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

Michael Fritsch and Yvonne Schindele

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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 effect 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 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: L26, M13, O1, O18, R11

Keywords: Entrepreneurship, new business formation, regional development, direct employment effect

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1. Aim and scope[1]

The question "Who creates jobs" (Birch, 1981) is subject of an intensive and long-lasting policy debate. This debate focused, particularly, on 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, Joseph A. Schumpeter (1911/34) argued that the creative destruction, which is initiated by start-ups of new firms, may result in superior performance with regard to innovation and growth. In his later work (Schumpeter, 1942), he, however, reversed his view by suggesting that large incumbent firms are economically much stronger than their younger and smaller competitors and are, therefore, the main drivers of development. Recent empirical research suggests that both sides may be correct (see Fritsch, 2008, for an overview). It has been shown that new (small) businesses directly contribute to employment by creating jobs. However, they also may have indirect effects by inducing innovation and employment in the incumbent large firms. The magnitude of these direct and indirect effects may, however, vary considerably 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 the extent and the reasons for such regional differences. 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 allows us to also investigate the stability of the direct employment effect of new businesses over time. The following section (section 2) provides an overview of the empirical evidence on the development of new businesses. Section 3 introduces the data and basic definitions. Based on an overview

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

on regional differences of the direct employment effect (section 4), we discuss factors that may be responsible for the regional variation that we find (section 5). Indicators and estimation procedures are discussed in section 6. Section 7 presents the results of the empirical analysis, and the final section 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 soon after entry (Boeri and Cramer, 1992; Wagner, 1994; Fritsch and Weyh, 2006). Second, those new businesses that do 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 establishing an organizational structure and getting the new unit working efficiently enough to hold pace with competitors. In particular, this includes building relationships with customers and suppliers as well as acquiring suitable personnel. Another reason for the relatively high vulnerability of entries for closure is that several new businesses have to survive a considerable period of time before they earn their first profit. Because new firms tend to start on a relatively small scale, this liability of newness may as well be a *liability of smallness* (Aldrich and Auster, 1986). Such a high vulnerability of small units for closure could be explained by their rather limited endowment of resources that leave them only relatively poor chances to survive economic problems.

A key result of empirical studies that investigate the employment in start-up cohorts is that only a rather small proportion of the new

[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).

businesses do create considerable amounts of jobs (Storey, 1994, 113-119; Boeri and Cramer, 1992; Wagner, 1994; Fritsch and Weyh, 2006).[3] In most cases, the number of employees in a certain cohort rises only 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). According to Weyh (2006), high population density leads to relatively low survival rates of new businesses but to higher average employment in those start-ups that manage to survive. This suggests that the high intensity of competition in agglomerations results in rigorous market selection but that the surviving businesses perform relatively well there. With regard to the overall employment of start-up cohorts in different types of regions, Weyh (2006) finds that the new businesses in the service sector perform better in agglomerations than in moderately congested and in rural areas. The pattern for start-up cohorts in manufacturing is just opposite: manufacturing start-ups tend to generate more jobs in rural areas than in moderately congested regions and in the agglomerations.

Adding up the remaining employment in the 18 yearly West German entry cohorts of the 1984-2002 period, Fritsch and Weyh (2006) found that their 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], strongly indicating that the sectors in which the start-ups occur plays an important role.

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

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

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 contains information on 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 leads to a slight underestimation of the contribution of new business formation to employment. However, new businesses enter the database 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 separation of firms from new subsidiary that which are created by existing firms. In order to avoid distortions caused by new large plants set up by 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 effect of start-ups on employment. The first of these indicators is the employment share of the start-up cohorts in total private sector employment after two years. This is meant to represent the *initial direct employment effect* of new businesses. We consider the employment after the second year because this may be regarded as the point in the evolution of new businesses

[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).

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 private sector employment in the current year (*t=0*).[7] This indicator accounts for the results of earlier studies that have shown that the effect of new businesses on employment evolves over a period of ten years (Fritsch, 2008). We label this indicator the *total direct employment 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 forest, the share of the young trees.

The spatial framework of the analysis is provided by 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 travel 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 our 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 begins in the year 1993. Second, many studies show that the developments in East Germany in the 1990s were heavily shaped by the transformation process to a market economy and that this part of the country, therefore, represents a rather special case that should be analyzed separately (e.g., Fritsch, 2004; Kronthaler, 2005). The Berlin

[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.

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

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, these cities have been merged 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.

4. Overview on the direct employment effect

There is a remarkable variation in the magnitude of the direct employment effect 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 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, which is probably a result of the higher level of start-up activity in the service sector.[10] Another important observation is that the variation across space (*between* regions) tends to be much larger than the variation over time (*within*). Figure 1 shows that the total direct employment effect of new businesses is, indeed, rather constant over the different years.

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

[10] The average yearly number of start-ups in services per 1,000 employees during the period of analysis amounts to 13.43 and is about six times higher than the respective figure for the manufacturing sector 2.16).

Table 1: Descriptive statistics of the direct employment effect[11]

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

The regional distribution of the total direct employment effect in all private industries for the years 1993 to 2002 (figure 2) shows that regions with relatively high direct employment effect are concentrated in the northern part of the country, while the direct contribution of new businesses to

[11] Between: regional average values over the period of observation; within: average deviation of yearly values from the regional mean over the observation period.

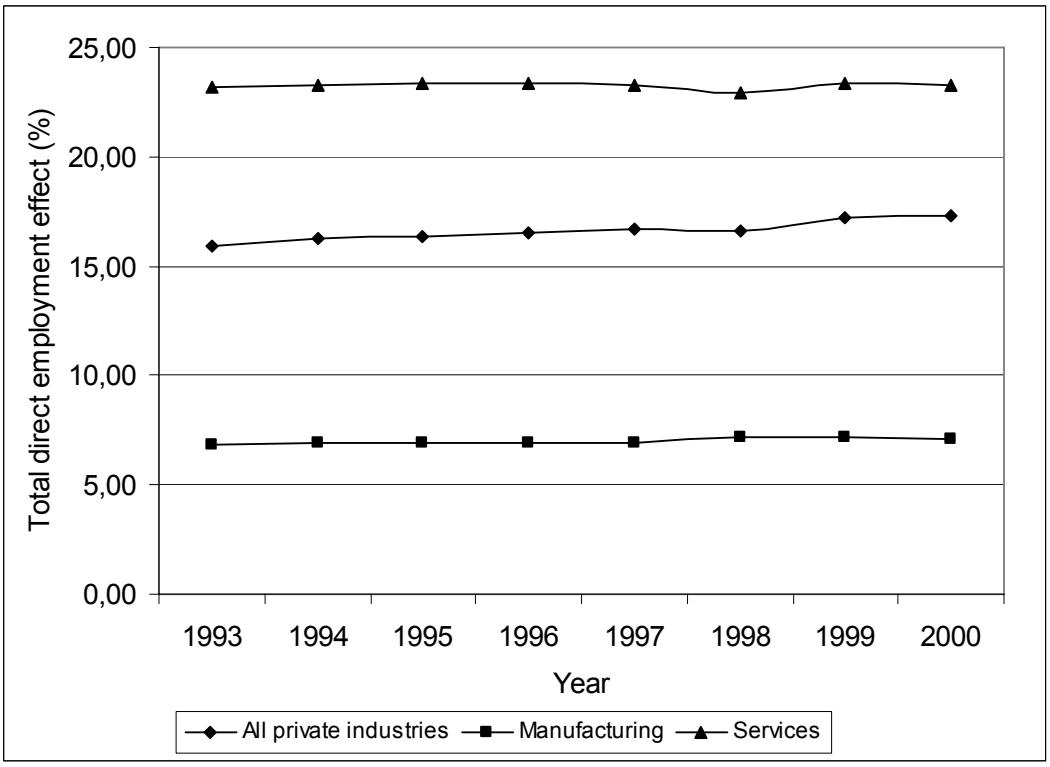

Figure 1: Total direct employment effect of new businesses over time

employment is relatively low 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 overall private sector and for manufacturing (figure 3), the picture for the service sector (figure 4) is quite different.[12] In services, the total direct employment effect of new businesses seems to be relatively low in regions with large agglomerations such as Cologne, Frankfurt, Hamburg, Munich, and Stuttgart, while it tends to be relatively high in peripheral areas with below-average population density.

[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.

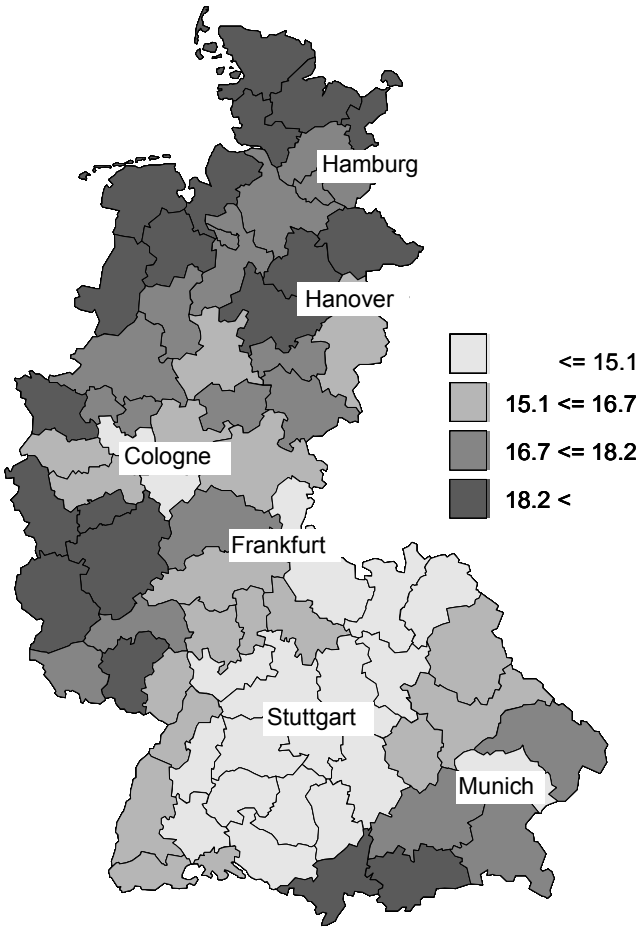

Figure 2: Spatial distribution of total direct employment effect in West Germany – mean values 1993 to 2002 (all private industries)

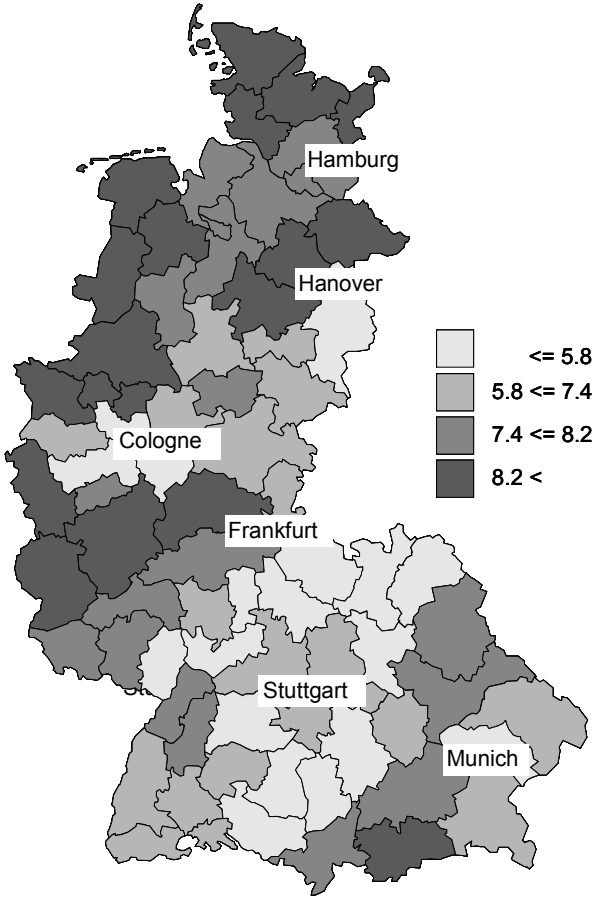

Figure 3: Spatial distribution of total direct employment effect in West Germany – mean values 1993 to 2002 (manufacturing)

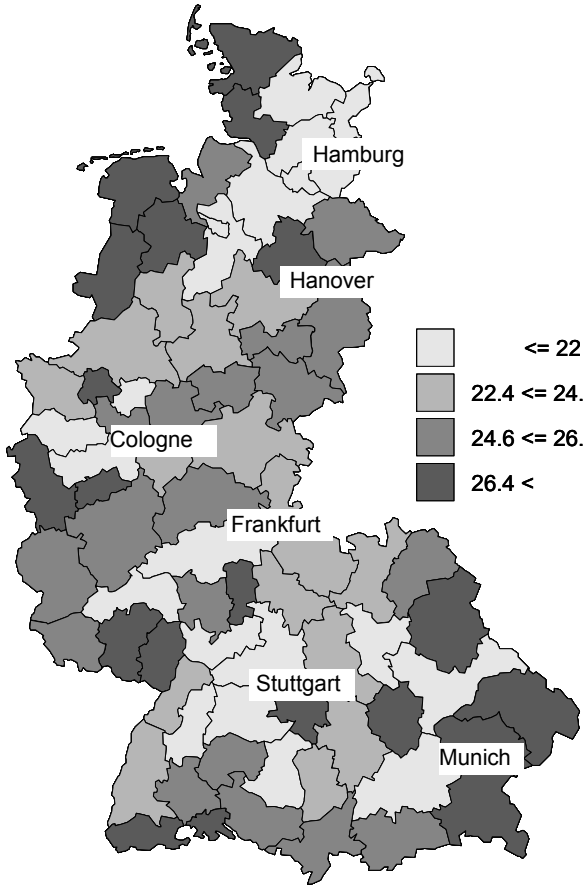

Figure 4: Spatial distribution of total direct employment effect in West Germany – mean values 1993 to 2002 (services)

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

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

- First, the regional level of new business formation. The more new businesses that are set up per regional employment leads to a higher employment share, which can be expected in newly established units.
- Second, the success of the new businesses. The more successful the new businesses are, the larger their employment share is.
- Third, the development of the incumbent businesses. Relatively high employment growth in incumbent businesses leads to a correspondingly low employment share of the new businesses. Moreover, the success of the incumbents may be at the expense of the newcomers and can, therefore, result in a relatively small direct employment effect of 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 that 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 its survival chances are and the more pronounced the direct employment effect is.

Many of these internal success factors may critically depend on characteristics of the regional environment. For example, since there is a strong tendency to set up new businesses close to the founders' residence

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

(Stam, 2007), a high qualification of the regional workforce may lead to a relatively high share of start-ups that are run by qualified individuals. Moreover, the regional knowledge base, the presence of academic research institutions as well as the innovativeness of other firms and respective knowledge spillovers may be rather important factors shaping the innovativeness and quality of regional start-ups (Audretsch, Lehmann, and Keilbach, 2006). A high share of a highly educate workforce and of knowledge may not only lead to a higher proportion of high quality start-ups but may also be important success factors for new businesses after they have been set up. However, since the incumbents located in the respective region can also benefit from such properties of the economic environment, they are not at the particular advantage of the newcomers. Hence, a positive effect of such factors should primarily be regarded as an indication for relatively high quality of the regional start-ups and not for better environmental growth conditions.

Contestability of market positions and survival chances of entries also may be 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 may 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 rich, differentiated labor markets and specialized services, easy access to research institutions, 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). Because of these opposite effects of density on start-ups, the overall impact on the direct contribution of new businesses to employment is a priori unclear.[14] 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 should not be identical in all regions. In fact, we can expect considerable differences. The employment share of new businesses should be relatively large in regions with a high level of start-up activity, 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 rich 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.

[14] With regard to the overall (i.e., the direct and the indirect) 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.

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

In order to test which factors 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 the 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[15]. 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.

[15] 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 implemented to develop a measure of sector adjusted start-up activity.

- A high *population density* indicates the advantages as well as the disadvantages that young businesses experience when they are 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 conditions.
- The *education level of the regional workforce* was measured by the share of regional employees with a tertiary degree, i.e. bachelor's degree or higher.
- *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[16]. We expect a positive effect of an entrepreneurial technological regime on the share of small business employment because under such circumstances it should be easier for entries to successfully compete than in case of a routinized regime.
- *The employment change of incumbent businesses* per year and region should show a negative relationship with the total and the initial direct employment effect for two reasons. First, the value of 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 (tables A1 and A2).

[16] 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.

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 the workforce with a medium education level, and an indicator for industry specialization.

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 (model I) that gives us the average influence of each of the independent variables on the direct employment effect. 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.[17] We apply a spatial lag model here since we expect that the values of the independent variables (e.g., the start-up rate or the high education level) in neighboring areas may have an influence on the regional employment effect of start-ups.

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 that accounts for unobserved region-specific influences is appropriate. A possible disadvantage of a fixed-effects estimator could, however, be that the influence of variables that are rather time-invariant may be partly included into the region specific fixed-effects and are 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]

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[17] A Moran's I test indicates a significant degree of spatial autocorrelation (see table A3 in the Appendix). Adjacent regions are all planning regions that directly share a common border with the respective region.

[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 in our analysis.

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

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:

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

The results for the interaction variables show to what extent the respective control variables become effective in interplay with the level of regional start-up activity. The 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 in the start-up rate leads to a 0.22 percent increase in 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

Table 3: Regression results for the direct employment effect 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 incumbent 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.

reaches a maximum after about two years and then declines. The coefficient for population density is significantly negative indicating a relatively low contribution of new business employment in large agglomerations.

A relatively high share of the workforce with a high education level is related to a significantly higher direct employment effect, as was expected. A one percent increase in the number of the regional workforce with a tertiary degree leads to an increase in the total direct employment effect of 0.13 percent and to a 0.26 percent increase in the initial direct employment effect. As explained above (section 5), this result suggests that a high share of highly educated people in a region leads to a relatively high average quality of regional start-ups. This interpretation is supported by the estimates of models II and III that show a significantly positive coefficient for the interaction between the share of the workforce with a tertiary degree and the start-up rate. This means that the benefits of a well-educated workforce become effective through the regional start-ups.[20] It is quite remarkable that this effect is more important in the short-run than in the long-run. Figure A1 in the Appendix shows that this positive marginal effect of a high education level is statistically significant if the share of regional employees with a tertiary degree amounts to at least two percent.

The significantly positive coefficient for the entrepreneurial character of the regional technological regime corresponds to our expectation that a relatively high share of innovation activity conducted by small firms leads to better chances 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 the new businesses and the incumbents are positively interrelated so that a considerable part of the regional employment growth results from the interaction of both types of actors, start-ups and incumbents. By entering the market, new businesses challenge the incumbents, thereby, stimulating their competitiveness and their long-term employment.

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[20] Note: in models that include interaction variables, the basic term – here the share of highly educated workforce – should not be interpreted because it creates the hypothetical effect in the event that the regional start-up rate assumes a value of zero, which does not occur in the data (Brambor, Clark and Golder, 2005).

Improvements on the side of the incumbents may then induce improvements in the newcomers, etc. This type of interaction 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 as an indication that such indirect effects do not emerge immediately after start-up but only become relevant in the longer run, as has been suggested by Fritsch and Mueller (2004).

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 only 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 total direct employment effect of new businesses, is rather constant over time but differs considerably across regions. This suggests 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, which

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 positive coefficient for the development of incumbent employment indicates that, on the whole, employment gains of the start-ups are not at the expense of the incumbents but that the success of the new businesses and the success of the development in the previously established businesses are positively interlinked. Although some new businesses most likely do crowd out established suppliers, the newcomers also induce improvements on the side of the incumbents that may well lead to increased competitiveness and to positive employment for the incumbent sector as a whole (Fritsch and Mueller, 2004, 2008). According to our estimations, this constitutes a general tendency for the average region and it may well be that this effect is considerably more pronounced in some regions and rather unimportant in others.

Generally, the results of our analysis clearly show that region-specific factors play an important role in the development of new businesses and in 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 prove 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 effect of new businesses clearly suggests that the regional dimension should be included in respective analyses.

Our analysis was limited to the direct employment effect of new businesses, which produce 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 strongly indicate that direct and indirect effects of new business formation are positively interlinked and that it is the interaction between new and incumbent businesses that may have a strong effect on regional development. This interaction between start-ups and the incumbents needs to be investigated further.

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.

Figure A1: Marginal effects of start-up rate at different levels of the high education level of the regional workforce

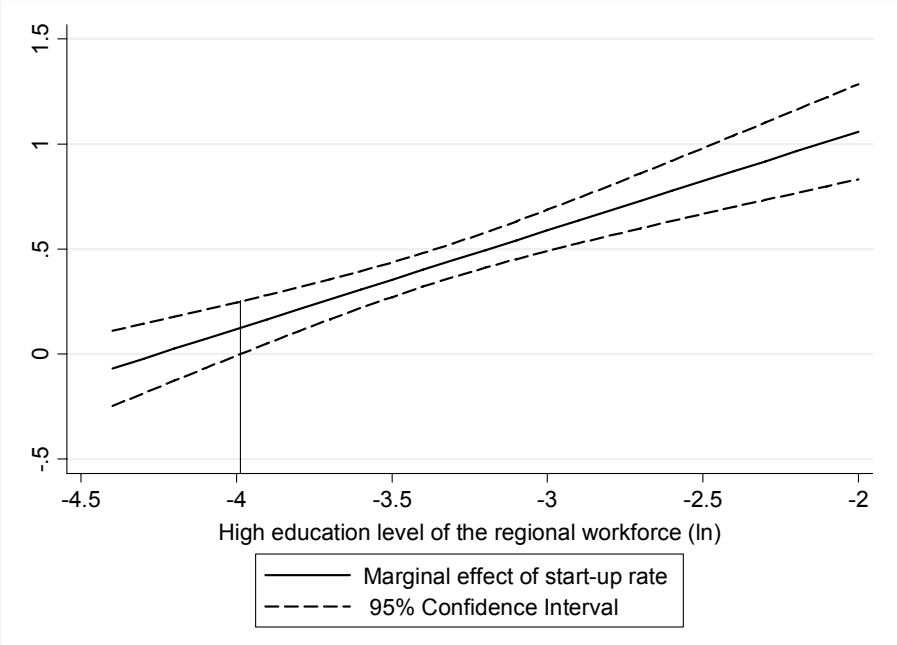

Table A4: Regression results for the total and initial direct effect[a]

	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 employment	0.004*	0.008***	0.008***	0.025	-0.001	0.014***	0.019***	-0.002
	(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

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