-ups and incumbent enterprises, a shift-share procedure was deployed to develop a measure of sector adjusted start-up activity.

conditions. Hence, the effect of population density on the share of new business employment in a region is a priori unclear.

- The high *education level of the regional workforce* was measured by the share of regional employees with a tertiary degree.
- *The entrepreneurial character of the technological regime* in a region is measured by the proportion of R&D employees in establishments with less than 50 employees over the share of R&D employment in total employment[15]. We expect a positive effect of an entrepreneurial technological regime on the share of small business employment.
- *The employment change of incumbent businesses* per year and region should show a negative relation with the total and the initial direct employment effect for two reasons. First, the denominator of the employment share in new businesses increases with the growth rate of the incumbents. Second, a high growth rate of incumbents indicates economic strength and competitiveness of incumbents that makes it hard for newcomers to succeed.

Table 2 provides an overview on the definitions of variables and the expected signs. Descriptive statistics of variables and a correlation matrix are given in the Appendix (table A1 and A2).

A number of further indicators have been tested but did not prove to be statistically significant. Among these variables were measures for regional innovativeness (e.g., number of students, professors, research institutions, patents per employee), for the regional economic condition (GDP per head, unemployment rate, labor productivity), the share of workforce with a medium education level and an indicator for industry specialization.

[15] Acs and Audretsch (1987) have introduced an output-oriented measure for the technological regime. In their approach it is the number of innovations per employee introduced by small firms (with less than 500 employees) as compared to the number of innovations per employee in all firms

Table 2: Definition of variables and expected signs for the relationship with the direct employment effect

Variable	*Definition*	*Expected Sign*
Start-up rate	Yearly average number of start-ups in a region over the regional workforce in the ten / two recent years (ln).[a]	+
Population density	Number of inhabitants in a region per square kilometer [c].	+ / -
High education level	Share of employees in a region with a tertiary degree (ln)[a].	+
Entrepreneurial regime	Share of R&D employees in establishments with less than 50 employees over the share of R&D employment in total employment in the respective region, industry and year (ln)[a].	+
Change of incumbent employment	Number of employees in incumbent businesses in period t over the number of employees in incumbent businesses in period t-1 (ln)[a].	-

Notes: a) Source: Social Insurance Statistics; b) Source: Federal Employment Services; c) Source: Federal Statistical Office.

6.2 Estimation approach

For explaining the direct effect of new business formation on regional employment, especially its variance across regions, we first estimated a linear-additive model that gives us the average influence of each of the independent variables on the direct employment effects (model I). This model has the form

$$Direct\ \ Employment\ \ Effect_{it} = \alpha + \beta_1 * start-up\ rate_{it} + \beta_2 * population\ \ density_{it} + \beta_3 * high\ \ education\ \ level_{it} + \beta_4 * entreprerp eneurial\ \ regime_{it} + \beta_5 * change\ \ of\ \ incumbent\ \ employment_{it} + a_i + u_{it}$$

where a_i represents the spatial lag that controls for interregional autocorrelation (Anselin, 1988) and u_{it} is the usual disturbance term.[16] In

[16] A Moran's I test indicates a significant degree of spatial autocorrelation (see table A3 in the appendix).

order to control for spatial autocorrelation a spatial lag model was estimated.[17].

All variables are calculated for the 71 planning regions of West Germany (i=1,…, 71) in the 1993 to 2000 time period (t=1993, 1994,…,2000)[18]. Since the variables are entered in logarithmic form this log-log model has the advantage that the estimated coefficients can be interpreted as elasticities and can, therefore, be directly compared with each other. A Hausman-test as well as an F-test for joint significance of regional dummy variables indicated that unobserved heterogeneity is important and that a fixed-effects model is appropriate that accounts for unobserved region-specific influences. A possible disadvantage of a fixed-effect estimator may, however, be that the influence of variables which are rather time-invariant may be partly included into the region specific fixed-effects and not attributed to the respective variable. In our model this may particularly apply to population density and the start-up rate. In order to control for such a misspecification we also estimated random-effects and between-effects models.[19]

In a second step we estimated models with interaction terms of the start-up rate with population density, high education level and the entrepreneurial regime variable (model II). These models have the form:

$$Direct\ Employment\ Effect_{it} = \alpha + \beta_1 * start-up\ rate_{it} + \beta_2 * population\ density_{it} + \beta_3 * start-up\ rate_{it} * population\ density_{it} + \beta_4 * high\ education\ level_{it} + \beta_5 * start-up\ rate_{it} * high\ education\ level_{it} + \beta_6 * entrepreneurial\ regime_{it} + \beta_7 * start-up\ rate_{it} * entrepreneurial\ regime_{it} + \beta_8 * change\ of\ incumbent\ employment_{it} + a_i + u_{it}.$$

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[17] Adjacent regions are all planning regions that directly share a common border with the respective region. We apply a spatial lag model since we expect that the values of the independent variables (e.g. the start-up rate or the high education level) in neighboring region may influence the employment effect of start-ups,

[18] Unfortunately, the information for the entrepreneurial regime variable is currently only available until the year 2000. For this reason, we do not include the years 2001 and 2002 into our analysis.

[19] The results of random-effects and between-effects regressions are shown in table A4 in the appendix.

The results for the interaction variables show in how far the respective control variables become effective in interplay with start-up activity. These interaction terms allow us to calculate marginal effects of the start-up rate for certain value ranges of the control variables (see Brambor, Clark and Golder, 2005). A problem with the interaction model is the relative pronounced correlation between the start-up rate and the interaction terms of the start-up rate with the control variables. In the final model (model III) we, therefore, include only those interaction terms that proved to be statistically significant in order to reduce the level of multicollinearity.

7. Regression results

Table 3 and Table A5 (appendix) display the results of regressions for explaining the total direct effect and the initial employment effect of start-ups on regional employment for all private industries as well as for the manufacturing and the service sector. As could have been expected, we find a significantly positive impact of the *start-up rate* on the direct employment effect. The estimated coefficients indicate that a one percent increase of the start-up rate leads to a 0.22 percent increase of the share of employees in businesses younger than ten years and to a 0.32 percent increase in businesses younger than two years. The stronger impact of the start-up rate in the short run corresponds to results of cohort analyses (Fritsch and Weyh, 2006) which show that employment in start-up cohort reaches a maximum after about two years and then declines. The effect of population density on the direct employment effect (model I) is significantly negative.

A relatively high share of workforce with a high education level is related with a significantly higher direct employment effect, as was expected. A one percent increase of the number of workforce with a tertiary degree in a region leads to a 0.13 percent increase of the total direct employment effect and to a 0.26 percent increase of the initial direct employment effect. Hence, we can say that a high number of highly qualified people in a region is more important in the short-run than in the

Table 3: Regression results for the direct employment effects of new businesses – all private sectors[a]

	All private industries					
	Total direct effect			Initial direct effect		
	I	II	III	I	II	III
Start-up rate	0.219*** (5.60)	1.489*** (3.15)	1.576*** (6.85)	0.321*** (3.82)	1.199 (1.14)	1.286** (2.51)
Population density	-0.530*** (-3.33)	-0.901*** (-3.02)	-0.768*** (-4.83)	-0.727** (-2.13)	-1.220* (-1.86)	-0.893** (-2.55)
Population density * start-up rate		0.028 (0.48)			0.066 (0.51)	
High education level	0.126*** (5.48)	-1.621*** (-4.91)	-1.659*** (-5.54)	0.259*** (5.41)	-0.953 (-1.30)	-1.006 (-1.52)
High education level * start-up rate		0.392*** (5.32)	0.400*** (5.98)		0.273* (1.67)	0.284* (1.91)
Entrepreneurial regime	0.079*** (3.16)	-0.366 (-0.67)	0.094*** (3.84)	0.084 (1.58)	-1.441 (-1.20)	0.093* (1.74)
Entrepreneurial regime * start-up rate		0.102 (0.85)			0.342 (1.27)	
Change of incum-bent employment	0.004*** (3.64)	0.003*** (2.69)	0.003*** (2.77)	-0.001 (-0.51)	-0.002 (-0.80)	-0.002 (-0.76)
Constant	4.586***	0.177	0.360	-0.251	1.430	0.890
	(5.43)	(0.08)	(0.17)	(-0.22)	(0.30)	(0.35)
Regional dummies	yes	yes	yes	yes	Yes	yes
rho	0.103***	0.098***	0.099***	0.140***	0.137***	0.138***
	(11.51)	(11.16)	(11.27)	(17.89)	(17.24)	(17.52)
Log Likelihood	1236.50	1254.28	1253.87	801.87	804.56	803.70
Wald (rho=0)	132.55	124.60	127.04	320.09	297.19	306.88
R-squared	0.67	0.69	0.69	0.62	0.64	0.63
Observations	568	568	568	568	568	568

a spatially lagged regression model. Absolute z-values in parentheses. * statistically significant at the 10 percent level; ** statistically significant at the 5 percent level; *** statistically significant at the 1 percent level.

long-run. The significantly positive coefficient for the entrepreneurial character of the regional technological regime is in line with our expectation that a relatively high share of innovation activity conducted by small firms leads to a relatively good chance for new firms to compete successfully. In models for all private industries (table 3 and table A4 in the Appendix) employment change in incumbent businesses is statistically

significant with a positive sign. This indicates that a high share of new business employment is, all in all, not at the expense of the incumbents. It suggests that the development of new businesses and of incumbents are positively interrelated so that growth and employment result in an interaction of both types of actors: start-ups may have a stimulating effect on employment in the established firms and vice versa. It is such interaction that leads to the indirect effects of new business formation (Fritsch, 2008, Fritsch and Noseleit, 2008a and b). That the employment change in the incumbents is not statistically significant in nearly all models for the initial direct effect may be regarded an indication that such indirect effects do not emerge immediately after start-up but become relevant only in the longer run.

Estimations limited to the manufacturing sector and to services (table A5 in the Appendix) confirm these results. A main difference between the two large sectors is that the interaction of start-ups with the indicator for a high education level is only statistically significant in services but not in manufacturing. The indicator for the entrepreneurial character of the regional technological regime as well as the respective interaction with the start-up rate is neither statistically significant in manufacturing nor in services. Most remarkable, we find that the employment change in the incumbents has a significantly negative effect in services. In manufacturing this positive effect for incumbent employment change can be found for the total direct effect while it is not statistically significant for the initial direct effect.

8. Conclusion

New business formation has a number of different effects on regional development that have been subject of recent empirical research. One of these effects is their direct contribution to regional employment. We found that on average about 17 percent of regional employment is in businesses that are up to ten years old. This share, the direct employment effect of new businesses, is rather constant over time but differs considerably across regions. This indicates an important influence of region-specific

factors. Variation of the direct employment effect of new business formation can also be found between services and manufacturing what may be largely due to respective differences in market contestability between the two sectors.

Regression analyses for explaining the impact of regional characteristics on the direct employment effect of new business formation showed that the start-up rate, a high education level of the regional workforce and an entrepreneurial character of the regional technological regime have a significantly positive impact, while the overall effect of population density on the employment share in new businesses was negative. If the development of incumbent firms has a statistically significant effect on the share of new business employment the respective coefficient is positive. This suggests that employment in the start-ups is not at the expense of the incumbents but that the success of the new businesses and the development in the old-established businesses is positively interlinked.

The results of our analysis clearly show that region-specific factors play an important role for the development of new businesses and for their direct contribution to employment. This suggests that growth conditions for new businesses and their role in regional development may considerably vary under different regional conditions. This corresponds to regional variation of the overall employment effect of new businesses (Fritsch and Mueller, 2008; Fritsch and Schroeter, 2007). These pronounced regional differences deserve further investigation. Particularly the strong impact of population density and of a high education level of the regional workforce should be explored more deeply. It is quite remarkable that indicators for the level of regional innovation activity did not proof to be statistically significant while a positive impact was found for the indicator of an entrepreneurial character of the regional technological regime. This suggests that it is not the level but the structure of R&D activities that is important for regional development. The important role of regional conditions for the employment effects of new businesses clearly suggest that the regional dimension should be included in respective analyses.

Our analysis was limited to the direct employment effects of new businesses that make only a part of their overall effect. Even if the magnitude of the indirect effects should be larger than this direct effect (Fritsch and Noseleit, 2008a and b), the evolution of the start-ups and their contribution to employment is very important. The results of our analysis suggest that direct and indirect effects of new business formation are positively interlinked and that it is the interaction between new and incumbent businesses in that may have a strong effect on regional development. This interaction between start-ups and the incumbents needs to be further investigated.

Appendix

Table A1: Descriptive statistics for variables[a]

Variable		Mean	Std. Dev.	Min	Max
Total direct effect (all private industries)	overall	2.82	0.16	2.47	3.25
	between		0.16	2.53	3.23
	within		0.03	2.70	3.02
Initial direct effect (all private industries)	overall	1.30	0.21	0.80	1.94
	between		0.17	0.99	1.80
	within		0.12	1.06	1.79
Total direct effect (manufacturing)	overall	1.97	0.27	1.35	2.90
	between		0.26	1.47	2.53
	within		0.08	1.61	2.72
Initial direct effect (manufacturing)	overall	0.20	0.32	-0.66	2.37
	between		0.27	-0.32	0.88
	within		0.17	-0.26	1.85
Total direct effect (services)	overall	3.20	0.10	2.93	3.46
	between		0.10	2.95	3.43
	within		0.02	3.08	3.28
Initial direct effect (services)	overall	1.67	0.14	1.30	2.04
	between		0.12	1.36	1.97
	within		0.07	1.43	1.91
Start-up rate	overall	4.49	0.13	4.15	4.85
	between		0.13	4.21	4.78
	within		0.04	4.39	4.63
Population density	overall	5.44	0.66	4.32	7.13
	between		0.66	4.34	7.12
	within		0.01	5.39	5.48
High education level	overall	-3.24	0.45	-4.33	-1.96
	between		0.44	-4.08	-2.10
	within		0.10	-3.54	-2.98
Entrepreneurial regime	overall	-0.80	0.17	-1.42	-0.35
	between		0.16	-1.25	-0.46
	within		0.05	-0.99	-0.66
Change of incumbent employment	overall	-0.01	0.02	-0.07	0.05
	between		0.01	-0.03	0.01
	within		0.02	-0.07	0.04

a All variables are logarithmic values.

Table A2: Correlation between variables (*Pearson* correlation coefficients)

		1	2	3	4	5	6	7	8	9	10	11
1	Total direct effect (all private industries)	1.00										
2	Initial direct effect (all private industries)	0.91	1.00									
3	Total direct effect (manufacturing)	0.81	0.65	1.00								
4	Initial direct effect (manufacturing)	0.74	0.70	0.81	1.00							
5	Total direct effect (services)	0.41	0.31	0.27	0.21	1.00						
6	Initial direct effect (services)	0.32	0.31	0.29	0.25	0.84	1.00					
7	Start-up rate	0.46	0.46	0.35	0.34	0.71	0.64	1.00				
8	Population density	-0.07	-0.07	-0.10	-0.03	-0.38	-0.41	-0.41	1.00			
9	High education level	-0.13	-0.07	-0.25	-0.18	-0.55	-0.55	-0.49	0.66	1.00		
10	Entrepreneurial regime	0.23	0.18	0.35	0.29	0.06	0.03	0.09	-0.08	-0.31	1.00	
11	Change of incumbent employment	0.29	0.37	0.06	-0.01	-0.01	-0.17	0.19	0.14	0.10	0.20	1.00

Table A3: Morans I

Variables	I	E(I)	sd(I)	z	p-value[a]
Total direct effect	0.086	0.00	0.03	3.30	0.00
Initial direct effect	0.359	0.00	0.03	13.46	0.00

a One-tail test.

Table A4: Regression results for the total and initial direct effect[a]

	Total direct effect				Initial direct effect			
	Spatial lag model	Fixed effects	Random effects	Between	Spatial lag model	Fixed effects	Random effects	Between
Start-up rate	0.219***	0.416***	0.469***	0.591***	0.321***	0.979***	1.066***	0.728***
	(5.60)	(9.90)	(11.70)	(3.85)	(3.82)	(9.63)	(12.36)	(4.10)
Population density	-0.530***	-0.525***	-0.050*	0.039	-0.727**	-0.551	-0.0617*	0.0250
	(-3.33)	(-2.77)	(-1.83)	(1.00)	(-2.13)	(-1.20)	(-1.75)	(0.55)
High education level	0.126***	0.229***	0.161***	0.015	0.259***	0.521***	0.318***	0.0358
	(5.48)	(9.00)	(8.61)	(0.23)	(5.41)	(8.48)	(8.38)	(0.48)
Entrepreneurial regime	0.079***	0.110***	0.123***	0.161	0.084	0.0527	0.158**	0.171
	(3.16)	(3.70)	(4.32)	(1.39)	(1.58)	(0.73)	(2.54)	(1.28)
Change of incumbent	0.004*	0.008***	0.008***	0.025	-0.001	0.014***	0.019***	-0.002
employment	(3.64)	(6.82)	(7.24)	(1.00)	(-0.51)	(5.13)	(6.83)	(-0.07)
Constant	4.586***	4.633***	1.603***	0.138	-0.251	1.646	-1.976***	-1.845**
	(5.43)	(4.08)	(5.79)	(0.19)	(-0.22)	(0.60)	(-3.93)	(-2.25)
Number of observations	568	568	568	568	568	568	568	568
Number of ROR	71	71	71	71	71	71	71	71
R-squared	0.67	0.67	0.19	0.27	0.62	0.62	0.25	0.26

a Absolute values of z statistics in parentheses; * statistically significant at the 10 percent; ** statistically significant at the 5 percent level; *** statistically significant at the 1 percent level.

Table A5: Regression results for manufacturing and services[a]

	Manufacturing					Services				
	Total direct effect			Initial direct effect		Total direct effect			Initial Direct Effect	
	I	II	III	I	II	I	II	III	I	II
Start-up rate	0.075***	-0.841**	-0.850***	0.317***	0.141	0.055***	0.148	0.387***	0.089***	-0.151
	(2.60)	(-2.01)	(-4.10)	(5.17)	(0.16)	(4.85)	(0.79)	(5.55)	(3.00)	(-0.31)
Population density	-1.372***	-0.170	-0.153	-0.156	-0.174	0.038	0.184	0.018	-0.738**	-0.274
	(-3.31)	(-0.33)	(-0.31)	(-0.18)	(-0.16)	(0.32)	(1.10)	(0.16)	(-2.42)	(-0.62)
Population density		0.179***	0.171***		-0.004		0.027			0.084
* start-up rate		(4.24)	(4.50)		(-0.04)		(1.29)			(1.53)
High education	-0.305***	-0.338	-0.277***	-0.172	-0.455	-0.020*	0.233**	0.343***	-0.087***	0.140
level	(-5.84)	(-0.95)	(-5.34)	(-1.57)	(-0.60)	(-1.78)	(2.22)	(4.51)	(-2.87)	(0.51)
High education		-0.010			-0.046		0.060**	0.084***		0.054
level * start-up rate		(-0.17)			(-0.37)		(2.50)	(4.83)		(0.87)
Entrepreneurial	-0.042	0.454	-0.052*	-0.001	-0.071	-0.008	-0.166	0.004	0.075**	0.292
regime	(-1.36)	(1.20)	(-1.73)	(-0.02)	(-0.09)	(-0.53)	(-0.65)	(0.29)	(2.03)	(0.44)
Entrepreneurial		0.081			-0.011		-0.039			0.048
regime * start-up rate		(1.35)			(-0.09)		(-0.66)			(0.31)
Change of incum-	0.011***	0.010***	0.010***	-0.004	-0.004	-0.004***	-0.004***	-0.004***	-0.005***	-0.005***
bent employment	(5.22)	(4.61)	(4.49)	(-0.83)	(-0.79)	(-5.52)	(-5.59)	(-5.60)	(-2.94)	(-3.00)
Constant	7.387***	1.629	1.211	2.345	1.182	3.089***	3.275***	4.560***	2.313	3.494
	(3.53)	(0.46)	(0.49)	(0.54)	(0.15)	(5.23)	(2.92)	(6.97)	(1.80)	(1.19)
Regional dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
rho	0.043***	0.021	0.027	0.057***	0.057***	0.036**	0.046***	0.044***	0.062***	0.083***
	(2.59)	(1.21)	(1.62)	(3.26)	(3.24)	(2.28)	(2.97)	(2.86)	(0.01)	(6.24)
Log Likelihood	660.80	672.10	670.76	234.96	235.06	1346.31	1358.87	1357.72	811.67	815.84
Wald (rho=0)	6.72	1.46	2.62	10.65	18537	5.18	8.85	8.16	35.72	39.95
R-squared	0.14	0.18	0.18	0.05	0.05	0.13	0.16	0.16	0.25	0.26
Observations	568	568	568	568	568	568	568	568	568	568

a Spatial lagged regression model with absolute values of z statistics in parentheses; * statistically significant at the 10 percent level; ** statistically significant at the 5 percent level; *** statistically significant at the 1 percent level.

References

Acs, Zoltan J. and David B. Audretsch (1987): Innovation, Market Structure and Firm Size, *Review of Economics and Statistics*, 69, 567-75.

Aldrich, H. E. and E. R. Auster (1986): Even Dwarfs Started Small: Liabilities of Size and Age and their Strategic Implications, *Research in Organizational Behavior*, 8, 1655-198.

Anselin, Luc (1988): *Spatial Econometrics: Methods and Models*, Dordrecht: Kluwer.

Audretsch, David B. (1995): *Innovation and Industry Evolution*, Cambridge (Mass.): MIT-Press.

Audretsch, David B. and Maryann P. Feldman (2003): Knowledge Spillovers and the Geography of Innovation, in J. Vernon Henderson and Jacque Thisse (eds.), *Handbook of Urban and Regional Economics*, Volume 4, Amsterdam: North Holland Publishing.

Audretsch, David B. and Michael Fritsch (1999): The Industry Component of Regional New Firm Formation Processes, *Review of Industrial Organization*, 15, 239-252.

Audretsch, David B. and Michael Fritsch (2002): Growth Regimes over Time and Space, Regional Studies, Vol. 36 (2002), 113-124.

Audretsch, David B., Max C. Keilbach and Erik E. Lehmann (2006): *Entrepreneurship and Economic Growth*, Oxford: Oxford University Press.

Boeri, Tito and Ulrich Cramer (1992): Employment growth, incumbents and entrants – Evidence from Germany, *International Journal of Industrial Organization*, 10, 545-565.

Brambor, Thomas, William Roberts Clark and Matt Golder (2006): Understanding Interaction Models: Improving Empirical Analyses, *Political Analysis*, 14, 63-82.

Brixy, Udo and Reinhold Grotz (2004): Entry-Rates, the Share of Surviving Businesses and Employment Growth: Differences between Western and Eastern Germany since Unification, in: Michael Dowling, Juergen Schmude and Dodo zu Knyphausen-Aufsess (eds.), *Advances in Interdisciplinary European Entrepreneurship Research*, Muenster: Lit, 143-152.

Engel, Dirk and Georg Metzger (2006): Direct Employment Effects of New Firms, in: Michael Fritsch and Juergen Schmude (eds.), *Entrepreneurship in the Region*, New York: Springer, 75-93.

Federal Office for Building and Regional Planning (Bundesamt für Bauwesen und Raumordnung) (2003): *Aktuelle Daten zur Entwicklung der Städ*te, Kreise und Gemeinden, Vol. 17, Bonn: Federal Office for Building and Regional Planning.

Fritsch, Michael (2004): Entrepreneurship, Entry and Performance of New Businesses Compared in two Growth Regimes: East and West Germany, *Journal of Evolutionary Economics*, 14, 525-542.

Fritsch, Michael and Udo Brixy (2004): The Establishment File of the German Social Insurance Statistics, *Schmollers Jahrbuch / Journal of Applied Social Science Studies*, 124, 183-190.

Fritsch, Michael and Pamela Mueller (2004): The Effects of New Business Formation on Regional Development over Time, *Regional Studies*, 38, 961-975.

Fritsch, Michael, Udo Brixy and Oliver Falck (2006): The Effect of Industry, Region and Time on New Business Survival – A Multi-Dimensional Analysis, *Review of Industrial Organization*, 28, 285-306.

Fritsch, Michael and Antje Weyh (2006): How Large are the Direct Employment Effects of New Businesses? – An Empirical Investigation, *Small Business Economics*, 27, 245-260.

Fritsch, Michael (2008): How Does New Business Formation Affect Regional Development? *Small Business Economics*, 30, 1-14.

Fritsch, Michael and Pamela Mueller (2008): The Effect of New Business Formation in Regional Development over Time: The Case of Germany, *Small Business Economics*, 30, 15-29.

Fritsch, Michael and Florian Noseleit (2008a): Start-ups, New Business Employment, and the Effect on Incumbents: Who contributes the larger share? Friedrich-Schiller-University Jena (mimeo).

Fritsch, Michael and Florian Noseleit (2008b): Investigating the Anatomy of the Employment Effects of New Business Formation, Paper prepared for presentation at the 48th Congress of the European Regional Science Association (ERSA), 27 – 31 August 2008 in Liverpool.

Fritsch, Michael and Alexandra Schroeter (2007): Why Does the Effect of New Business Formation Differ Across Regions ? Jena Economic Research Paper, 077-2007.

Geroski, Paul A., Jose Mata and Pedro Portugal (2007): Founding Conditions and the Survival of New Firms, DRUID-Working Paper No. 07-11.

Kronthaler, Franz (2005): Economic capability of East German regions: results of a cluster analysis, *Regional Studies*, 39, 739-750.

Marshall, Alfred (1920): *Principles of Economics*, 8th edition, London: MacMillan.

Porter, Michael (1998): Clusters and the new economics of competition, *Harvard Business Review*, November-December, 77-90.

Saxenian, Annalee (1994): *Regional Advantage: Culture and Competition in Silicon Valley and Route 128*, Cambridge (Mass.): Harvard University Press.

Schumpeter, Joseph A. (1911/1934): *Die Theorie wirtschaftlicher Entwicklung*, Berlin 1911: Duncker & Humblot; english edition: *The Theory of Economic Development*, Cambridge, MA 1934: Cambridge University Press.

Schumpeter, Joseph A. (1942): *Capitalism, Socialism and Democracy*, Harper & Row, New York.

Stam, Erik (2007): Why Butterflies Don't Leave: Locational Behaviour of Entrepreneurial Firms, *Economic Geography*, 83, 27-50.

Storey, David J. (1994): *Understanding the Small Business Sector*, London: Routledge.

Wagner, Joachim (1994): The Post-Entry Performance of New Small Firms in German Manufacturing Industries, *Journal of Industrial Economics*, 42, 141-154.

Wagner, Joachim and Rolf Sternberg (2004): Start-up Activities, Individual Characteristics, and the Regional Milieu: Lessons for Entrepreneurship Support policies from German Micro Data, *Annals of Regional Science*, 38, 219-240.

Weyh, Antje (2006): What Characterizes Successful Start-up Cohorts? in: Michael Fritsch and Juergen Schmude (eds.), *Entrepreneurship in the Region*, New York: Springer, 61-74.

Winter, Sidney G. (1984): Schumpeterian Competition in Alternative Technological Regimes, *Journal of Economic Behavior and Organization*, 5, 287-320.